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SETT: A Framework for Capacity Building Partnerships

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Abstract

A contemporary issue for many non-profits is identifying effective ways to build capacity for service delivery. Interdisciplinary processes take time to carry out; herein lies a challenge when working with a university in which the lifecycle of student activity is not aligned (much shorter) that of the project for the alternative education program. In the current work, we describe the pathway of a partnership that improves the ability of nonprofit staff to achieve their mission while simultaneously meeting the service motivation in an academic setting. This paper describes the “pathway” for a mutually beneficial collaborative relationship between a higher education institution and a non-profit serving students with moderate to severe disabilities for the development of Assistive Technology using the SETT Framework as well as the Stanford BioDesign process.

Introduction: Overarching Problem

Assistive technology (AT) is any item, piece of equipment, software program, or product system that is used to increase, maintain, or improve the functional capabilities of persons with disabilities. The benefits of Assistive Technology are well documented as related to the education, employment, and independence of individuals with disabilities [1]. In a systematic review with meta-analysis, adolescents with learning disabilities achieved improved learning outcomes and higher quality of life with access to assistive technology or AT [2]. Despite the association with improved learning outcomes in non-profit or educational settings, teachers and related service providers (ie. Occupational Therapists, Physical Therapists, Speech-Language Pathologists, etc.) often lack the background knowledge and skills to effectively support Assistive Technology services [3]. This knowledge base includes policies, procedures and devices, as well as strategies for implementation. Even though most teachers and related service providers receive training on Assistive Technology through licensure coursework, the experience is limited to merely exposure and lacks the depth of practical experience in order to effectively embed AT into instructional practices. Individuals with the most profound disabilities typically require more intense assistive technology tools to use throughout the school day, further magnifying the problem. Barriers include the misunderstanding of complexities surrounding those with the most significant needs, misperceptions of people disabilities, poorly designed assessments and a missing person centered approaches [4]. This creates a critical need to build capacity within school teams for assistive technology services.

For optimal assistive technology utilization, the tools must be cost-effective, reliable, and of ample quality in the design to serve the intended purpose [5]. A unique problem arises when assistive technology is of insufficient quality or does not exist to serve a need for marginalized individuals with disabilities. Given challenges noted with the lack of qualified team members to support AT needs and the need for more specialized technology tools, this paper explores the opportunity for collaboration and partnership as a means of capacity building. In particular, the partnership encompassed a unique collaborative process with a non-profit alternative education program and a local university surrounding a vocational skills project for high school students with severe disabilities.

Collaborative project launch

The project involved students with severe disabilities who engaged in a vocational skill development program in an alternative education program. Most students in the program used speech devices and wheelchairs, with very limited abilities with moving their limbs. These high school students participated in creating one-of-a-kind artwork on drink coasters using alcohol inks. In addition, the students participated in packaging and selling the artwork as a means of building life skills. At first, the students used basic assistive technologies such as Environmental Control Units and switches to operate a standard blow dryer to move the paint on the surface of the coasters. While this offered a means of participation, it was limited in scope. Given that most artists sign their creations, the team struggled to identify a suitable means for the students in the program.

Through exploration of community resources, the team reached out to the Engineering Department at local university to gauge interest in helping with this problem. The peer-to-peer strategy for collaboration led to a robust partnership with the creation of a switch accessible robotic arm for a student to stamp their name on the back of the artwork. The partnership grew as the team members came to understand the unique strengths of each organization as well as the strengths and needs of each student. This led to a robust creation of various assistive technologies for other vocational projects including additional artwork opportunities and meal preparation.

Collaborative Process for Capacity Building

Our collaborative capacity building process is iterative and team-based. Indeed, the peer-to-peer aspect of the effort reflects "equal privilege" at every step of the way. There are essentially 5 major steps in the process:

1. Identify the assistive technology (AT) need
2. Identify a stakeholder within each organization as a point person for communication
3. Create an action plan for prototyping
4. Develop, demonstrate and assess the prototype within the context of Step 1.
5. Revise as needed, going back to any of the steps *over and over*, as needed!

