Is Constructivism Universal: In Search of Meaningful Technology in Morocco and Namibia

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Introduction

The question we tackle is basic: Is a shift from instruction via the transmission model to constructivism a universally desirable outcome for educational systems and societies worldwide?[3] If so, can small, pilot technology initiatives provide creative disturbances that encourage learner-centered education, particularly in rural areas of the developing world? Should the answers be affirmative to these questions, these findings would suggest that education technology projects with constructivist orientations could be widely applicable and be taken to scale, that technology may improve (universal) access to quality education, and that strategic spending can go a long way to supporting reforms within countries. In other words, the benefit to cost ratio would be overwhelmingly favorable throughout the developing world without the need for Pareto-safety allocation conditions in which the reform winners compensate reform losers. The education technology tide should show the potential to lift all boats and redress disparities in access to quality education. The digital divide would be a short-lived concern, relegated to the trash directory on history's hard drive.

These questions are being asked by planners and educators who seek quality improvements in education and place digital technologies alongside complementary and competing investments in other reform priorities: decentralization, whole school improvement, private-public partnerships, community involvement and curricular change. Over the past two years, the ministries of education in the Kingdom of Morocco and the Republic of Namibia have mounted new initiatives in education technology. Planners in both countries are examining technology's potential for improving the delivery of training and support to teachers at all levels and at all points in their professional development.

The authors of this paper have been involved in piloting two small, model projects financed by the U.S. Agency for International Development (USAID) under its Computer-Assisted Teacher Training (CATT) initiative. The Moroccan and Namibian projects have served a very small part of larger technology initiatives. Both national initiatives are part and parcel of national reform efforts spelled out in Morocco's National Charter on Education, and Namibia's Ten-Year Plan for Educator Development and Support in Namibia. The involvement of development assistance begs another set of questions: How can foreign assistance best facilitate the use of education technology integration in reform contexts? And, is constructivism itself a heuristic?

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[2] The authors thank USAID project officers Stephen Tournas, CATT Program Director and USAID Education Officers Monique Bidaoui, Dominique Zemrag and Catherine Powell Miles for comments on earlier versions of this draft, with a special thanks to manager extraordinaire, Saida Abouid, for her precision on technical aspects of CATT-PILOTE. We equally thank Kathleen Fulton and Eduardo Contreras for critiques of earlier versions of this paper.

[3] Constructivism is a theory of learning that "defines knowledge as temporary, developmental, socially and culturally mediated and thus non-objective. Learning from this is understood as a self-regulatory process of resolving inner cognitive conflicts that often become apparent through concrete experience, collaborative discussion and reflection." Brooks and Brooks, 1993, p.viii, cited in Sandholtz, Ringstaff and Dwyer, p.12. It often stands in contrast to what many term the transmission model of instruction, "just-in-case" learning, and implies shifts towards authentic assessment, student-centered learning, active inquiry, the teacher as facilitator of collaborative learning processes, and real, meaningful and connected learning to problems of real life in a complex socio-cultural environment.

Stated more eloquently, planners, parents and taxpayers are faced with decisions about how to deploy limited technology money in education so that it can be leveraged and multiply in environments of scarcity and need. Integration has become a critical concern because the technology, too frequently, has been provided seemingly for the sake of providing technology. The technologies, therefore, go underutilized, and the fixed investments depreciate without yielding improvements in desired educational outcomes. Certain bundles of technologies lend themselves to leveraging and multiplication more than others – they are inexpensive, easily maintained, enable access and are effectively used. And certain institutional reforms lend themselves to greater educational returns that may be multiplied through technology. So, might it be true that constructivism is both an end and a means, for which digital technology is one potential vector and development assistance a potential facilitator? Would this be universally applicable if two pilot programs in two disparate developing countries showed similar signs of potential to develop human capacity, through divergent institutions and programs in disadvantaged rural areas?

This approach defined here as $e^{(y)}$ or $e^{(iv)}$, denoting the exponential potential of technology and inquiry in education (e), advocates investments in teacher professional development and a focus on teacher technology skills development in inquiry-based learning and problem-solving. This stands in contrast to a strict focus on either distance education or computer-assisted instruction. Not only does inquiry learning build upon what teachers know, but it models desired pedagogical change and moves debate away from techno-centric topics. Through active technology training programs, and development assistance structured on "learning processes," learners come to appropriate the network, the program, their community and their learning as they build technology competency (if not before). Such a model does not depend on experts, planners, or international consultants. Rather, technicians, planners and consultants facilitate problem solving (particularly by providing enabling policy) rather than determine the problems to be solved. In so doing, education professionals become practitioners of learner-centered education and project-based learning. With the mobilization of participants, scarce money becomes multiplicative.

This chapter makes a case that e(y) – inquiry technology in education, for lack of a better term – (1) does allow for education technology to be transferred in meaningful, relevant ways, and (2) provides a model for effectively leveraging scarce pilot program money. It also contributes to an argument for a universal constructivism with which social capital can be built locally – with or without significant technology endowments. However, we argue that neither development assistance, nor the state, nor private commercial firms are efficient vehicles for effectuating these types of changes. They require partnerships in order to move down the path to efficient and sustainable learning organizations or systems operating in the public interest.

