

Program design of STEAM education initiatives in urban communities

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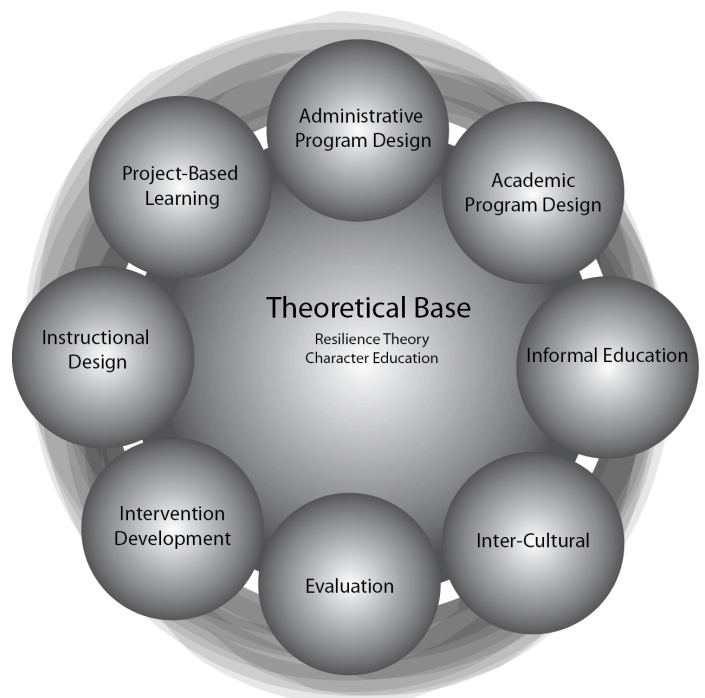
ABSTRACT

This presentation discusses the significance and relevance of program design research in Informal environments in urban communities. Design and project based research developed through the Center for Urban Youth and Technology (CUYT) model has produced several Science, Technology, Engineering, Arts, and Math (STEAM) projects in urban communities. Elements of our design model will be explored and defined. Connections between project, design, and intercultural research will be presented to define how the CUYT model has evolved. A case study intervention will be included to provide evidence and details of our model. An external project based research model will be provided for comparison and utilized to enhance further discussion.

Keywords: Project Based Research, Informal Education, Instructional Technology, Resilience, Character Education, Inter-Cultural, Intervention, and Evaluation.

1. INTRODUCTION

The CUYT model (Figure 1) is adaptable, flexible, and able to be implemented in any urban setting given knowledge of that community environment. It is a project based, hands-on, and non-threatening, student-centered learning environment. A driving theme is the importance of providing intercultural models that are based on the population of participants living in these urban settings.



CUYT Design Model (Figure 1.)
Design by Manulito Loman, M.L.S.

The model addresses “cradle to the grave” or “pipe line” notions, and provides continuity in STEAM education activities for urban youth, their parents, and their teachers. The theoretical base for the model centers around the “resilient” nature of urban youth and the design of interventions that support and expand these attitudes and concepts.

Our presentation defines the model and discusses the basic themes for the design and development of program interventions that incorporate project-based design, informal education environments, and intercultural [1] models.

STEAM is identified as a critical factor in the development of innovation, economic opportunities, and social expansion of the United States of America. We are challenged by a “Quiet Crisis”[2]: we are not preparing our youth to become future 21st century leaders of the labor and university workforce. Public and private education must provide academic and scholarly pathways that support educational achievement for our youth. The challenge of the “Quiet Crisis” includes high drop out rates that are problematic. Each year, approximately 1.2 million students fail to graduate from high school, more than half are from minority groups. [3]. The average scores of 15-year-old students (PISA 2009) rank 25th out of 34 countries when compared with students elsewhere in the world. [4]. The average scores of 15-year-old students on a science literacy scale, Ranked 17th out of 34 OECD countries. [5]

The data suggests that educational program designers need to identify new, innovative, and creative strategies to address these issues and reach this “new majority” of learners.

The problem is how to reach the students of the ‘Quiet Crisis’ with cost effective program design models that support and supplement existing formal academic systems. Another option is to create alternative (informal) program models that provide authentic, hands-on activities to mirror or shadow educational and workforce experiences. Our model has selected an informal education, intercultural, and project based approach. The CUYT model can align its applications with the needs of the student population and with the needs of the academic and workforce environment where the model is deployed. STEAM activities, intercultural models, instructional design, and project-based research anchor the model. Flexibility allows the model to be used in formal and informal settings, but informal settings (summer, after school, and weekends) have provided greater creativity, larger collaborative opportunities, and immersion ‘direct connection’ STEAM experiences.

