

## **iSTEP Bangladesh 2010**

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## **Abstract**

The TechBridgeWorld iSTEP (innovative Student Technology ExPerience) internship program provides Carnegie Mellon students and recent graduates with the opportunity to work in a multidisciplinary and globally distributed team to develop needs-based technology solutions in collaboration with developing communities. This iSTEP2010 final report provides a detailed account of the 2010 internship, the research projects, key findings, and the teams work and overall personal experiences. The 2010 iSTEP internship partnered with Asian University for Women (AUW) in Chittagong, Bangladesh to research two projects. The first project explored educational technology tools to enhance English literacy for pre-university students in the Access Academy program at AUW. The second project investigated needs of the visually impaired population in Bangladesh and corresponding customization of the TechBridgeWorld Braille Writing Tutor in collaboration with Young Power in Social Action (YPSA).





Chittagong,  
Bangladesh



# iSTEP 2010 · Chittagong Bangladesh

August 20, 2010

## iSTEP Interns

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Jonathan Muller  
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Anthony Velázquez

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## Executive Summary

The innovative Student Technology ExPerience (iSTEP) internship was designed and is organized by the TechBridgeWorld research group at Carnegie Mellon University. iSTEP provides Carnegie Mellon students and recent alumni with the opportunity to work in a multidisciplinary and globally distributed team. Students develop appropriate computing technology solutions with partner organizations in developing communities to address unique challenges.

This year's iSTEP location is Chittagong, Bangladesh. The team collaborated with two community partners, the Asian University for Women (AUW) and Young Power in Social Action (YPSA), to execute two primary research projects: (1) developing an educational technology tool to enhance English literacy skills for students affiliated with AUW; and (2) adding new culturally-relevant features and customization for the next version of a low-cost Braille Writing Tutor (BWT) and DAISY AMIS development conducted with YPSA.

The two communities identified as potential beneficiaries for these projects were pre-undergraduate students at AUW and visually impaired students in Chittagong through YPSA.

Prior to the internship, the iSTEP interns engaged in preparatory sessions which included a six-week mini course and an independent study. The six-week mini course taught by Robotics Institute Assistant Research Professor and TechBridgeWorld Founder and Director, M. Bernardine Dias, included guest lectures, student and staff-led presentations and collaborative assignments.

During the internship, the field teams worked closely with the two communities to assess their needs, develop and test appropriate technology solutions, and demonstrate those solutions to stakeholders. Towards the end of the internship, the iSTEP and TechBridgeWorld teams discussed project sustainability and long-term partnerships with these communities.

For the project with AUW, the team created a web-based practice tool that allows teachers to input English literacy questions according to their lesson plan and allows students to practice the material by answering those questions. The iSTEP team demonstrated the tool to teachers and students at the Access Academy and received constructive feedback, particularly from teachers, who found it intuitive to use.

For the projects with YPSA, the team performed several modifications on the BWT. They added Bangla language functionality and the capability to provide Bangla-language instructions for writing Bangla braille. The iSTEP team successfully demonstrated the new capabilities of the BWT to students, teachers and members from YPSA at the Chittagong Government School for the Blind. In addition to the work done with the BWT, the iSTEP team added Bangla language functionality to the Adaptive Multimedia Information System (AMIS) under the international DAISY (Digital Accessible Information System) Standards<sup>1</sup>. The DAISY AMIS software package is designed to assist users in reading audio books.

The second year of iSTEP was a rewarding experience for everyone involved. Technology solutions were developed in collaboration with community partners based on the needs of potential users. The iSTEP 2010 interns found the internship to be a unique experience filled with important lessons and new understandings. For the TechBridgeWorld team, the internship provided valuable insight for future iSTEP internships and laid a strong foundation for future work with partners in Chittagong.

## Acknowledgements

The iSTEP 2010 team and the TechBridgeWorld research group are grateful to everyone who has contributed to the success of this year's internship. We would especially like to thank our community partners, the Asian University for Women (AUW) and Young Power in Social Action (YPSA), who helped to make this year's program a success. In particular we are extremely thankful to several contacts at AUW who were instrumental in supporting our iSTEP 2010 field team in Chittagong: AUW's Founder and Acting Vice-Chancellor, Kamal Ahmad; AUW Chief of Operations, Omar Shareef; AUW faculty and intern advisor, Faheem Hussain; Media Relations Officer, Zareen Sheikh; Internship Coordinator, Zarina Hossain; Executive Assistant to the CEO, Devlynn LeHuynh; Administrative Manager, Jane Norton; and Administrative Coordinator for Faculty, Tinne Sutradhar. Additionally, we would like to acknowledge the Access Academy staff and teachers for their guidance and collaboration on the Literacy Tools project. These individuals include Kathy Schneider, John Jordan, Jill Davis, Diana Davies, Fatema Haque, Mary Lagdamo, Simeen Khan, and Tamana Ahmad. We are appreciative to the AUW undergraduate interns who participated in all aspects of the field work including needs assessment, documentation, testing, and development. The intern team consisted of Binny K. Babu, Shumana Chowdhury, Zisrat Hasan, Fahria Kabir, Lutfun Nahar, Nipa Nandita, Nuzhat Nazmul Nishi, Sadeka Tasmin Nouf, Shivalaxmi Arumugham, and Shagufta Tazin Shathy.

We are also extremely thankful to YPSA's CEO, Md. Arifur Rahman, and DAISY Focal Point, Vashkar Bhattacharjee, who generously reached out to YPSA's vast network of people to ensure the project included as many stakeholders as possible. Furthermore, we are also appreciative of the Chittagong Government School for the Blind, particularly the Headmaster, Mohd. Abdus Samad, for their participation in the project. We would also like to thank Liton Kumar Chowdhury, Umme Habiba Chowdhry, Umme Tangila, Umme Taslima, Helal Mohammad Rasel, and instructors and learners at YPSA's IRCD Center for their guidance on the Braille Writing Tutor project.

