New Initiatives in Youth Development: Technology Works Enterprises

David Cavallo
Epistemology and Learning Group
MIT Media Laboratory
Room E15-320A, 20 Ames Street
Cambridge, Ma. 02139-4307
cavallo@media.mit.edu

Abstract:

This paper describes a new initiative, Technology Works Enterprises (TWE), a radically different learning environment for low-income, at-risk adolescents. This article probes which aspects of the technological and educational infrastructure of Technology Works helped to make the project successful. It uses a case study of an individual and the developing learning culture to highlight these aspects. Finally, the paper discusses the implications of this project on approaches to vocational education.

Keywords: Vocational Education, Learning Environments, Technology and Education, Youth training.

1. Motivation

Many societies are facing a crisis with their youth brought about by the confluence of various major structural and attitudinal changes. These include the changing nature of work, the dysfunction and subsequent distrust of large, bureaucratic institutions, and the alienation felt by many young people. The symptoms of this crisis include large-scale, structural unemployment and underemployment, high drop out rates, substance abuse, and increasingly brutal and pervasive violence. A large segment of a whole generation risks being permanently disenfranchised and marginalized due to being unskilled and unprepared for active and productive participation in modern society.

Businesses complain that many youth are unprepared for the increasingly technical and complex nature of work. Given the rapidity of change, continuous learning and re-training are essential. Yet, most traditional methods for training and vocational education have limited effect at best.

This paper describes a new initiative, Technology Works Enterprises (TWE), designed as one approach to help address this crisis. The paper describes the goals and design principles of TWE, a sample of activities, and closes with a discussion of the successes and limitations of the initial project.

2. Technology Works Enterprises

Technology Works Enterprises is a radically different learning environment for low-income, at-risk adolescents. The youth involved had never achieved academic success or demonstrated the inclination or capability to perform intellectually rigorous work requiring sophisticated reasoning and mathematical, scientific and engineering knowledge. TWE was an experimental project to determine if we could design and operate a technologically rich environment where these adolescents could build and demonstrate this capability. The teenagers who participated experienced their first real successes in an organized learning environment through their involvement in TWE.

There are two primary goals to this work:
1) To document that it is possible for at-risk adolescents without prior school success to demonstrate significant achievement on difficult projects.
2) To probe and clarify which aspects of the technological and educational infrastructure of Technology Works helped to make the project successful.

2.1 Technology Works Enterprises: School that's not School

Conventional wisdom and practice is that a loosely structured, fast-paced, individual-centered, learner-driven, project-based, intellectually challenging, peer collaborative learning environment is appropriate only for children deemed the best and the brightest, those who are selected for advanced work classes. This same point of view relegates those who have not done well to an almost opposite environment; highly structured, slow-paced, standardized, directed, task-oriented, intellectually-stultifying, and non-collaborative.

This work takes the exact opposite direction for at-risk youth. Rather than pulling content, rigor, and autonomy out of their environment, we provide them with the same challenges and freedom normally only afforded to the elite. Technology Works Enterprises (TWE) is an existence proof of the validity of this approach for that population.

2.2 A Rolling Sample of Life at TWE

Day 1:
It is clear our twelve new participants think they are in school. And they are not happy about it. We decide to use LEGO/Logo for a Soap Box Derby project. Their task is to build cars that will go down a ramp the fastest. They have to theorize about what will make their vehicles go fast, and then build and test them. Bill is explicitly not participating, except to occasionally mock others who are. Worse, it appears, though it is not certain, that he is willfully trying to destroy others' vehicles as they exit the ramp.
Day 7:
Bill is working with the programmable brick, touch sensors and light sensors to develop an accurate timer for the races. There is a great controversy about how to tell who wins a race; how to ensure that all cars start at the same time; and how to get a time for each of the cars racing in a heat. There is animated discussion about various proposals. As a group they can find holes in each. The discussion is the first time they are cohering and cooperating as a group. Bill tries to write the program to control the sensors, coordinate them with the timer and display the values. He is having difficulty and quits. I offer to help but he is highly resistant. I believe he is afraid of not being smart enough to do what he wants and thus quits to avoid the embarrassment. I decide to wait for a while and approach him when fewer people are paying attention.

Day 8:
Bill and I find a time when the others are away on break to work through the difficulties. The program works and he joyfully demonstrates it to the others.