This discussion begins by outlining the parameters and design elements of computer-assisted teacher training (CATT), the subsequent modifications and attributes that characterize e(y) in light of current thinking on educational technology. We then discuss the experiences of CATT project designs in support of Plan 2005 in Morocco and Namibia's Ten-Year Plan. Finally, we conclude with some lessons and recommendations for future technology projects in education.

$e^{(y)}$ Development and Construction

As its name implies, the Computer-Assisted Teacher Training (CATT) program at USAID was informed by successive waves of thinking about education technology – an earlier wave on computer-assisted or computer-mediated instruction (CAI), and a latter wave that was more inquiry-based and focused on the relationship between technology and reform. For many, the paradigm of computer-assisted teacher training invokes "teaching by machine" and a "top-down process of advocating and implementing technology," which often left teachers out of the equation (Tyack and Cuban, 2000). It evokes promising investments in smart tutors, simulations, and expert-based systems that are not yet at the point of perfection. As Bellman notes:

> ….We have seen the development of some stunning beginnings in educational technology, but it's not yet the right stuff. Education technology needs to support different teaching and learning styles, gracefully specialize into individual differences, handle diverse theories of pedagogy and learning, evaluate performance within a variety of media, support group as well as individual learning, and incorporate deep and rich content resources. (Bellman, 2001, pg. 379).

In some respects, smart machines and expert systems share the premises underlying a host of other initiatives in technology: that teachers are the problem and a supply of experts and expert digital materials are the solution. They share these premises with advocates of distance education and more populist approaches, who prefer putting computers in students' hands outside formal educational systems. Similar premises are shared by engineers and technicians for whom educational technology is but the long march from computer literacy to programming proficiency. These smart machines and expert systems represent intriguing but suboptimal investments in technology where resources are scarce. Further, most discount systemic change and the importance of the teacher in the learning and reform process.

USAID's Computer-Assisted Teacher Training (CATT) programs in Namibia and Morocco were most extensively influenced by the growing body of experience and literature on education technology, constructivism and teacher professional development. The literature augured for:

- Investments in teachers and advisors with the potential to develop learner-centered pedagogies and instructional designs that could effectively integrate technology and could be enhanced by it (see Archer, 2000).
- Investments in tools and technologies that (a) are inexpensive, (b) address and develop critical and creative thought, multiple intelligences and learning styles, (c) allow learners to imagine and use the tool in other contexts, and (d) are flexible, accessible, and easily learned (see Jonassen, 1996).
- Investments in organizations and networks that could sustain computer networks and peripheral equipment while simultaneously providing the necessary encouragement and support to teachers moving along steep technology learning curves. The networks not only served to exchange information but knowledge, particularly pedagogical knowledge.

The beauty of this approach for developing countries is that constructivism – in the presence or absence of technology – had the potential of serving as a lingua franca for teachers and student teachers with limited or intermittent access to technology via provincial or regional resource centers. Schools could situate their progress within a context of school improvement planning, much as they would develop indicators for progress in other dimensions of institutional improvement. The conditions favoring successful technology integration were simply the conditions that favored education reform more broadly – and significant quality improvements in rural education through community, multi-grade education as well as through whole school reformist approaches. The downfall of providing technology to schools, at least from the U.S. experience, is that constructivism and project-based learning characterize apparent positive results from computer use in schools serving wealthier communities. In contrast, computer use in poorer districts, characterized by drill, practice and remediation, has proved to have negative results for students when used beyond primary education (see Archer, 2000).

Consequently, the big unknowns are the institutional and socio-cultural environmental variables enabling this approach to education technology. In many developing countries, the factors behind institutional incapacity are familiar – centralized ministries, inspectorates, nationalized testing, textbook teaching, rigidities in certification and professional development paths, administrative rules for facilities management and use, revenue-raising restrictions, corruption, unaccountability,

shortages of leadership, insufficient investment and public reach into rural areas, etc. Like other investments in professional development that often do not yield expected benefits when educators are not provided the freedom or the opportunity to apply their newly-acquired skills. Moreover, the development paradigm itself presents other constraints; blueprint planning, international expertise without sensitivity to local culture and society, two-year implementation schedules, a need for visible products and photo opportunities, and the bias toward achieving expedient results over learning processes and capacity-building.

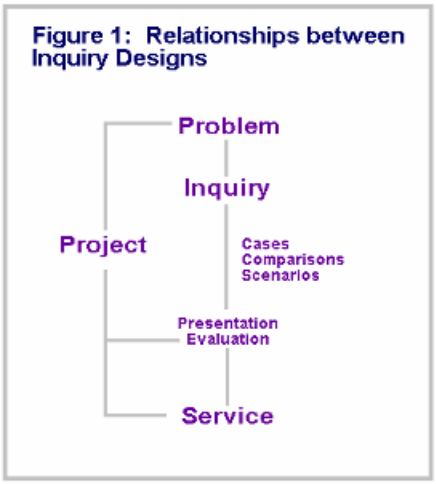
The inquiry technology in education e(y) approach devised through CATT, not only incorporates institutional considerations, but it challenges some tenets of the constructivist paradigm. E(y) works along four principle dimensions:

(1) institutional dimensions related to policy ideas, roles, rules and procedures that enable educational technology programs, constructivist reform and the creation of social capital;
(2) improvement in learning systems that become more open, accountable, transparent, inclusive and flexible;
(3) instructional designs for pre-service and in-service training (preparation and continuing professional development) that are inquiry-based and active (case teaching, Socratic seminars, action research, school improvement planning);
(4) training and implementation designs that are equally inquiry-based and active, that cover skills training, pedagogical changes associated with construction, with overviews of communications in learning systems, and the institutional and technical dimensions of education technology.