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## Table of Contents

1	Introduction.....	9
1.1	TechBridgeWorld .....	9
1.2	iSTEP: innovative Student Technology ExPerience.....	9
1.2.1	iSTEP 2010 .....	10
1.2.2	Internship Logistics.....	10
2	Team .....	13
2.1	iSTEP 2010 Interns .....	13
2.1.1	Jen Horwitz .....	13
2.1.2	Brian Manalastas.....	13
2.1.3	Jonathan Muller .....	14
2.1.4	Aysha Siddique .....	14
2.1.5	Anthony Velázquez.....	14
2.2	Asian University for Women Interns .....	15
2.2.1	Binny K. Babu .....	15
2.2.2	Shumana Chowdhury .....	15
2.2.3	Zishrat Hasan .....	16
2.2.4	Fahria Kabir .....	16
2.2.5	Lutfun Nahar .....	16
2.2.6	Nipa Nandita .....	16
2.2.7	Nuzhat Nazmul Nishi.....	17
2.2.8	Sadeka Tasmin Nouf.....	17
2.2.9	Shivalaxmi Arumugham.....	17
2.2.10	Shagufta Tazin Shathy .....	17
2.3	iSTEP 2010 Team Advisors.....	18
2.3.1	Needs Assessment and Evaluation.....	18
2.3.2	Braille Writing Tutor Project .....	18
2.3.3	English Literacy Tools Project.....	18
2.3.4	Documentation .....	18
2.3.5	Language and Cultural Training .....	18
2.4	TechBridgeWorld Team .....	18
2.4.1	Sarah M. Belousov .....	19

2.4.2	Yonina S. Cooper.....	19
2.4.3	M. Bernardine Dias.....	19
2.4.4	M. Freddie Dias.....	19
2.4.5	Ermine A. Teves.....	20
3	Country Overview.....	21
3.1	Bangladesh.....	21
3.2	History.....	22
3.3	Economy and Development.....	22
3.4	People, Culture and Literature.....	22
3.5	Education.....	23
3.6	Technology Infrastructure.....	23
3.7	Summary.....	24
4	Community Overview.....	25
4.1	Partner 1: Asian University for Women (AUW).....	25
4.2	Project Overview: Literacy Tools Project.....	27
4.3	Partner 2: Young Power in Social Action (YPSA).....	27
4.4	Summary of Partnership.....	28
5	Needs Assessment.....	29
5.1	Overview.....	29
6	Project with AUW.....	31
6.1	AUW Needs Assessment Process.....	31
6.2	Needs Assessment Data Analysis.....	32
6.3	Needs Assessment Outcomes.....	32
6.4	Challenges and Considerations.....	33
6.5	Related Work.....	33
6.6	Solution Overview.....	36
6.6.1	Teacher Interface.....	36
6.6.2	Student Interface.....	39
6.7	Technical Development.....	39
6.7.1	Authentication.....	41
6.7.2	Question Manager.....	46
6.7.3	Practice Mode.....	56
6.7.4	Evaluation.....	62

6.8	Monitoring & Evaluation Process.....	65
6.8.1	Iterative Testing .....	65
6.8.2	Evaluative Data Collection .....	66
6.9	Deployment and Sustainability .....	67
6.10	Future Work.....	67
7	Projects with YPSA .....	70
7.1	BWT Needs Assessment.....	70
7.2	Needs Assessment Data Analysis .....	71
7.2.1	Community Needs .....	71
7.2.2	Challenges and Considerations .....	72
7.3	Related Work .....	72
7.3.1	DAISY Materials and AMIS.....	72
7.3.2	Braille Writing Tutor .....	73
7.3.3	Other Related Work .....	74
7.4	Solution Overview .....	74
7.5	Technical Development .....	75
7.5.1	DAISY AMIS Software.....	75
7.5.2	Braille Writing Tutor Translations.....	76
7.5.3	Two-Cell Letter Problem .....	76
7.5.4	Short Form of Vowels.....	77
7.5.5	The Sentence Structure Problem.....	77
7.5.6	Addressing Cultural Relevance in the Animal Game .....	78
7.5.7	Addressing Cultural Relevance of the Game Hangman .....	78
7.6	Monitoring and Evaluation for YPSA Projects.....	78
7.6.1	Iterative Testing for the BWT .....	78
7.6.2	Iterative Testing Data Analysis.....	79
8	Dissemination .....	80
8.1	Approach.....	80
8.1.1	Communication Objectives.....	80
8.1.2	Target Audiences .....	80
8.2	Social Media Channels.....	81
8.2.1	Blog.....	82
8.2.2	Facebook.....	82

8.2.3	Twitter .....	83
8.2.4	YouTube .....	84
8.2.5	Flickr .....	85
8.3	Traditional Media Channels.....	85
8.3.1	Newspapers .....	85
8.3.2	Website .....	86
8.3.3	Radio .....	88
8.3.4	Presentations .....	88
8.3.5	Popular Mediums .....	88
8.4	Conclusions.....	89
8.4.1	Improvements .....	89
9	Team Experiences .....	91
9.1	Overall Team Experience.....	91
9.2	iSTEP Individual Team Experience.....	92
9.3	AUW Individual Team Experience.....	96
10	Conclusion .....	101
11	Appendices.....	108
11.1	English Literacy Tool Interview Questions .....	108
11.2	Braille Writing Tutor Interview Questions .....	113
11.3	English Literacy Tool User Manual.....	120
11.3.1	Introduction.....	121
11.3.2	Before you start.....	121
11.3.3	Administrators.....	123
11.3.4	Teachers .....	127
11.3.5	Teacher’s Assistants.....	142
11.3.6	Student .....	143
11.3.7	Known Issues and Limitations .....	147
11.3.8	Credits and Contact Information.....	148
11.4	Braille Writing Tutor User Manual.....	149
11.4.1	Introduction and Terminology .....	150
11.4.2	Getting Started .....	150
11.4.3	Connecting the Device.....	151
11.4.4	Interacting with the Device .....	152

11.4.5 Buttons and Layout .....	152
11.4.6 Inserting the Stylus into the Cells .....	152
11.4.7 Listening to the Instructions.....	152
11.4.8 Selecting a Mode.....	152
11.4.9 Exiting a Mode.....	153
11.4.10 Entering a Single dot.....	153
11.4.11 Entering a Series of Dots .....	153
11.4.12 Finishing a Dot Pattern .....	153
11.4.13 Language Switching.....	153
11.4.14 Explanation of Modes .....	153
11.4.15 Learning modes.....	154
11.4.16 Troubleshooting .....	158
11.4.17 Credits and Contact Information.....	159

# 1 Introduction

TechBridgeWorld's iSTEP (innovative Student Technology ExPerience) internship program provides Carnegie Mellon students and recent graduates with the opportunity to work in a multidisciplinary and globally distributed team to develop needs-based technology solutions in collaboration with developing communities.

The primary objective of this iSTEP final report is to provide a detailed account of the 2010 internship, the research projects, key findings, and the team's work and overall personal experiences. Furthermore, the report seeks to explain how the projects' outcomes from this internship will positively impact the developing communities identified in Chittagong. A secondary goal this report seeks to achieve is to increase awareness and credibility of the Information and Communication Technologies for Development (ICTD) field, and contribute to ICTD literature.

## 1.1 TechBridgeWorld

TechBridgeWorld (<http://www.techbridgeworld.com>) is a research group based in the Robotics Institute at Carnegie Mellon University that innovates and field tests technology solutions that address the needs of underserved communities around the world. Founded in 2004 by Robotics Institute Assistant Research Professor Dr. M. Bernardine Dias, TechBridgeWorld is pioneering research in the field of ICTD.

Combining the insights of local partners in developing communities, along with the knowledge and creativity of Carnegie Mellon faculty, staff, and students, TechBridgeWorld contributes its technical expertise to help realize each community's vision of progress.