2. CUYT DESIGN MODEL ELEMENTS

The CUYT design model uses several elements of instructional design theory in the format, concept,

and structure of this STEAM based model of instruction. Needs assessments, task analysis, learning theories, cultural awareness, and technology integration are aspects of this component area. The goal is to develop program intervention models that reach underserved, economically challenged youth (3rd grade – 12th grade, cross gender, ethnically mixed, all religions) who have an interest in learning about the STEAM fields. Many students are level 1 or 2 in middle school (under the New York State evaluation system) and special education in high school. Although written off, these students have great educational and academic potential if the academic environment can be changed and modified. Student centered, non-threatening, informal education environments and interventions need to be created to serve this population.

Elements of the CUYT design model (see Figure 1) are defined and include: Intervention Development, Program Design, Academic Program, Administrative Program, Intercultural models, Project based learning, and Informal and Public education around a Theoretical base.

3. INTERVENTION DEVELOPMENT

Two central themes need to be considered as this phase (intervention) evolves. (1) Knowledge of your audience, their concerns, academic background, attitude, and interest level. (2) What is the working or operating environment (school, university, CBO, informal or public education, private, and community) that we will operate in. The CUYT model has operated in public schools, community based organizations, churches, universities, and city community centers. We prefer university settings with significant resources (faculty, students, and facilities), but many of our most successful interventions were convened in community settings. We are embedded in urban settings and have the opportunity to interact with students, parents, and their environment. This action gains student and community trust, respect, and teaches us how to reach and serve this population.

4. ACADEMIC PROGRAM DESIGN

In this area we reverse engineer our design by asking what expectations, outcomes, assessments, and final projects would be evaluated for student success. A

series of course/workshop rubrics, activities, and presentations that identify student skills levels and content knowledge are created to support the academic program design. Discovery, hands-on immersion, STEAM exploration, and cultural awareness techniques are used to create problem solving and other higher order learning skill activities with the students. We raise the academic bar for these students and in active programs have observed that when challenged, they move toward and meet the challenge. Curriculum content is developed with subject area specialists, is examined and matches our content to the graduation specific standards at the national and state level.

This ensures that these interventions follow the same curriculum grade level standards that the students follow in their public school lives. Knowledge of student learning and achievement status provides us (curriculum designers, teachers, and university faculty) with a guide to student's prior learning and skills. This allows our interventions to develop a mentorship and tutor resource for students and parents.

5. ADMINISTRATIVE PROGRAM DESIGN

Operational considerations are essential elements of a total program model and ensure effective handling of program activities. Elements include: salary, schedules, space-facilities, contracts, calendars, availability (staff, students, parents, faculty/instructors), transportation, food, securing funding, and grants writing. Program intervention sustainability is equally important to determine program resources, length of intervention, and quality of services.

Any program design model must have a strong leadership team, who are passionate about the work, willing to put in the required time for program success, and have the ability to work with a diverse range of staff, faculty, and students. Attention to detail is an important quality of the leader team. (It is the little things that can bring things to a halt and stop the show). Networking and the ability to create collaborative partnerships are important, as this impacts funding, establishes other program resources, and adds new content ideas to the interventions. (in this discussion interventions and

activities are used in the same context to represent various aspects of our CUYT programs).

6. THEORETICAL BASE

The CUYT model has been rooted in the importance of cultural awareness and resilience theory [7]. Our view of resilience theory subscribes to the beliefs that all youth are resilient, creative, and ready to learn. By labeling or branding students, (at-risk, level 1 or 2, and/or special education) we place a stigma, bias, and attitude toward these students. A stigma that we project through our educational system and our society. It is these labels that our students buy into. When we stop the labeling or change the label type that we associate with our youth, their attitudes about who they are and their academic abilities will also change.

Resilience theory is an important concept that can be used to start the process. We view all students as gifted and/or talented and provide them with the resources and opportunities that allow them to succeed. We are not naïve and realize that these youth are at different levels on the social, emotional, and academic scales. The respect and passion that we demonstrate toward these youth; the non-threatening learning environment that the design model creates; and the unique content areas of study in STEAM through nanosciences challenge and stimulate students' desire to learn. This supports our integration of character education into the design model to address issues of self-respect, team building, honesty, loyalty, bullying, and motivation. Character education provides assistance to students that reside in communities where gang violence, crime, and drugs are prevalent.

7. INTER-CULTURAL MODEL

The CUYT model is designed for all youth and adult learners, but clearly focused on underserved, economically disadvantaged, and academically challenged urban populations (African-American, Caribbean-American, and Hispanic). As part of our CUYT design model and to address the multi-cultural needs of our program population, inter-cultural models are included in the design model. Cultural elements of historical contributions, STEAM role models, current tools/devices in STEAM, STEAM movies, shows, and theater

presentations, and demonstrations of economic and community development are integrated into the CUYT design model.