We cannot overstate the critical first step in the collaborative project process is to understand the fundamental assistive technology (AT) need. Then, it is critical to build the team. In the current work, this is accomplished through a hybrid model formed by the basic BioDesign process modified by the SETT framework, as show in Figure 1. The Stanford BioDesign method for device design divides the innovation process into three main steps: Identify, Invent, Implement [6]. Many designers rush through the "Identify" first step, compromising the ultimate AT solution available to the patient. By not addressing the root "needs analysis" at the start, the ending result is the creation of products that often are left unused in educational settings due to their inability address client need. In the current work, we reexamined assistive technology need by including the SETT (Student, Environment, Task, Tools) framework as part of the Needs Analysis [7]. The SETT framework ensures critical factors such as the target audience, the setting, and the desired tasks are accounted for at the start of the innovation process to determine the root need before production on a solution begins.

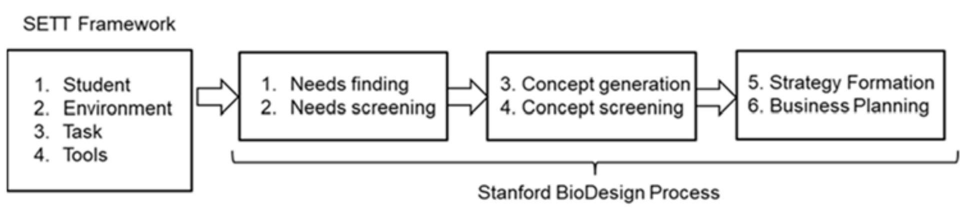

Figure 1- The need-based approach to innovation and design is embodied in the 3-phase "identify, invent, and implement" design process. The SETT framework is a four-part model that enhances need identification through a unique collaborative process.

The overall process we follow is shown in Figure 2. Classroom observations are at the core of the process, followed by a formalized approach to "need analysis." Subsequently, a notion of the AT concept is created by the team, including brainstorming device/design options. Once a prototype is demonstrated to the entire team, the concept is evaluated for "readiness for use." This is often an enlightening period of the project, as new ideas arise during the demonstration process.

Sample project outcomes

As a specific example of this "need analysis" in action, students with Cerebral Palsy exhibiting decreased fine and gross motor functionality were observed following the steps of the SETT framework. In line with the BioDesign process, our design effort was launched with observations regarding the student's general concerns relating to movement quality along with special accommodations and possible learning environments the students were exposed to in the classroom setting. Creative art room activities were decomposed into tractable design sub-elements that could be more easily managed and amenable to iterative design efforts. Analysis of SETT framework report revealed the need for assistive technology capable of providing independence to student regarding stamping signatures, logos, and in completing daily art projects. In the absence of SETT considerations, tasks were initially thought to be a requirement for a single generalized complex robot. By breaking down the necessary responsibilities through the SETT framework, the specifications were revised to design simpler task-specific robots that were constructed and placed successfully in service.