## 1.2 iSTEP: innovative Student Technology ExPerience

Launched in the summer of 2009 by TechBridgeWorld, iSTEP is designed to provide Carnegie Mellon students and recent graduates with firsthand opportunities to conduct ICTD research in underserved communities. iSTEP interns apply their knowledge and skills to solve societal problems in specific communities by working with its members to understand challenges and explore technology solutions that address their needs.

iSTEP is offered to students at Carnegie Mellon's campuses in Pittsburgh and Doha. Participants prepare for the internship during the spring semester through a rigorous mini course which introduces the team to ICTD field work and focuses on teamwork and research. The team further prepares for the internship through an independent study and scheduled preparation sessions. Shortly after the end of the spring semester, most of the team travels to the target communities (field team) and work on-site with partners previously identified by TechBridgeWorld. The remaining interns (home team) work remotely with the field team from either the Pittsburgh or Doha campus.

The internship consists of several phases: needs assessment, technology development, field testing, and evaluation. The field team conducts needs assessment with the partner communities to develop a comprehensive understanding of the target audience's needs. Based on needs assessment findings, the

iSTEP and TechBridgeWorld teams develop new tools or customize existing technologies to meet the partner community needs. Time permitting, the technology solutions are tested with the community members and towards the end of the internship, the teams discuss sustainability and long-term partnerships with the partners. Throughout the internship, the goal is to create innovative solutions that address real-world problems, thereby serving the needs of underserved communities.

### **1.2.1 iSTEP 2010**

The iSTEP 2010 team had ten weeks to research and develop two projects in Chittagong, Bangladesh. The first project resulted in the development of a web-based educational technology tool to enhance English literacy for pre-university students in Access Academy program at Asian University for Women (AUW). The second project developed new features and customized TechBridgeWorld's Braille Writing Tutor (BWT) in collaboration with Young Power in Social Action (YPSA). The team also developed Bangla language features for YPSA's DAISY AMIS software project.

### **1.2.2 Internship Logistics**

Prior to the internship, the team engaged in preparatory activities from January to May 2010. Organized by TechBridgeWorld, preparation included a six-week long mini course, a six-week long independent study, and additional preparation sessions.

#### **1.2.2.1 iSTEP Mini Course**

The goal of the mini course is to equip students with the practical skills that are crucial in conducting field research in ICTD and to understand how computing technologies can have a positive influence on underserved communities.<sup>2</sup> The class involved interactive presentations that covered topics from automated tutoring systems to effective communication and media planning. Additionally, students were tasked with multidisciplinary team assignments that helped them understand specific challenges in Bangladesh and were required to design basic technology solutions that addressed those challenges. Lectures also covered the importance of research protocols, needs assessment, and sustainability of projects.

The six-week mini course commenced in the first half of the Spring 2010 semester and included students from both the Doha and Pittsburgh campuses, as well as interested Carnegie Mellon students that did not participate in the internship. The class convened twice a week over videoconference from mid-January to late February. The unconventional collaboration approach taught students how to effectively manage their responsibilities in a team setting. They were also exposed to the benefits and challenges of working in a globally distributed team.

The key deliverables of the mini-course included a research assignment, team plan assignment, media plan assignment, and automated tutor assignment. The class developed a background research report on Bangladesh to help the field team prepare for their work on the ground. Students developed an action plan for each member of the team, and an integrated plan that captured the synergies and constraints of the different team roles.<sup>2</sup> Additionally, the

class developed a media plan that consisted of communication strategies for effectively disseminating relevant information to gain support and engage a larger community.<sup>2</sup> Lastly, the class researched ways to design and enhance automated tutors that would potentially meet the educational objectives of our partners in Bangladesh.<sup>2</sup>

Through the mini course, the class gained valuable knowledge about the ICTD field while enhancing their research, teamwork, analytical and critical thinking skills for real-world scenarios.

### **1.2.2.2 iSTEP Independent Study and Preparation Sessions**

The goal of the independent study was to provide iSTEP interns with the opportunity to conduct role-specific research, write detailed action plans, gain a more comprehensive understanding of the responsibilities associated with each role, and prepare materials for the internship. Furthermore, the team attended a series of preparation sessions that covered topics such as logistics, travel, health, safety and research compliance issues.

The six-week independent study commenced in the second half of the spring 2010 semester and lasted from mid-March to late-April. Individual members of the team arranged meeting times with internship advisors and continued to meet as a group. During group meetings, the team discussed individual and team work plans in-depth and decided how individual skills and available resources could be leveraged to complement the diverse roles, strengths and weaknesses. In addition, each member of the team was required to take a course on protecting the rights of research participants as part of Carnegie Mellon's Institutional Review Board. The course enhanced the understanding of how to protect the welfare of human subjects while conducting research.<sup>3</sup>

Furthermore, the team was introduced to Bangla culture and learned a few short Bangla phrases, learned how to develop contingency and emergency plans, and discussed how to handle difficult situations that can arise in the field and ethical issues related to conducting research with human subjects.

As a result of the independent study and preparation sessions, the team gained a clearer understanding of the scope of work and acquired vital skills that included how to assess which items were crucial for field-research in Chittagong.

### **1.2.2.3 iSTEP Relationship Building**

The iSTEP internship is a launching point for TechBridgeWorld to collaborate with new partners around the world. The iSTEP 2010 internship was TechBridgeWorld's first experience working with the community partners in Bangladesh. Through iSTEP, both AUW and YPSA have explored ways to continue the projects beyond the internship.

While the 10-week internship takes place in the summer, planning for the iSTEP program is a year-long process. The summer before the internship starts, TechBridgeWorld identifies partners interested in collaborating on technology research projects for the benefit of

underserved communities. Whenever possible, TechBridgeWorld visits project locations in advance to conduct a general needs assessment with partners and to identify specific project areas.<sup>4</sup> Once the initial discussions are held and the preliminary stages of the partnership are formed, TechBridgeWorld staff work with local partners in the fall, winter and spring on necessary agreements and logistics for hosting the team of iSTEP interns. TechBridgeWorld remains in contact with the partners during and beyond the interns' work.

## 2 Team

The iSTEP 2010 internship brought together a large number of individuals, all focused on creating sustainable technology solutions for communities in Bangladesh. The collaborators included the intern team of five students from Carnegie Mellon University, a team of ten students from the primary host and partner organization (AUW), TechBridgeWorld faculty and staff, AUW faculty and staff, the research partners at YPSA, and advisors of the iSTEP 2010 team.

### 2.1 iSTEP 2010 Interns

The iSTEP 2010 team was a multidisciplinary team consisting of undergraduate and graduate students and recent alumni from different colleges within Carnegie Mellon University's Pittsburgh and Doha campuses. The team represented various disciplines from the School of Computer Science, Heinz College, and the Tepper School of Business. During the internship, the globally distributed team conducted two technology research projects on the ground in Chittagong, Bangladesh and remotely from Pittsburgh, United States.