The main assumptions challenged by CATT are the following:

1. *Movement towards developing inquiry-based applications and technology skills need not be linear and incremental in the present development context.*

A widely held perspective is that educators pass through stages beginning with the development of technology entry skills through drills and exercise and continue through to technology integration and developing collaborative projects and inquiry-based learning activities. Developing countries, though, are mounting education technology programs at a different point in educational technology's historical timeline such that adoption might be accelerated, training might focus on creating technology champions rather than applications-cognizant educators, inquiry-based instructional designs may appear earlier, and entry into communities of educators may be encouraged during the initial stages in order to accelerate a non-linear acquisition of technology and inquiry skills.



2. *Technology integration through constructivist, inquiry-based, or learner-centered education may include the teacher playing multiple roles alternately shifting from the lecture podium on center-stage to the workstation and workspaces throughout the classroom, offstage.* Much of the current literature suggests a gradual shift from one end of the spectrum to the other. The conception of this transition requires clarification and less hyperbole. Currently, theorists and practitioners overly-differentiate among designs termed problem-, project- and inquiry-based by definition, or they become constrained by their historical and philosophical origins and orientations. In too many cases, these typologies fail to offer insights into technology's relationship to basic methodology (i.e., knowledge construction through comparison) or into technology's integration into case teaching.

There is also a long track record of technology crash courses (and methods) that are paired with initiation sequences for student-professionals in education and in the social sciences. Typically, technology's relationship to improvements in delivery mechanisms for in-service training, beyond distance education, receive scant review. Depending on the instructional design, the education system level (primary versus secondary), and learning and teaching styles, teachers effectively convey information and knowledge directly to students and play a central, active role in directing structured inquiry. The field and the paradigm often lack the pragmatism they embrace.

3. *Technology training can begin with active learning and inquiry.* Because of its linear and logical infrastructure, many trainers feel the need to construct their training following a line of linear, logical and overwhelmingly passive review of the equipment's architecture, history, and known uses. Particularly in the international development context, technology provides a window to demonstrate new learning paradigms to education professionals. E(y) implies an active involvement of learners in education technology training. This includes thinking critically about technology, imagining and testing possible applications in instructional design, evaluation of results, and reflection on the processes and outcomes involved. The training walks educators more broadly through the creation of their professional projects and instructional designs and involves them in the appropriation of their community and learning environment very quickly. In this way, technology training allows the professional to acquire the skills to use the technology, but immediately begins to press them to provide it meaning while providing them an experience as a learner in a new paradigm as well. Moreover, e(y) encourages training heterogeneous groups that may yield high multiplicative effects in various domains using technology.

4. *Meaning is as important as knowledge and information.* While economists recently discovered knowledge after decades of focusing on information (perfect information and information asymmetries), education researchers have focused on knowledge and its relationship to cognition and intelligence. But the more interesting connections to be drawn are tri-fold, between information, knowledge and *meaning*, in direct relationship to experiential if not existential learning (with potential negative and positive effects of computer-mediation). Meaning begs the questions of culture, values, language, effort and struggle, currency and relevancy that are critical components of educational quality. In this case, e(y) suggest that both *e* and *IT* should be a function of why (i.e., e(y) and it(y)). Through such questions, meaning is explored and created in line with the constructivist paradigm. This is not solely a domain for economists or knowledge management consultants, but for the pragmatists and the advocates of project-based learning and social capital.

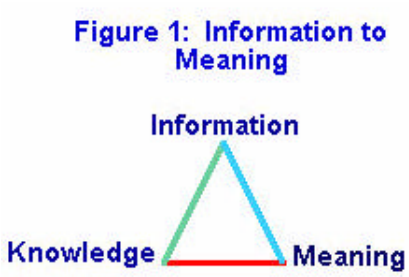


Figure 1: Information to Meaning

5. *If technology is to be seen and used as catalyst for change, then institutions and institutional roles must be assumed capable to change.* As the case studies will demonstrate, e(y) would suggest technology has perhaps its greatest impact where it can be a catalyst for change. Where change and reform are desired or imminent, institutions should not be considered fixed or immutable, but variable and subject to experimentation and change. Technology programs, therefore, should take "responsible risks" in support of institutional change.

6. Finally, *technology integration and adoption are facilitated by community IT Projects and benefit from democratically fostering the development of community.* On the other hand, knowledge networks and collaborative exchange cannot be simply mandated and do not fit easily within blueprint planning and non-participatory approaches to international development. In the absence of congruence between desired outcomes and implementation processes, a community cannot be created by fiat or by contractual stipulation. This is the equivalent of expecting change by mandating that meetings will be scheduled. Rather, it demands mobilization and participation in the conception of the education technology enterprise itself. Because learners are appropriating their learning, e(y)

provides the architecture for inquiry but not the content, provides ideas that are open to cultural values yet are non-determinative, asks questions with multiple answers that depend on environmental factors, and poses options that stop short of decisions.