Day 28:
Bill is still struggling to get his LEGO/Logo vehicle to turn. Because the vehicle carries a programmable brick, its weight is relatively heavy. His car moves forward and back well enough, but it stalls when tying to turn. He realizes he needs to trade speed for power in his design. He is experimenting with gear reduction to increase the power. While playing, he places a small LEGO brick in font of the wheels. To his surprise and joy, his car climbs over the brick! He creates a taller barrier. His car is powerful enough to climb this one as well. He had never realized or even considered that there might be a connection between the power needed to turn and the ability to climb barriers. He shows this effect to his friends. Suddenly, a whole new activity grows at TWE: creating climbing vehicles. To these boys, this resonates as a Monster Truck and Tractor Pull. They add it as a new event for our Programmable Brick Olympics. He also bets me that he can design and build a car that will climb the steep hill from the river to TWE. Before the day is over, he demonstrates it. They now have a cluster of activities (climbing, turning, slow-racing, pulling) that utilize gearing down.

Day 34:
Bill is now calling himself "Mr. Brick." He refuses, even in the pressure of having a finished demo for the imminent Open House, to customize his program to adapt to the specific layout of a maze. He insists that the program must be general enough to navigate any maze. He goes through a repeated cycle of modification, testing and debugging. He succeeds and a great cheer is let out.

2.3 TWE Design Principles

The concept of TWE was formulated around several broad beliefs, growing out of the educational philosophy of Constructionism, about what types of environments facilitate powerful learning experiences. The following are some of our design principles. Some are social; some relate to the physical environment; and some relate to the learning environment. All are intertwined.

- Expectations that everyone in the group was capable of significant achievement
- Validation of their lives as important, their experiences as relevant, and their language, thoughts, activities and social interaction as critical components to learning
- Deeply, immersive environment where there was a computer for every child
- Extended amount of time
- Work with materials that are open-ended and malleable
- No pre-set curriculum, where the presentation of ideas are pre-determined
- Authentic activity as the most effective method of engagement and retention
- Understanding systems and powerful ideas within systems
- Technological fluency as opposed to specific skill training as a critical element for developing a continuing and renewable expertise [Papert, 1994].

3. Discussion

The children involved in this project had not resonated with the approaches used in traditional school settings. As often is the case with children from poor or non-mainstream backgrounds, the language, culture, activities and issues within traditional learning environment were not those of the children.

By not having a pre-set curriculum or a pre-defined set of problems, the projects could emerge from the ideas and interests of the children themselves. Often they set much deeper and ambitious projects goals than anyone might have chosen for them. But because they were their own, they had an investment in bringing them to fruition. In order to do this, they had to utilize sophisticated reasoning. These ideas were rooted in authentic activity, in their own language and images [Lave, 1991], [Collins, 1991].

We utilized a multiplicity of materials. Combined with free choice on projects, this provided multiple ports of entry because they were free to choose what to work on and what to work with. This also helped resolve gender issues that often arise as the four girls in our project all performed extremely well.

The materials we initially used all were programming environments (Microworlds Logo, LEGO/Logo, and StarLogo) [Resnick, 1994]. As the project continued, new tools were introduced as children built databases, spreadsheets, and web pages. Because we wanted the children to work on projects of interest to them, and thereby learn concepts that they could apply to subsequent projects, it was crucial that utilize open-ended, malleable environments that the children could adapt for their own purposes. We believed that by developing fluency first, they would be better suited to expressing and completing projects in the future, particularly as new tools and domains were addressed. Our experience demonstrated that this view was justified.

We received two criticisms for this approach. One was that programming was too difficult and that these kids could not do it. The children themselves thought that it was hard, but this turned out to be beneficial. Because they attempted something they believed to be difficult, using technology that they endowed with the quality that it takes smart people to use it, they gained an incredible amount of cultural capital. They altered their views of themselves from a bunch of dummies to sharp technologists. They reasoned that if they could perform this work, then they too must be smart. If their work had been pared down this benefit would not have accrued.

The other criticism was that they would not be employable by learning the Logo suite of tools; that we should teach keyboarding or spreadsheets or something where they might get a job. Typical vocational education is task-oriented and slow-paced, because children receive vocational education since they are too slow for regular education. They are only trained on specific tools.

This too we rejected, not merely because even if such jobs do exist now, they soon will be obsolete, but also because by developing a technological fluency they would be better suited to perform meaningful work in the near and long terms. This view also was justified as by the end of the summer project, they had secured projects building web pages for community activities, providing network, hardware and software support, and as teacher's aides.