#### 2.1.1 Jen Horwitz

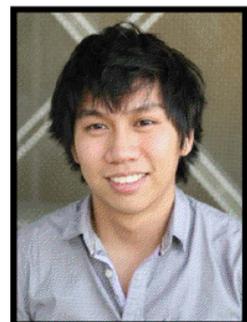
Jen Horwitz is pursuing a master's degree in Public Policy and Management at Carnegie Mellon University's Heinz College in Pittsburgh, where she is focusing on international policy and development. Previously, Jen worked with Amnesty International USA in Washington, D.C. and the American Cancer Society in Vermont. Jen has a bachelor's degree in government and legal studies with a minor in biology from Bowdoin College in Maine.



Jen was elected the Team Leader and the Needs Assessment and Evaluation Coordinator for the iSTEP Team and she stationed in Chittagong. Jen took the lead on needs assessment and evaluation of the two projects, was the main coordinator with the AUW intern team leader, assisted with necessary field testing, and helped with sustainability plans.

#### 2.1.2 Brian Manalastas

Brian Manalastas is a rising senior business administration major pursuing a minor in history and a concentration in entrepreneurship at Carnegie Mellon University in Qatar. His areas of interest consist of social entrepreneurship, global development and environmental sustainability. Brian has taken on several initiatives that range from developing a non-profit organization that encourages entrepreneurship and innovation to a student-led consulting group. He is the co-founder of Tartan Consulting Group, formally known as LiveGreen and Education City's Maachla.



Brian served as the iSTEP 2010 team's Documentation Lead and was stationed in Chittagong. Brian's role was to tell the iSTEP 2010 team's story in a compelling manner to various audiences

and through various media and he coordinated all dissemination efforts of the iSTEP team and assisted with sustainability plans.

### 2.1.3 Jonathan Muller

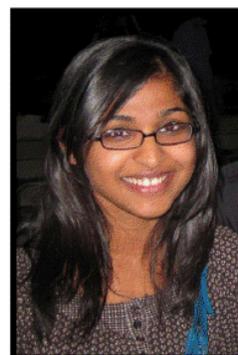
Jonathan Muller is pursuing a master's degree in information systems management at Carnegie Mellon University's Heinz College in Pittsburgh. Jon graduated from Michigan State University, where he worked on educational technology projects with the Comm Tech Lab. After graduation, Jon developed online learning experiences for corporate clients such as Charles Schwab. He served as a Peace Corps volunteer in the Dominican Republic and has used technology to teach environmental science with the Golden Gate National Parks Conservancy. Before coming to Carnegie Mellon, Jon was a key member of the Stanford Technology Ventures Program where he worked on Entrepreneurship Corner, a popular educational website.



Jon was selected as the Yahoo! iSTEP 2010 Fellow and was the team's Technical Floater. He was stationed in Pittsburgh supporting interns in the field with technology development for both projects. Jon was especially involved with the literature review for both projects, and the design and implementation phases of the English Literacy Tools project.

### 2.1.4 Aysha Siddique

Aysha Siddique is a recent graduate in computer science and in information systems from Carnegie Mellon University in Qatar. She is interested in field research and has gained significant experience in the ICTD field conducting research in Cambodia and India through an undergraduate research project and internship with Microsoft Research India, respectively. For her senior thesis, Aysha has worked on expanding the iSTEP 2009 Literacy Tools project with TechBridgeWorld for user groups such as middle school students who are deaf or hard-of-hearing as well as immigrant laborers and refugees. Her career interests lie in using technology to find creative solutions for problems in daily life. Aysha has been involved with TechBridgeWorld for several years, spearheading research in the ICTD field.



Aysha was the iSTEP 2010 team's Technical Lead for the Literacy Tools project and was stationed in Chittagong. She took the lead on all technical development and testing for the project and assisted with sustainability plans.

### 2.1.5 Anthony Velázquez

Anthony Velázquez is a recent graduate in Computer Science from Carnegie Mellon University in Pittsburgh. On campus, he worked with Women@SCS<sup>5</sup> to promote broader participation of women in computer science and completed a senior thesis investigating cultural factors that can encourage diversity in computer science programs in the United



States. In 2008 Anthony assisted with the Pennsylvania Governor's School for the Sciences teaching computer science to high school students, and he participated with TechBridgeWorld on the inaugural iSTEP 2009 team as the Pittsburgh-based Technical Floater. Following iSTEP 2010, Anthony begins working as a software engineer in San Diego.

Anthony served as the iSTEP 2010 team's Technical Lead for the Braille Writing Tutor project and was stationed in Chittagong. His role was to take the lead on all technical development and testing for the project, and he assisted with the sustainability plans.

## 2.2 Asian University for Women Interns

The iSTEP team worked closely with ten AUW students throughout the internship. The AUW interns worked as local liaisons, facilitating communication between stakeholders and translating between Bangla and English. They contributed significantly to the needs assessment process and to the development of the Bangla version of the BWT. A number of AUW interns also actively participated in the preliminary design of the web-based English Literacy Tool (ELT).

### 2.2.1 Binny K. Babu

Binny K. Babu is a second-year undergraduate student pursuing a major in ICT. She is interested in learning how women can shape society. Her professional interest lies in using technology for community development with a focus on the Southeast Asian region.



Binny was the team leader for the AUW iSTEP 2010 team and worked with the Needs Assessment team for both the BWT and ELT projects. She was particularly involved in developing both projects, planning for the student feedback session, and managing research data for the ELT project.

### 2.2.2 Shumana Chowdhury

Shumana Chowdhury is a second-year undergraduate student and intends to continue her studies in the ICT field. Her professional interests lie in combining the use of ICT and electronics to address problems in her community.



As a precursor to her work with the Braille Writing Tutor project, Shumana previously volunteered at the YPSA IRDC department through a community service opportunity. She was responsible for demonstrating the BWT in Bangla to stakeholders from YPSA.

### 2.2.3 Zishrat Hasan

Zishrat Hasan is a second-year undergraduate student and aims to pursue a degree in Computer Science & Information Systems/ Environment Science & Technology. She is particularly interested in researching how information systems can be used to socially and economically empower women in slums and rural areas to encourage sustainable development.

Zishrat worked with the needs assessment team and was involved in planning for the student feedback sessions, generating test questions and developing a project proposal for the ELT project.



### 2.2.4 Fahria Kabir

Fahria Kabir is a second-year undergraduate and is pursuing a major in Information and Communication Technology (ICT). Her areas of interest lie in web design and web development.

Fahria was involved with the needs assessment team and was responsible for facilitating discussions with YPSA stakeholders, developing a project proposal and managing research data for the ELT project.



### 2.2.5 Lutfun Nahar

Lutfun Nahar is a second-year undergraduate student and is pursuing a degree in Information and Communication Technology (ICT). Her areas of interest consist of innovating technologies to address educational challenges in slum communities. Currently, Lutfun is the Vice President of the Community Service Club at AUW and aspires to develop her career in the ICTD field.