The e(y) approach thus attempts to combine institutional and programmatic approaches. It develops a consistency between constructivism in education, training, and project implementation. It challenges development timelines; it augurs for emphasis on meaning and experience in keeping with pragmatism; and, it centers the debate on inquiry and instructional design, and personal/professional projects. Sustainability and organization require fresh thinking about organizational roles and networks that support active inquiry. These requirements suggest that technology tools should be powerful and simple. Teachers figure prominently in both old and new equations, and the computer is relegated to a tool to be used in the proper context per the proper instructional design.

The e(y) approach is consistent with Sen's (2000) conception of development as freedom, and with proposition that development is closely related to a complex multifaceted understanding of "maturity." Founded in pragmatism, e(y) acknowledges cultural values but is ideologically-independent in that it provides for deliberation and problem-solving among members of the educational community. It is democratic in that it asks learners to exercise choice in the course of their own learning and to contribute to problem-solving in the public sphere. E(y) is not antithetical to markets or governments but, because it is community-based, it is not wholly situated in any one particular segment or sector of society. It looks at technology costs per student or teacher as a point in a cycle of human-fixed capital investments that depreciate over time and that have varying salvage values at the end of an amortization period. It envisions community and equitable institutions of trust as cost-effective vehicles for managing maturity and retooling. E(y) thus builds social capital over the course of an extended, institutional learning process.

Critics would argue that there are intractable problems of collective action in e(y), namely free-ridership. They would suggest that community members must still overcome myopic under-investment in the short-term in order to reap long-term benefits. Property rights issues arise, as do conflicts requiring resolution. Incentives must be provided to educators who take risks for innovation and change. And thought must be given to the time frame within in which the under-served are reached. Many problems become apparent only as technology programs develop – and consequently inquiry and problem-solving skills again are requisite to an e(y) approach.

Inquiry technology programs of an institutional nature [e(y)] is in many respects a short-hand for the Computer-Assisted Teacher Training (CATT) program dimensions that developed out of a combination of theory and practice from 1999 to 2001. In order to determine the "goodness of fit" in two development contexts, we turn now to experiences of Morocco and Namibia to compare the programs against the four dimensions of the model, and the six challenges to the conventional constructivist paradigm for education technology.

The CATT Program in Namibia and Morocco: General Outlines

The Computer-Assisted Teacher Training (CATT) program was developed by USAID's Center for Human Capacity Development in order to assist its country offices in cost-sharing projects that piloted education technology in teacher training.[4] During the latter half of 1999 and early 2000, the USAID offices in Morocco and Namibia expressed their interest in exploring education within the context of their strategic objectives in improving access to quality education.

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[4] The CATT program was developed under USAID's LearnLink Initiative by Stephen Tournas (USAID/HCD).

Many of the design components in the Morocco and Namibia projects were similar. For example, the main objective in the Kingdom of Morocco was to develop a network of seven teacher training colleges linked by Internet, and to develop a basic training program for in-service and pre-service training that would teach teachers how to use and maintain the network, computer equipment and peripherals. A similar objective in Namibia was to link five Teacher Resource Centers and develop capacity at the National Institute for Educational Development to produce multi-media professional development materials largely to assist in delivering teacher certification training programs via distance education. An interesting challenge in the project designs was their foci on training (and creating) "technology champions" over and beyond demonstrating that a certain number of teachers received applications training that resulted in proficiency. In both cases, USAID asked that CATT build communities of educators able to communicate and collaborate via electronic mail with one another and capable of producing instructional materials. Technology integration was a core concern. The budgets and time frames were modest -- $700,000 over a two-year period in Morocco initially and $1.0 million in Namibia over a sixteen-month period.

In neither country was technology a major component in USAID's education portfolio. These were not technology-centric endeavors. The issues confronting policymakers in both countries were primarily issues of systemic under performance and unequal access to quality education. In Morocco, where development falls on the urban-rural divide, the principal losers are rural women who are illiterate and fail to enroll or persist in the educational system. In Namibia, educational opportunities did not historically avail themselves to black Namibians in the apartheid years prior to 1990. USAID in Morocco supported a girls' education initiative that focused on rural educational improvements and quality instruction in demonstration schools under the Morocco Education for Girls (MEG) Project. The USAID Mission in Namibia assisted the MBESC in piloting a "whole school" approach to educational quality improvement, involving community participation in school improvement planning, under the Basic Education Support (BES II) Project.

As Figure 2 indicates below, the CATT initiatives in Morocco and Namibia nonetheless were unique in many respects, reflecting the needs and the institutional specificities of the two education training systems. The figure provides a brief description of the project design elements in each of the four dimensions of CATT or alternatively the e(y) approach. This summary will assist in framing the discussion and comparison across the two countries.

Case 1: CATT-PILOTE/Morocco: Ibtikar

CATT's program in Morocco arrived at a time when the Ministry of National Education (MNE) was in the midst of developing a reform agenda. Prior to his death in 1999, King Hassan II voiced the mounting frustration of the general population at the poor performance of its educational institutions. The king called together various members of civil society to develop a National Charter on Education, working under the auspices of the Belfikh Commission. These consultations took place under a Palace-led coalition government that was nonetheless headed by socialist Prime Minister and placed left-centrist ministers at the education helms.