By providing a deeply immersive environment, we were not constrained by lack of access to machines or materials. This allowed everyone to gain the benefits from working with the technology. We did not have to take Legos apart to allow another group to work with them. The children had ample time and access to computers. They could have multiple projects in development simultaneously. Many expressed gratitude that they could work on several things at once, for if they were stuck in one project, as often happened, they could take a break and work on something else returning to the original project with a fresh approach. This resembles a typical work environment more than a typical school environment and that is precisely the point. Often the constraints imposed by schools in the name of providing bite-sized morsels of knowledge.

The TWE participants enjoyed the luxury of time. Projects could evolve over a long periods. Thus, they could delve deeply into areas of interest, rather than broadly but shallowly as so often happens.

Perhaps the most critical thread running through the entire program was the issue of *control*. Students from disadvantaged backgrounds typically have little control over their learning, and hardly none over the institutions they attend [Giroux, 1981]. We wanted them to have both, while not abdicating our responsibility as caring adults involved in their lives.

We not only opened up the activities to their freedom of choice, but we also opened the operation of TWE itself. In the beginning of the project, the staff would run a morning meeting to map out the day's activities, plan for the future, address problems, etc. At first, the children treated this as school. That is, they ignored most things, did not pay attention, just wanted to get out. Gradually, they came to see the program as their own and by the end of the project were running the meetings, setting the budget, and making decisions democratically.

A turning point was when we first had a meeting to "debug TWE." We opened the discussion to them to say what was going well, what was going badly, and what they wanted to do differently. It was clear that they had never been engaged with an institution in this way previously. They were reluctant to offer any criticisms. Perhaps this was not only a matter of being unaccustomed to such a role, but also because they did not trust or believe that we would act upon their voices. When we did, and truly demonstrated that this was their project as well as ours, their participation changed on numerous levels.

Our goal was to use critical questioning, not only in debugging programs and mechanical artifacts, but also in addressing institutions and activities in their lives. Their learning in institutions had never been their own, in their control. Thus we could see a discrepancy between the institutional description of these children as incapable of learning and their lives where they demonstrated intelligence in their own activities. Our aim was to bridge from their inner strengths to other domains. To do so required a valuing of their experiences and language and not an imposition of a different set.

Once this was achieved, and an initial fluency developed, we toured their city to study how technology was used, and how they might improve their environment. This was a radically different relationship for these children to their community. These are adolescents who, when they go into the stores of their neighborhood, the proprietors become nervous and watchful. These are children normally alienated from the established norms. Now they were called upon to improve the community.

After their investigation, they returned to TWE to analyze what they found, to brainstorm about improvements, and then to build models of what they would change. This was then demonstrated back to the community at the project-ending Open House.

3.1 Limitations

Naturally, not everything attempted at TWE worked or resonated with the teenagers. Many suggestions were made that were not accepted. Many developments occurred that were unexpected or unwelcome. There were many aggravations and frustrations. Not everyone made all the progress we desired.

The structure of TWE itself had advantages and drawbacks that require elucidation. While we had the luxury of only working with 12 children, even this 12:1 ratio was too large in the beginning of the project. Much of the early work was spent searching for activities that could engage the participants. Early on every obstacle was met by a tendency to quit, and naturally, while working with technology there were constant, and often obscure, obstacles. The children were not resilient learners.

Finally, the seven week period that the program ran, while sufficient to demonstrate that the approach is feasible and, most importantly, sufficient to provide an extremely positive experience in the lives of the participants, was not sufficient to turn anything totally around in the community nor to necessarily provide a lasting effect in the lives of the children.

4. Future Plans

Currently, a new Computer Clubhouse has evolved from TWE. We hope to begin a new TWE and run it over an extended period of time. This should help address some of the deficiencies mentioned above, as well as provide a better basis for evaluation of the concept.

We will begin with a smaller number of children, and gradually increase the number of participants. We hope to have that children will flow into and out of the program seamlessly; that is, participating at TWE part-time, going to work, going to school, returning, and so on. Early participants will serve as mentors for later ones. The roles of coaching, teaching and guidance will be taken on more by the children themselves. This, coupled with the revenue earned through performing work for the community, will help reduce the costs of the project.

We believe that TWE demonstrated that it is a viable option for preparing disadvantaged youth for meaningful work in the modern, technological economy. We adapted our approach based upon our interests, the lives of the children involved and their interests. Business is evolving from large hierarchical organizations to smaller, more varied, nimbler ones. We believe that by providing a multiplicity of learning environments, the needs of more children can be addressed better than trying to accomplish everything within one type of institution.

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