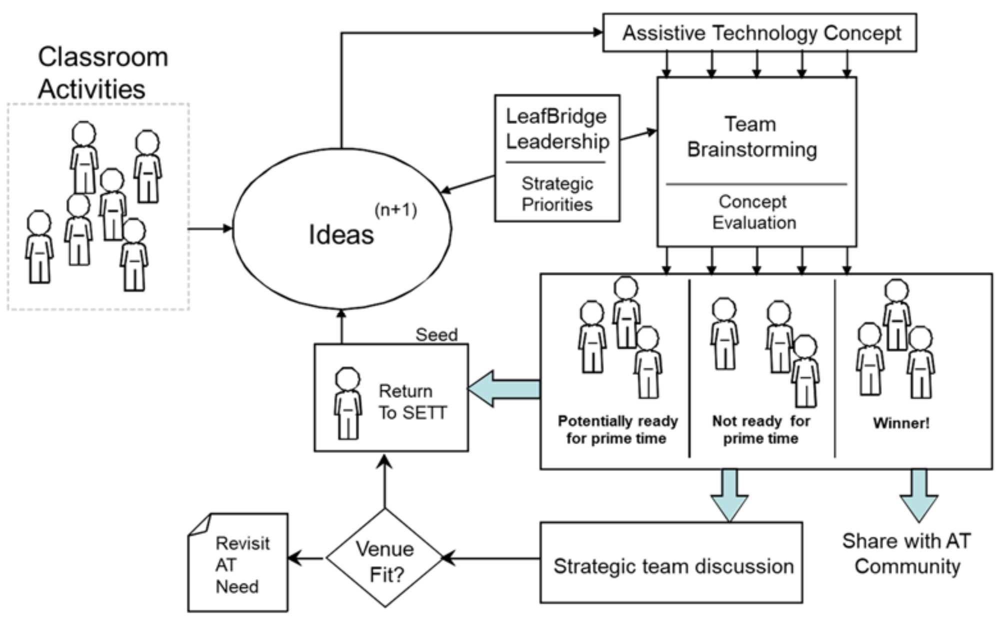

Figure 2 – Collaborative process reflecting the peer-to-peer development work that iteratively assures continuous quality improvement and relevant client outcomes.

Results

Often, partnerships represent a pathway that – when mutually beneficial – are sustainable over an extended period of time. Research demonstrates a number of benefits from a team-based approach including appropriate goal development, advancement of knowledge and AT skills, team confidence, effective decision making processes, and improved service coordination for assistive technology [8]. Through the implementation of the collaborative process, both the university and the nonprofit organization reaped many benefits, including the development of robust assistive technology. Less obvious benefits included opportunities for co-curricular and peer-to-peer pedagogy. Due to the perceived complexity of the individuals served by the nonprofit, the university students had the opportunity to fully immerse themselves within the program to better understand the unique challenges the individuals faced when accessing the curriculum. This co-curricular approach not only allowed for the university students to discuss biomedical engineering theory, but to take the theory and apply it in real time. The university students engaged in peer-to-peer instruction which encouraged constructive feedback on failed developments within the design process and created opportunities for students to analyze each other's work and apply a new strategy to the design. When students have the opportunity to learn from one another, student engagement and conceptual learning is increased which directly impacts a student's ability to solve novel problems [9].

The non-profit alternative educational program team members benefited immensely from regular opportunities to interact with university students and professors with a knowledge base in robotics and engineering. This helped to build internal capacity for identifying needs and articulating those needs to university students charged with building the tools. The individuals served within the non-profit alternative education program have directly benefited from the collaborative process due to the tangible outcome of assistive technology designed specifically to meet their needs. With the assistive technology developed by the university team, the individuals within the alternative education program have demonstrated increased engagement with greater independence across the curriculum.

Discussion

Dorrington et. al. [10] describe a similar collaborative partnership utilizing a User Centered Design (UCD) to develop assistive switch devices for individuals with complex disabilities. Through interviews with the switch users and direct observation, the design created AT to improve the quality of daily life and experiences of people with complex disabilities. In the present paper, the SETT Framework allows a similar approach in a school setting to help build an understanding of specialized needs for AT with students who rely on adults to observe and anticipate their needs due to highly complex disabilities. In the absence of SETT considerations, tasks were initially thought to be a requirement for a single generalized complex robot. By breaking down the necessary responsibilities through the SETT framework, the specifications were revised to design simpler task-specific robots that were constructed and placed successfully in service. This set the stage for a more realistic (iterative) strategy for development and launch of assistive technology. This was not a case of "one-and-done" in which external volunteers "jump in" to create a device or system that only partially meets the educational needs of the staff, left with a refreshed but non-optimal project execution. Interdisciplinary processes take time to carry out; herein lies a challenge when working with a university in which the lifecycle of student activity is not aligned (much shorter) that of the project for the alternative education program. A disciplined approach to the partnership enables students to engage over short periods and create value, but without taxing the nonprofit staff more easily.

Summary

Over the past year, a non-profit alternative education program for children with complex disabilities and a biomedical engineering department in a higher education institution explored a collaborative relationship based on developing Assistive Technology for students with moderate to severe disabilities. By utilizing the well-known SETT framework (Student, Environment, Task, Tools) as a prelude to the Needs Analysis for design based on the Stanford BioDesign process, a pathway was established between the entities which directly contributed to the success of service delivery and student engagement. The strategic significance of the SETT-BioDesign framework is the identification of specific roles for each of the partners. In essence this can be thought of as a "matching strategy" in which the demands of the alternative education program for specific project activity are matched with the competencies of the biomedical engineering team. We have found that when bringing together different (but complementary) communities of thought, a "disciplined approach" to interdisciplinary project activity leads to collective expectation settings and reduced frustration on long-term project activity.

Acknowledgments
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