Lutfun worked on the BWT project and was responsible for demonstrating the tutor to YPSA stakeholders.



### 2.2.6 Nipa Nandita

Nipa Nandita is a second-year undergraduate student and intends to pursue a major in Information and Communication Technology (ICT). She is interested in the different technology innovations that can be applied to the education sector. Previously, Nipa volunteered at the Non-Formal Primary Education of Nowzuwan and aspires to pursue a career in ICTD.

Nipa worked with the documentation team and was responsible for



translating content into Bangla. Nipa coordinated the local media outreach and was involved in publishing five articles in the local press.

### **2.2.7 Nuzhat Nazmul Nishi**

Nuzhat Nazmul Nishi has completed her second-year of undergraduate studies and aspires to pursue a degree in Politics, Philosophy and Economics. She is interested in researching the different ways businesses can have a more positive effect on communities and strategize to become actively involved in Bangladeshi society.



Nishi worked on the ELT project and was involved in designing user interface mock-ups, creating databases in Microsoft Access and conducting user testing with students.

### **2.2.8 Sadeka Tasmin Nouf**

Sadeka Tasmin is a second-year undergraduate student and seeks to be an environmental engineer. Her ambition is to minimize the effect of climate change and transform the neglected environmental conditions of Bangladesh by raising awareness in the areas of sustainable development. She is specifically interested in exploring how the application of information technologies can facilitate in promoting environmental consciousness.



Sadeka worked with the documentation team and assisted in documenting the overall team's experience, coordinated the media outreach and translated iSTEP media articles into Bangla.

### **2.2.9 Shivalaxmi Arumugham**

Shivalaxmi Arumugham is a second-year undergraduate student and is interested in pursuing a major in ICT and obtaining a masters degree in public policy. Her professional interests lie in software development and computer science related work.



Shivalazmi worked with the ELT project and was responsible for researching existing literacy games, creating user interface mock-ups for the ELT as well as developing and testing the tool.

### **2.2.10 Shagufta Tazin Shathy**

Shagufta Tazin Shathy is currently a second-year undergraduate and she seeks to pursue a biological science major. Prior to her work with iSTEP, she interned at YPSA and participated in the campaign to promote a smoke-free environment within the Chittagong



Division. She was involved in advocating for smoke-free policies and contributed to raising awareness within local communities.

Shathy worked with the documentation team and was responsible for translating iSTEP articles to Bangla, conducting user testing for both projects and facilitating discussions with stakeholders from YPSA.

## **2.3 iSTEP 2010 Team Advisors**

Each member of the team consulted with advisors that generously volunteered their time to consult with the team. Advisors primarily lent their advice during the independent study course and were available through email if additional advice was needed during the internship. The advisors for the iSTEP team are as follows:

### **2.3.1 Needs Assessment and Evaluation**

- M. Beatrice Dias, Ph.D. Student, Department of Engineering & Public Policy, Carnegie Mellon University
- Dr. David Dausey, Senior Director, Health Programs and Distinguished Service Professor, Heinz College, Carnegie Mellon University
- Ameer Abdulsalam, Research Programmer, Carnegie Mellon University in Qatar

### **2.3.2 Braille Writing Tutor Project**

- M. Freddie Dias, Research Engineer, Robotics Institute, Carnegie Mellon University
- Imran Fanaswala, Research Programmer, Carnegie Mellon University in Qatar
- Hend Gedawy, Alumna, Carnegie Mellon University in Qatar and Masters Student, School of Computer Science, Carnegie Mellon University

### **2.3.3 English Literacy Tools Project**

- Dr. Silvia Pessoa, Assistant Teaching Professor of English Writing and Sociolinguistics, Carnegie Mellon University in Qatar
- Ayorkor Korsah, Ph.D. Student, Robotics Institute, Carnegie Mellon University
- Hatem Alismail, Alum, Carnegie Mellon University and Masters Student, Robotics Institute, Carnegie Mellon University in Qatar

### **2.3.4 Documentation**

- Dr. Yonina Cooper, Associate Teaching Professor of Computer Science, Carnegie Mellon University in Qatar
- Chris Labash, Assistant Teaching Professor, Heinz College, Carnegie Mellon University
- Matt Richards, Videographer, TechBridgeWorld, Carnegie Mellon University

### **2.3.5 Language and Cultural Training**

- Susmita Ghosh, President, Bengali Association of Pittsburgh

## **2.4 TechBridgeWorld Team**

The TechBridgeWorld team organized and assisted the iSTEP preparation process and remained in constant contact with the team throughout the ten weeks of the internship. To ensure the team was

receiving adequate feedback and advice on both projects, interns met with TechBridgeWorld's Project Assistant Ermine Teves on a weekly basis to provide updates on the accomplishments over the week, delivered status updates on both projects and explained how the team intended to move forward into the upcoming weeks. The TechBridgeWorld team consistently provided advice in ways that would advance the projects and partner relationships. Both teams met for brainstorming sessions after the needs assessment process and determined how technical development would proceed on both projects. Additionally, TechBridgeWorld was interested in seeing how long-term relationships could be established with community-partners given what was achieved throughout the internship.

#### **2.4.1 Sarah M. Belousov**

Sarah M. Belousov is the Project Manager for TechBridgeWorld and is based in the Robotics Institute at Carnegie Mellon University's School of Computer Science. Her primary responsibilities involve extending the activities of the TechBridgeWorld research group at Carnegie Mellon University's campuses in Doha and Pittsburgh. She earned her bachelor's degree in International Studies and French at Johns Hopkins University and l'Institut d'Études Politiques in Paris. She recently completed her master's degree in Public Policy and Management at Carnegie Mellon's Heinz College.

#### **2.4.2 Yonina S. Cooper**

Dr. Yonina S. Cooper is the Associate Director of TechBridgeWorld and a faculty member at the Qatar Campus of Carnegie Mellon University where she teaches computer science courses. She is also Professor Emerita at the School of Computer Science, University of Nevada, Las Vegas, retiring after twenty years. Her previous experience in working with developing communities includes volunteering with HOPE Worldwide, an international charity providing humanitarian aid, as well as with Reach Out To Asia in Doha, Qatar.

#### **2.4.3 M. Bernardine Dias**

Dr. M. Bernardine Dias is the Founder and Director of TechBridgeWorld, an Assistant Research Professor in the Robotics Institute at Carnegie Mellon University's School of Computer Science, and a member of the computer science faculty at Carnegie Mellon University Qatar. Her research experience is in technology for developing communities, assistive technology, technology education, autonomous team coordination, and automated planning and navigation. Dr. Dias is a native of Sri Lanka. Her career goal is innovating means of developing and disseminating suitable and sustainable technology for empowering developing communities. She is a strong supporter and mentor for women in science and technology.