In 1999, the Belfikh Commission released its report as the MNE developed a series of twelve quality plans for educational system improvement. One of the twelve was devoted specifically to education technology in primary education. The plan, entitled "Plan 2008: un center – multimedia – Internet", here denoted as Plan 2008, was very ambitious in terms of its roll-out. In its first year of operation, 1999-2000, the MNE undertook a large scale procurement of a computer based local area networks for 300 educational establishments which was to be doubled in its second year. The MNE established a computer training venue in Settat, and set about training technicians and educators capable of manning the centers. The training program was partially underwritten through a donation by Microsoft, which provided the software packages, operating systems, and training assistance in Microsoft software.

Figure 2
CATT Project Dimensions in Morocco and Namibia

Dimension	Morocco	Namibia
Learning Systems	Teacher preparedness / Development of community of educators associated with the CATT-PILOTE project; outreach by individual training colleges to members of their communities; Technology consists of local area network connected by server appliance and peripherals with permanent connection to the Internet; supplemented by second LAN consisting of 5 additional ministerial workstations. Communications tools and training college websites developed locally.	Teacher professional development / Development of community of educators supported through professional development unit at the National Institute for Educational Development (NIED), with ties to local non-profit, SchoolNet, working with out-of-school youth; Technology consists of local area network connected by Linux servers with permanent connection to the Internet; wireless hubs and laptops proposed for advisory services; thin clients for future laboratories.
Institutions	Decentralization/regional academies of education; training colleges as provincial resource centers, with some autonomy for revenue generation; local academies to be given responsibility for creating 15% of the national curriculum; pedagogy to become differentiated and project-based at mid-semester.	NIED and a proposed Educator Development and Support Network offering certification, extension support and ongoing professional development through Teacher Resource Centers.
Inquiry	Constructivism, questioning strategies, inquiry-based learning (web quests) and project-based learning among topics covered in training, with view to future reform.	Social constructivism is an MBESC philosophy; CATT putting existing materials online; development of InformED – a program that combines civic education and web quest competitions; development of inquiry-based, reflective approach to technology acquisition by education professionals.
Training Model	Pre-service; seven module introductory series influenced by ministry design, STaR chart progression, ministry needs assessment; opportunities for mounting professional projects and reflection	Active training piloting a seven-step process from entry to reflection; integrated training into systems for in-service training: certification, school improvement, and mobile advisory service development.

Participants	Heterogeneous regional training groups of college instructors, primary teachers, project center advisors and student teachers Study tour of education technology programs in the United States for training college directors and senior ministry directors Network administration and support provided by ISP Morocco Trade and Development Services (MTDS)	Training of unemployed, semi-skilled youth (women) as resource center facilitators; Training of multi-media working group at NIED; Training of Regional Education Technology Teams (RETTs) that include teachers, student teachers, regional education advisors, adult education tutors and administrators
Materials	Training modules and web site developed in Arabic.	Training modules repurposed to provide basic skills materials available online and on demand.
Main Indicators	Participants, beneficiaries and adoption rates, web presence	Number of participants and visitation at resource center computer facilities. Demonstration that competencies achieved by training participants.

CATT was developed in consultation and partnership between USAID and the MNE. In November 1999, the project undertook a technical needs assessment at the teacher training college in Sidi Kacem. This assessment was intended to develop the specifications for a modular network of sorts, consisting of (a) local equipment and physical improvements to facilities at the teacher training colleges and (b) the sets of central services (ISP hosting, addressing, network support and troubleshooting) that would be consistent with the MNE's Plan 2008 and meet the objectives of the project. As quotations were solicited for the entire network, the contract was expressed as a series of options for installation and configuration at each training college. The mechanism allowed for adjustments, and in principle, could accommodate as many or as few additional "modules" or LANs as required. Based on this assessment of technical needs, CATT worked with USAID and the MNE to formalize a memorandum of understanding that specified the obligations of the partners. Over time, this formed the basis for credible commitments of resources to the project. It was agreed that the programs would cost-share, each providing five computers to the colleges, with USAID picking up the network installation and peripherals, and the MNE covering recurrent connectivity charges and the costs of improving and securing the physical locations for the multimedia centers.

The training design considerations were multiple, and consensus was not always reached on issues before the joint working groups and consultants. First, there was the issue of language and the appropriateness of technology training manuals available on the market. It was decided that it was worth CATT-PILOTE's time and effort to craft a modular series in Arabic language with which to reach 100% of the educators working in rural areas of the country. The series, moreover, would open with discussions of constructivism and situate skills acquisition within a broader context of reform and change in Moroccan education.

Second, there was an issue of structure, training objectives and backwards planning. The Plan 2008 training program was sketched out, with introductory modules to cover basic office applications, communications and network basics. Yet it left the latter modules covering topics of technology and instruction "to be determined" for development prior to Year 2 of the program. Through collaboration with Future Kids, the MNE sought to develop a similar training design for professional

development involving approximately forty to sixty hours of training that could be completed in a week. The materials were to be flexible, allowing use in formal seminars and self-study modes.