Specific program activities include: Culturally Situated Design Tools that provide web-based instruction on the cultural relationship between math and their culture; the “Black Book Project” sessions, where musicians interpret the images from the Hubble Telescope for youth; and the urban “Nano” theater, where students create skits and video productions about African and Hispanic American scientists.

Cultural design inclusion demonstrates how various cultures have supported the rich mosaic of STEAM discoveries and opportunities in the country. It provides evidence of our participation in science and math through human history.

8. PROJECT BASED LEARNINGS (PBL)

The days and times of the “sage on the stage” has given way to “coach teaching” classroom activities that are supported with simulations and interactive learning between multiple school sites. Technology of all forms is integrated in the classroom environment. Even the classroom can be transformed into an outdoor living lab or a mobile or remote site around the country or world. This is the world our students see and we are challenged to use real world experiences to assist in the academic and instructional development of their experiences. Larmer and Mergendoller (2010) presented seven elements of PBL which are supported by the CUYT model: a need to know, a driving question, student voice and choice, 21st century skills, inquiry and innovation, feedback and revision, and a publicly presented product. Student centered learning environments, team building, and collaborative teaching are included in the CUYT design model.

9. INFORMAL AND PUBLIC EDUCATION

Early interventions of the design model were implemented in school settings, adhering to class periods, block schedules, administrative red tape, class size, staff/instructor availability, and classroom/computer lab availability. We moved to an infused school day activity where one or two days

and times were selected and program activities were provided. This was facilitated by the school administration, small school size, selection of students, small class size, and community and business participation.

After school interventions continued in elementary and middle school environments, but student external activities (Boy/Girl scouts, sports programs, and other social activities) compromised our attendance and completion rates. We scaled back the after school activities and increased the weekend and summer activities. Our informal education interventions have evolved into yearly weekend and summer (four to six week) programs. The CUYT model has created external partnerships with community based organizations, area businesses, school districts, state/local agencies, and universities/colleges. The model allows our program interventions to be flexible, current, and provide real world experiences for program participants.

10. INSTITUTE FOR NANOSCALE TECHNOLOGY AND YOUTH – HIGH SCHOOL CASE STUDY

This intervention focused on thirty high school and adult education students, who were considered “Special Education”, on track for academic dismissal (drop out) from area schools, economically disadvantaged, and represented Afro-American and Hispanic populations in the capital district of New York State. Our goals were to introduce them to career opportunities in information technology, nanoscale sciences, and multi media design. Students met in a series of workshops sessions to explain program goals, session activities, benefits of this intervention, program expectations, student outcomes, and criteria for selection to the six week summer program (no summer school classes).

Our partners, College of Nanoscale Science and Engineering (CNSE), provided the Nanoscience training sessions (three weeks). The Center for Urban Youth and Technology (CUYT) provided the character education and multi media (e-publishing, video production, and robotics) sessions (one week). And the University Center for Academic and Workforce Development (UCAWD) provided the

Microsoft IT Academy Word training and certification (two weeks).

Youth development city resources provided employment salaries for students and they were required to make presentations about their program experiences to university faculty, district administration, teachers, parents, and fellow students. Students produced a program newsletter and a program video production. In these hands-on activities, students created articles, photos, power point presentations, and rap poetry for the newsletter. Scripts, program formats, production crew selection (camera person, audio, lighting, and video editor) had to be determined to complete the video production.

11. REFLECTIVE PROCESS

As part of our reflective process, other design models were identified and reviewed.

The CUYT model was compared with the *Research Methods for Community Change: A Project-Based Approach*, by Randy Stoecker.[6] Stoecker's project-based approach (diagnosis, prescription, implementation, and evaluation) (PBA) was similar to our model, population, and communities. PBA enhanced our research and evaluation methodology and we included surveys, writing samples, student presentations, focus groups, and interviews for the CUYT model and student achievement. We are creating a program evaluation report and an analysis of participant attitudes and achievement in the STEAM fields of study.

12. CLOSING

The CUYT design model is created to provide information and access to STEAM resources in urban communities. Many students, teachers, and parents in these communities are not exposed to the high tech bio-technical, alternative/renewable energy, nanoscience, e-transportation, robotic, radio frequency aircraft, high speed broadband/wireless, and information technology fields of today and the future. Our model is flexible and can be utilized across elementary, middle, high school, and adult students. We have focused our interventions on the STEAM

fields to address the country's aging work force and under utilization of our underserved populations, and to increase the pool of innovative ideas into our society. The CUYT design model is bridging educational achievement with work force needs and economic development opportunities to demonstrate the effectiveness of this type of design process.

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