#### **2.4.4 M. Freddie Dias**

M. Freddie Dias is a Research Engineer for TechBridgeWorld and is based in the Robotics Institute at Carnegie Mellon University's School of Computer Science. He assists with robotics research in the Field Robotics Center, supporting projects related to multi-robot coordination and also serves as a technical consultant for projects related to technology and development under

TechBridgeWorld. His work in both categories bridges Carnegie Mellon University's campuses in Doha and Pittsburgh. Originally from Sri Lanka, he graduated from Hamilton College in New York with a double major in physics and computer science.

#### **2.4.5 Ermine A. Teves**

Ermine A. Teves is the Project Assistant for TechBridgeWorld and is an alumna of Carnegie Mellon University. She graduated in May of 2008 with a B.S. in Business Administration with a concentration in Marketing. Her responsibilities include expanding TechBridgeWorld's programs, marketing, and fundraising efforts. In the summer of 2008, Ermine spent ten weeks in Bangalore, India interning with Microsoft Research India and the Mathru School for the Blind to field test the second version of the Automated Braille Writing Tutor. She is currently pursuing a master's degree in Public Policy and Management at Carnegie Mellon's Heinz College.

## 3 Country Overview

This section summarizes key information about Bangladesh from its climate, to geography and culture, and provides a brief overview regarding the socio-economic conditions of Bangladesh. There are widespread socio-economic challenges that communities in Chittagong face. The projects the iSTEP team worked on attempt to address specific educational challenges facing partner organizations in Chittagong. Participants in the iSTEP six-week mini course and the AUW interns have researched these topics in-depth. The sections give a background for the projects that are central to the iSTEP 2010 internship and explain how these projects will serve the needs of the target communities.

### 3.1 Bangladesh

Bangladesh is a South Asian country, mostly surrounded by India and bordering Myanmar in the southeast. With a land area of 144,000 square kilometers and a population of around 140 million,<sup>6</sup> Bangladesh is the 7<sup>th</sup> most populous country in the world and is among the most densely populated countries with a high rate of poverty.<sup>7</sup>

There are six administrative regions in Bangladesh that include Dhaka, Chittagong, Rajshahi, Khulna, Sylhet and Barisal. Most of these regions have capitals with the same name as the division. Among these cities, Dhaka and Chittagong are two of the most important in Bangladesh. Dhaka is the capital of Bangladesh and also the most thriving, colorful and congested metropolis numbering some 12 million people. Chittagong, a bustling commercial center, is the largest international seaport in the country as well as the host city of iSTEP 2010.<sup>8</sup>

Bangladesh is located in a low-lying, riparian land mass formed by a delta plain at the confluence of the Ganges Brahmaputra and Meghna Rivers. Most portions of Bangladesh are less than 12 m (40ft) above the sea level, and it is believed that about 50% of the land would flood if the sea level were to rise by 1m (3.28ft).<sup>9</sup> The climate of Bangladesh consists of mainly tropical monsoon characterized by high temperature, high humidity as well as seasonal rainfall. The Bangla calendar year is generally divided into six seasons: spring, summer, rainy, autumn, late autumn and winter. During the summer, the overall temperature is relatively hot, usually between 38°C - 41°C.<sup>10</sup> The average annual rainfall is 2300mm.<sup>12</sup> As a result of the seasonal changing climate and the rainfall sensitive geography, Bangladesh is widely recognized to be among the countries which are most vulnerable to natural disasters such as floods, drought and cyclones. Natural hazards seriously affect agriculture, water and food security, human health and shelter.<sup>12</sup>



Figure 1 - Divisions of Bangladesh  
(image source: Wikipedia)

## 3.2 History

Bangladesh was under British and Indian colonization for a hundred years. After the partition of the subcontinent in 1947, Bangladesh became part of Pakistan, and was known as East Pakistan. After the amalgamation of the two regions, East and West Pakistan, Bengali people were forced to use Urdu as the only official language instead of their mother tongue, Bengali, as Urdu was declared the only national language by the government of Pakistan.<sup>11</sup> Consequently, a language movement was introduced by the Bangla-speaking people in 1952. Bangladesh seceded from Pakistan in 1971.<sup>12</sup>

## 3.3 Economy and Development

The economy of Bangladesh is primarily supported by agriculture, manufacturing and investment from international companies. One half of Bangladeshis are farmers and their primary crops are rice and jute. These agricultural products are mainly exported to the United States and Europe.<sup>13</sup> Secondary industries in Bangladesh include tea processing, newsprint, chemical fertilizer, light engineering, and sugar.

The biggest economic engine in Bangladesh is the industrial sector, mainly focusing on the garment industry. However, since 85% of the total population is predominantly rural,<sup>22</sup> work related to the agriculture industry still remains the main source of income for the majority of the people.<sup>14</sup> More than three quarters of Bangladesh's export earnings come from the garment industry<sup>15</sup> as a result of increasing foreign investment. Recently, Bangladesh has been targeted by foreign companies for its economic potential. It was selected by the Goldman Sachs investment bank as having a high potential of becoming one of the largest economies in the world, together with 10 other countries, called the Next Eleven (or N-11).<sup>16</sup> In the past decade, the economy of Bangladesh showed a rapid, yet steady growth. The GDP growth rate was 5%-6% from 2004 to 2006<sup>17</sup> and reached 6.5% in 2008.<sup>18</sup>

Based on 2008 estimates, 36.5%<sup>19</sup> of the total population is below the poverty line and Bangladesh continues to struggle with unemployment rates. Although this developing country has large human power capabilities, high rates of illiteracy continue to increase unemployment rates.<sup>20 21</sup> Additionally, factors such as natural disasters that include floods and cyclones, coupled with Bangladesh's delicate infrastructure, contribute to increases in poverty.

## 3.4 People, Culture and Literature

The culture of Bangladesh is enriched with literature, diverse religions, festivals, music, dances, clothes, arts and archeology.<sup>22 23</sup> Amongst the numerous well-renowned literature figures in Asia, two notable Bangladeshi writers are the Nobel laureate, Rabindranath Tagore, and the national poet, Kazi Nazrul Islam.

The majority ethnic groups of Bangladesh are Bangladeshi, a group that comprises 98% of the population in the country. The remainders are mostly Bihari migrants and indigenous tribal groups. Though the majority of the people are Muslim, being a secular country, all the people from different religions live here relatively peacefully and their rituals, customs and traditions have enriched the

Bengali culture.<sup>24</sup> Bengali or Bangla is the official language of Bangladesh. However, English, as a second language, is widely used among the middle and upper classes as well as in higher education.<sup>25</sup>

Traditional clothing for women is an outfit called a *sari* and for men is a *lungi* and *panjabi*. Significant historical events in the country resulted in archeological elements such as sculptures, paintings and architecture.<sup>26</sup> The typical food of the people of this region is fish, rice and other agricultural products produced by local farmers.<sup>27</sup>

### 3.5 Education

Bangladesh ranks 135<sup>th</sup> out of 178 countries in the world in terms of literacy rates according to the 2009 United Nations Development Programme’s Human Development Report.<sup>28</sup> This is one of the lowest literacy rates in the world and is a matter of great concern for Bangladesh.