For months, CATT-PILOTE attempted to get a sense of the training college curriculum, reform strategy under consideration, and what integration of technology training might involve. Unlike other areas of education, it turned out that the training colleges had been relatively neglected and untouched. They were characterized by courses with syllabi and by instruction that did not deviate often from training in the use of the primary school text books. From discussions with counterparts, it became clear that the MNE was itself moving towards systemic reforms inspired by Philippe Perrenoud's work on differentiated pedagogy, by project-based learning, and by greater public-private partnership and community involvement in education.

The challenge consisted of providing enough information in an introductory course that would move learners (and institutions) from stages of technology entry well on their way to innovation. All this needed to occur in a development setting without assuming that technology would be awaiting these student teachers in their rural schools. Thus, while inquiry and constructivism were the dominant theme of the module series, CATT-PILOTE's end point was fixed on the development of instructional designs. These designs needed to be (1) project-based, and (2) if the product of the project was multi-media, then project-based learning (pedagogie du projet) could apply to the process of producing more polished multi-media products. CATT-PILOTE then planned backwards to inquiry-based learning using the Internet, to evaluation criteria of multimedia, to skills development in .html, the construction of knowledge through communications, and to basic skills – in keeping with the MNE's training design. The objective sought was, in this case, to favor depth (by providing breadth and context in education technology, over depth by providing intermediate skills training).

The design was exploratory and engaging, and assumed that what could not be taught in a tight time frame could be learned in class or made the subject of further inquiry – supported by the multimedia centers, as well as the work of the Morocco Education for Girls (MEG) Project.

The focus of project activity, and the locus of the intervention, were the teachers and student-teachers in the teacher training colleges. The project recruited young, unemployed, and semi-skilled multimedia center advisors. The implicit goal was to foster the creation and growth of a collaborative team – heterogeneous in nature – that would dissipate the ingrained role divisions between technician and educator, instructor and student teacher, teachers and students. By breaking down these divisions, mentoring, co-training/teaching, peer-to-peer exchanges would thrive. Moreover, by training a larger group of educator-trainers, CATT-PILOTE hoped to assure a larger multiplicative effect of the intervention and coverage for longer periods of multi-media center operations. By spreading the training, the additional burdens of assuming education technology responsibilities would not fall heavily on the shoulders of one individual, but lightly over a larger group. The program thus rested in the hands of the faculty of educators, rather than in the hands of the project or in the hands of the administration.

Preliminary Results

The CATT-PILOTE intervention turned out to be a rather complicated intervention, made more so by the administrative and contractual procedures associated with managing the USAID contract and the terms of the memorandum of understanding. Consensus-building and mobilization within the ministry required up-front investments in the first seven months of the project as plans were formulated and equipment procured. Consequently, CATT-PILOTE reaped less than a full year of experience and enjoyed a mere two months in which all seven centers were connected to the Internet. Nonetheless, there are a number of results that have been reported by the MNE, USAID and CATT-PILOTE's external evaluator in 2001:

- The combination of staffing, contractual support through MTDS, and the equipment itself permitted the local area networks to continue operation with very little down time. Cobalt Qube 2 servers, used extensively in French and German education systems because they can be managed by non-technical educators, were able to be remotely administered and monitored. They were stable and permitted center administrators to spend less time trouble-shooting and more time assisting center clients.
- The basic skills training modules –Module 1 – developed in Arabic was approved by the Curricula Department for use in all Moroccan educational institutions.
- The profile and job description for instructional technology advisors was adopted by the MNE for future staffing and system development. A total of seven multimedia center advisors and some 32 members of the technology core training groups directly trained approximately 2,500 learners, and between 3,000 and 4,000 individuals accessed the multimedia centers.
- External evaluations and visits provided qualitative data suggesting that the morale within the colleges had improved, collegiality and collaboration had increased through the creation of the teams, and most groups and stakeholders felt a sense of ownership in the project;
- The MNE members of CATT-PILOTE's joint commission signaled that CATT had been one of the most successful development assistance projects, and a model for other development assistance efforts.

Case 2: CATT-Namibia: ED'S Net.

In Namibia, the post Independence education philosophy adopted by the SWAPO-lead government circa 1991 was a progressive form of social constructivism. The Government of Namibia charged the education establishment, i.e., the Ministry of Basic Education and Culture, with the formulation of policies advocating basic education for all and improved systems for tracking educational inputs and outcomes. The Ministry was also able to quickly upgrade educational quality by lowering student-teacher ratios and upgrading the credentials of its teaching corps. Four goals explicitly expressed in the Ministry's drive to better serve all of Namibia's youth have been *equity*, *access*, *quality*, and *democracy*.[5]

As with many cultures, Namibia has chosen investment in its youth as a primary vector for the remedy of social ills. In this case, the ills remaining from an apartheid system that explicitly encouraged its citizens to adhere to a system that relegated individuals to their place in a social pecking order based primarily on race and physical characteristics. Namibian learners, therefore, come to school from households where the adults are nearly as unfamiliar with concepts of democracy, self-reliance, and problem solving as the children. Further, both the adults and the children come with the psychological baggage accumulated from years of experience in a fragmented society that once actively and now passively informs the majority of its citizens that, at best, they are second-rate with little capacity for improvement or hope for advancement.

In 1999, a Ministry convened a task force to evaluate progress made by the post-Independence education system and propose recommendation for continued improvement and reform. Their report, the *Ten-Year Plan for Educator Support and Development in Namibia*, called for the creation of an Educator Development and Support Network to provide and encourage strong, early, and continuous professional development for Namibia's education professionals (Ministry of Basic Education and Culture, 1999). It also recommended that the National Institute for Educational Development (NIED) lead the creation of this network. NIED had been originally conceived by the SWAPO government in exile to serve as the nerve center for educational reform, innovation, and

[5] Ministry of Education and Culture, Towards Education for All: A Development Brief for Education, Culture and Training (Windhoek, Namibia, Gamsberg Macmillan, 1993), 32.

experimentation, research, and development in Namibia (Argula, 2001). The objectives of CATT/Namibia were to:

(1) Establish an information and communications network for education professionals;
(2) Develop the capacity at the NIED to develop multimedia teacher training materials;
(3) Develop model teacher training materials for online and CD ROM delivery;
(4) Develop a cadre of technology champions; and
(5) Provide IT policy support to MBESC.

In general, the project was seen as a mechanism to support the Ministry's ongoing efforts to raise the qualifications of the many teachers remaining in the system who, ten years after Independence, had yet to meet the minimum standards for teacher preparedness. It was also designed to help support the development of an Educator Development and Support Network. It was recommended in the *Ten-Year Plan* that the network be coordinated by NIED and located within the already existing network of Teachers Resource Centers (TRCs). In theory, this network of centers would grow to include all of the nation's advisory teachers and provide ongoing support services to classroom educators, and begin the process of encouraging continuous professional development (CPD).

NIED and other project partners encouraged the project to implement its interventions in a manner that not only conveys constructivist theory but also models a constructivist approach. One frequent theme was that, while Namibia had enthusiastically adopted the theoretical concepts of constructivism, this adoption was unnecessarily complicated. Too few education professionals had experiences in environments that model participant-centeredness, democratic development of purpose, and social construction of meaning. One foreign consultant, when informally interviewed, half-seriously asked, "How many articles and lectures on learner-centered education does this [country] need before it will understand these reforms?"

Indeed, Namibia's education sector has been experiencing the growing pains that normally accompany change. These have been compounded by more serious pains associated with the Government's embrace of education reforms that have sought to sweep away a highly prescriptive education system and replace it with a system based on a dramatically different world view. The new perspective not only suggests that the old rules were wrong but asks the constituent units within the system (e.g., learners, teachers, schools, principals, teacher training colleges) to construct their own definition of what the new rules mean. It has been somewhat akin to approaching a cook that, for years, has been asked to make one dish following a very precise recipe, and telling her that it is much better if she allows the food to tell her what it wants to become. Then, when she asks how to do this, continue to provide her with ever more in-depth explanations and books on why this approach is important, but never once provide her with a demonstration or hands-on experience with the process.

Wherever possible when developing implementation plans, project collaborators have attempted to take this advice to heart. In this regard, they have struggled to develop methods that model constructivism. They have also tried to allow the Ministry and its partners to lead the project's implementation. While the project is largely confined to activities that address its five objectives, most of these objectives have proven somewhat flexible. In general, the project's greatest successes have been in areas where it has helped develop space for project partners to determine the project's activities. It has been less successful in areas where it has been forced by the project objectives to be more prescriptive and directive.

Other objectives provided greater flexibility in allowing the project to develop more constructivist approaches. Objective 4, in which the project was asked to encourage the development of *technology champions*, provides an example. In developing its approach, project staff, once again, turned to project partners for guidance. Some of the advice was, first, that these technology champions should

attempt to bring various groups of education professionals together to discuss issues surrounding the use of IT in education. Second, the approach used to train these professionals should model learner-centered and reflective approaches. Project partners also wanted to develop an approach that would model what it means to be a technology champion. From the project's perspective, a technology champion is proactive, likes to tinker with new hardware and software, develops creative uses for technology, and shares their insights and experiences with others. In considering this job description, though, project partners came to believe that *any* training approach that remotely resembled a transmission model could seriously undermine the effort to develop champions. After all, champions should be active acquirers of technical competency and creativity, not consumers passively waiting for the next round of technology training. The approach finally developed by the project for this purpose was OSSIAR.

Short for *open, shake, share, imagine, act!!!, and …reflect*, OSSIAR is both the conceptual framework for the project's latter training designs as well as a model of the process a technology champion follows when actively experimenting with a new technology. *Open* is the starting point; literally taking the new technology out of the box and getting started using it. *Shake* is the experimentation phase where the champions push all the buttons and explore the new technology to find out what it can do. *Share* suggests that champions can and frequently do develop communities of like-minded experimenters who informally share insights and suggestions with one another. It also demands that they share their ideas and understanding with friends and colleagues. *Imagine* is where the champions ask, "So what?" or where they say, "Aha, we can use this to…" *Act!!!* implies that the champions move from the "aha" moment to active experimentation in applying the technology to a given purpose. Finally, *…reflect* asks that the champion reflect upon both the learning experience as well as the application of the new technology. Not surprisingly, the model for this process was a mental exercise trying to imagine what children would do if given a box with a mystery puzzle inside.