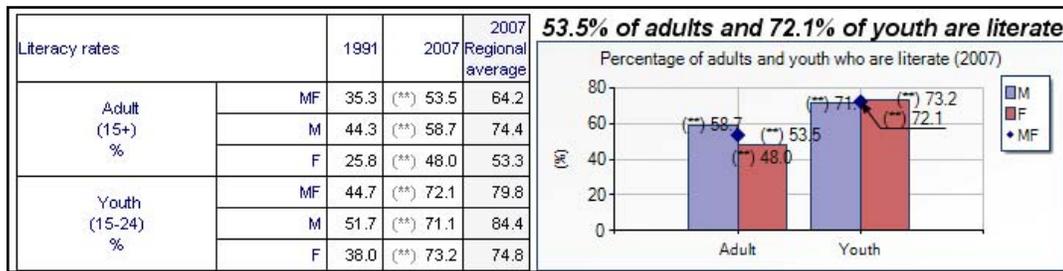


Figure 2 - Literacy Rates in Bangladesh, 2007, recorded by the UNESCO Institute

In addition, Bangladesh has devoted continuous efforts to eliminate gender disparity in education. As shown in Figure 2, the literacy rates in 2007 of the overall population, male and female were 53.5%, 58.7% and 48.0% respectively. This data reveals that there was a 10% difference between male and female literacy rates. Current government projects promote the education of children in Bangladesh, including free education for girls up to grade 10, stipends for female students, a nationwide integrated education system and food-for-education literacy movement.<sup>29</sup>

### 3.6 Technology Infrastructure

Unlike developments in education, the expansion of technology infrastructure in Bangladesh lags behind other developing countries. In a recent connectivity scorecard study conducted by Nokia Siemens network, Bangladesh was close to last among developing nations, only scoring higher than Pakistan and Nigeria. Because Bangladesh confronts significant developmental challenges such as

Sector performance	Unit	Bangladesh 2000	Bangladesh 2007	Low-Income 2007	SouthAsia Region 2007
Telephone lines	Per 100 people	0.4	0.7	4.0	3.2
Cellular subscriptions	Per 100 people	0.2	21.7	21.5	22.8
Internet subscribers	Per 100 people	0.0	0.1	0.8	1.3
Personal computers	Per 100 people	0.1	2.2	1.5	3.3
Internet users	Per 100 people	0.1	0.3	5.2	6.6

Table 1: Technology sectors of Bangladesh, 2007, World Bank

education, shelter, and potable water, ICT (information and communication technologies) has been a low priority for the government and private sector investors.<sup>29</sup>

The internet came late to Bangladesh with internet connections sprouting in 1996. Compared with the statistical data in 2000, the development of the internet has grown dramatically in recent years, despite low baseline connectivity rates. Additionally, this rate was still miniscule for low-income groups in 2007. As the Bangladesh Internet Market Overview and Statistics Report<sup>30</sup> demonstrates however, the country must work hard to overcome obstacles associated with the country's challenging economic status while still developing infrastructure.

Despite low internet connectivity, Bangladesh has made significant improvements in the mobile space. According to the World Bank, the percentage of population covered by mobile networks increased from 40% to 90% between 2000 and 2007. In the same period, mobile cellular subscriptions increased from 0.2 per 100 people to 21.7 per 100 people.<sup>30</sup>

Of particular interest to the iSTEP team is the fact that mobile phone tariffs in Bangladesh are the second lowest in the world. At a cost of 1.96 (USD) per month, Bangladesh pays less for mobile service than every country in the world except Pakistan. This means mobile service is one of the easiest resources to access in Bangladesh.<sup>31</sup>

The largest cellular operator in Bangladesh is Grameen Telecom Corporation. They have over 20 million subscribers, maintaining 46.5% of the wireless market as of June, 2008. The stated goal of Grameenphone is to bring affordable telephony to the entire population of Bangladesh.<sup>32</sup>

### 3.7 Summary

In conclusion, the geographic location and dense population of Bangladesh significantly influence the economy of the country and has contributed to slow development over the years. Because Bangladesh is a low-lying riparian zone with a climate susceptible to natural disasters, agriculture is an unstable industry despite being one of the most important economic engines for the country. Additionally, the dense population leads to the relative per-capita paucity of resources.

These factors greatly impede the economy from growing to its potential, the education system from improving, and technology infrastructure from further developing. Ultimately, these issues leave the country at risk for food shortages and perpetual national poverty.

Education and technology are of particular interest to the iSTEP 2010 team whose vision is to raise awareness of how technology can positively impact developing communities. The iSTEP 2010 projects take advantage of state-of-the-art technology merged with practical, low-cost solutions for solving problems related to education in developing communities. The following sections provide a detailed description of the projects, partners and the communities where the projects were implemented.

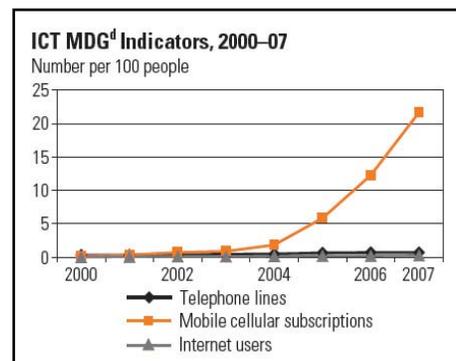


Figure 3 - Development of technology.<sup>33</sup>

## 4 Community Overview

The iSTEP 2010 team worked on two projects during the summer of 2010 that were identified through discussions between TechBridgeWorld and partners in Bangladesh. Partnerships developed from mutual connections between faculty and staff from TechBridgeWorld and community partners. The team refined the scope of work and the final product solutions during the course of the internship. Specifically, the projects examined how the use of technology can improve English and Braille literacy in two separate communities in Chittagong, Bangladesh.

### 4.1 Partner 1: Asian University for Women (AUW)

In 1991, Bangladesh had an adult literacy rate (defined as the percentage of people above age 15 who can read or write) of only 35.5% according to the UNESCO Institute for Statistics. When this statistic was evaluated based on gender, only 25.8% of adult females were considered literate. However, Bangladesh has succeeded in improving its literacy rate over the past ten years. In 2008, Bangladesh attained an adult literacy rate of 55%, and an adult female literacy rate of 49.8%.<sup>34</sup> According to the United Nations Development Fund for Women’s CEDAW Southeast Asia Programme, an issue of concern for women throughout Southeast Asia includes “the stark disparities in educational opportunities between males and females.”<sup>35</sup>



Figure 4 - AUW logo

There is not only a difference in literacy, but more fundamentally, a difference in basic educational opportunities that are available to women in the region. This disparity in educational opportunities between men and women also extends beyond Southeast Asia to other nearby regions such as the Middle East.<sup>36</sup>

The Asian University for Women is working to meet the educational needs of women from Bangladesh, the rest of Southeast Asia, and the Middle East. AUW is the first regional institution dedicated solely to women’s education and leadership development. The institution offers an English based liberal arts education as well as a socially applicable graduate and professional training.<sup>37</sup> To accomplish this task, the university offers two distinct academic programs for students:

1. The Access Academy is a year-long pre-collegiate program for students who intend to matriculate at AUW but who require additional preparation in English language skills, quantitative reasoning, mathematics, and computer skills.
2. The AUW academic program offers a degree program that allows students to earn a bachelor’s of arts degree based on a liberal arts curriculum.