Armed with this new approach, the project sought to operationalize the concept into a training approach. This was not difficult as it seemed obvious that the best method to train people to follow this approach was to simply use a sample technology that would allow them to experience the approach. Essentially, the project would initially provide a new technology along with a very short set of instructions describing how to "open" the technology and then allow the trainees to follow the steps, encourage them to help each other and share experiences, ask them to consider the technology's utilities, encourage them to try it in their jobs, and facilitate individual and joint reflection.

Realizing that the level of comfort with the technology would be varied, the project chose the first meeting's theme to be "overcoming fear." As such, the first technologies used with the OSSIAR approach were *Discover Windows 98*, *Mavis Beacon Typing Tutor*, and learning about a web-based e-mail service. The only materials brought to these meetings were four *One Page Introductory Sheets* (OPIs) designed to show the team members how to open the programs needed to start these applications. Beyond this, project staff made sure they were nearby to answer questions and provide support, but only when specifically asked. This support was seldom requested…the silence was deafening. All of the users were asked to work with the applications to decide how helpful they would be in helping their colleagues learn about computers and overcome their fears of technology. As such, the experienced users worked through the applications with this in mind, while the new users used the programs to teach themselves how to use the computers and these basic applications.

After each team was given time to work with one of the applications, the facilitator would bring the team members together to reflect upon their experiences and talk about how useful the tool would be in assisting one of their colleagues to gain confidence in using computers. The answer was quite obvious as all of the team members had managed to learn the new tools with very limited input from the project facilitator. A second questioned asked was, "How could this application be useful in your

job?" In two and a half days, the project managed to "train" a heterogeneous group of education professionals how to maneuver around an operating system, begin upgrading their typing skills, use a web-browser, and access and use e-mail. Further, the team members felt empowered to work with their colleagues, clients, and learners to help them acquire these same skills and had begun providing their own answers to the question, "For what can this technology be used?" Essentially, the team members were in control, learned at their own pace, asked for assistance only when they wanted it, got just-in-time answers to their questions, shared their experiences and ideas with other education professionals, and experienced the acquisition of several basic competencies in a learner-centered environment.

Preliminary Results

At the time of this writing, the CATT project in Namibia is three months into a six-month extension that gives the project a 22-month lifespan. The project is generally appreciated by the Ministry and other project partners. Listed below are a few of the more interesting preliminary results and outcomes of the project's activities.

- The four centers have been in near continuous operation since opening. They have all become key centers for providing IT training to educational professionals at NIED and in the regions.
- The project has been able to leverage significant support for local education technology, SchoolNet/Namibia.
- The centers now have a combined total of over 900 registered users. All four receive some revenues from use by users not affiliated with the education system.
- The centers are still managed by the original Education Technology Trainees trained by the project. These ETTs continue to gain valuable knowledge and experience and seem to professionally grow in their positions daily.
- The Regional Education Technology Teams are blossoming. In one case, two RETT members in one region teamed up to train over 90 faculty and staff from the local Teacher Training College largely using the materials and approached they experienced during their first meeting with project staff.
- The ED'S Net website has received several thousand hits including just under 500 that have lasted over 30 minutes. The site currently houses over 40 professional development modules covering basic teacher training topics, management topics, and HIV/AIDS education. The project has plans to train more NIED staff to provide content to the site.
- Using project input, NIED has recently procured sufficient workstations to provide small computer centers in ten additional TRCs around Namibia.

Conclusions

The experience of Morocco and Namibia suggests that education technology programs to strengthen teacher preparedness and professional development can enhance the quality of professional training. Appropriate and appropriated technology can also strengthen education reform processes. In the context of reform, education technology pilot projects can become creative disturbances that involve teachers not only in the acquisition of tools, but in the ownership of the educational reform project itself.

It has been our contention that inquiry technology in education, or e(y), is somewhat different from what we think of as computer-assisted instruction (CAI) or training. It integrates institutional considerations into the project design and it offers teachers the opportunity to participate actively in their own learning. By focusing primarily on technologies, inquiry and the tenets of constructing meaning and knowledge through action, Ibtikar and EDS Net in Morocco and Namibia respectively create educational community and public goods. In so doing, technology training programs become metaphors for the types of pedagogical changes desired in the classroom. It is our view that education technology programs funded through development assistance have a better chance of

generating multiplicative effects if donors and implementers fuse participatory, learning process approaches to implementation and training programs that are enhanced through technology. This not only augurs for a less techno-centric approach to education technology but a much more dynamic process of institutions and institutional change, in which stakeholders take responsible risks in educational innovation.

There are many reasons why this approach, e(y), will likely not be adopted widely. In general, donor organizations are risk-averse – even in reform. They are often not ready to admit that an approach like e(y) might have repercussions that would require institutions to change the way they do business or how they conceptualize and measure development. By and large, central ministries and donor agencies do not often allow pilot projects the flexibility to delegate authority down to the level of the learner in ways which allow them to begin structuring inquiry itself. But as the external evaluation of CATT-PILOTE in Morocco found, active involvement and participation of large number of teachers and student teachers is perhaps the most important factor ensuring that a project is sustained and institutionalized.

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