Figure 5 - Students at a computer lab

AUW graduated its second Access Academy class in July of 2010 and will be supporting a new Access Academy class of approximately 140 students, a first-year undergraduate class of 137 students, and a second-year undergraduate class of 155 students, in the fall of 2010. One of the qualities that intrigued TechBridgeWorld about AUW is their commitment to providing a world-class university education to young women who would not have such an opportunity otherwise due to their socio-economic circumstances. TechBridgeWorld was confident that the iSTEP interns would find the experience of working with AUW's diverse international staff and faculty to be exciting, intellectually challenging, and personally rewarding.<sup>38</sup>

One of the target audiences for the summer projects was students and teachers from the Access Academy. Students in the program were divided into sections A through I, with A being the most advanced section. Students were evaluated based on entrance exam scores. Classes were assigned based on section assignments, with the majority of classes being section-based, while a few classes integrated students from multiple sections.

The program is divided into three terms and a series of required classes, electives, and extra-curricular activities. The 2009-2010 program included the following courses:

- Three term courses:
  - **Grammar:** This facilitates the development of strong English language skills and impacts the learning outcomes for many of the other Access Academy courses.
  - **Reading and Writing:** This class focuses on reading comprehension and idea expression in English.
  - **Listening and Presentation Skills:** This aims to help students develop the skills necessary to listen to a lecture or presentation on various subjects in English. The course also prepares students to deliver clear and logical presentations in English.
  - **Quantitative Reasoning:** Lessons focus not only on strengthening basic math skills, but also provide students with the ability to describe and understand mathematics and quantitative analysis in English.
  - **Gym:** Students participate in lessons in karate, yoga, and other physical fitness activities.
  
- One term courses:
  - **Computer skills:** This a required course for the first term.
  - **Electives:** A variety of elective courses were offered based on teacher and student interest during the third term.
  
- Extra-curricular activities:
  - Activities included a variety of clubs that were formed based on student and teacher interest such as the basketball club, the peace club, the journalism club, and the drama club.

The team worked closely with the majority of Access Academy teachers including the Access Academy Director, Kathy Schneider over the course of the summer. Ms. Schneider coordinated the

team's communication with the Access Academy students and also provided opportunities to present to and update the teaching staff. The insight the team was able to gain through conversations with Ms. Schneider and the teaching staff was valuable to understanding the needs of the target audience. Having a strong understanding of the Access Academy's structure and curriculum allowed the iSTEP interns to begin to consider ideas for an English literacy tool that would address multiple literacy needs early in the needs assessment process.

## 4.2 Project Overview: Literacy Tools Project

The team developed an English literacy practice tool for students for AUW's pre-collegiate program. This tool served as a resource for both students and teachers. The tool not only helps teachers better monitor and evaluate student learning, but also allows teachers to create a database of practice material that can be updated or modified as the pre-collegiate program continues to grow. Furthermore, students are able to practice questions selected by their teachers through different question formats which include multiple choice, fill-in-the-blanks, reading and listening comprehension.

## 4.3 Partner 2: Young Power in Social Action (YPSA)



Figure 6 - YPSA logo

YPSA is a non-profit Bangladeshi social development organization that was founded in 1985 by youth from the Chittagong District of Bangladesh. YPSA's mission states that the organization "exists to participate with the poor and vulnerable population with all commitment to bring about their own and society's sustainable development."<sup>39</sup> YPSA first opened an office in the Sitakund Division and now operates over thirty offices throughout the south and southeastern parts of the country, with particular emphasis on the Chittagong Division and the Chittagong Hill Tracts district. Their main office is now located in Chittagong City but they still maintain a large office in the Sitakund Division.

YPSA currently supports a variety of social development programs that address issues from health, to education, to human trafficking awareness and prevention, to support services for disabled persons in Bangladesh. Of these programs, the iSTEP team worked with YPSA's Information Resource Center for Disabilities (IRCD). The IRCD program provides visually impaired individuals and other persons with disabilities with training on and access to hardware and software designed to enhance communication and learning opportunities.<sup>40</sup> The IRCD program is very important to the visually impaired community in Bangladesh. According to the World Health Organization, approximately 10% of Bangladesh's population, or 15 million people, are disabled, including individuals who are visually impaired.<sup>41</sup> The disabled community disproportionately experiences poverty, inadequate healthcare and



Figure 8 - YPSA's ICT & Resource Center



Figure 7 - YPSA staff member in computer lab

insufficient educational resources, particularly in rural areas. YPSA’s work is an important resource for the visually impaired community in Bangladesh. The organization helps to refer young children who are visually impaired to the proper educational facilities, often located hours from a rural village. YPSA also offers health facilities throughout the region that provide special services to persons with disabilities. YPSA’s IRCD program engages visually impaired individuals from their teenage years and upwards in appropriate ICT training to provide learners with skills to succeed in advanced studies or in the workforce. YPSA is a leader in DAISY usage and has received national awards for their work.

TechBridgeWorld and YPSA’s relationship developed through colleagues from AUW who had experience working with YPSA. As a result, YPSA was recommended as a strong partner for one of the projects given the extent of their involvement in the visually impaired individuals. AUW introduced TechBridgeWorld to YPSA, including the iSTEP team’s main point of contact at YPSA, Mr. Vashkar Bhattacharya. Mr. Bhattacharya is the organization’s lead for their DAISY program and is visually impaired himself. He was able to introduce the team to a wide network of visually impaired individuals, educators, and organizational partners, allowing the team to conduct a detailed analysis on the needs of not only YPSA, but also the broader visually impaired community. One important partner organization Mr. Bhattacharya introduced to the team was the Chittagong Government School for the Blind. The headmaster, Mr. Mhmd. Samad, is one of the foremost braille experts in Bangladesh. Mr. Samad was instrumental in providing the team with opportunities to test the BWT with young learners in classes (grades) 1-5.

The iSTEP 2010 team modified and customized a low-cost automated Braille Writing Tutor by adding Bangla language functionality and the capability to provide instructions for writing Bangla braille. Existing games and modules were then modified on the current tutor to reflect the local culture. The team designed and implemented a word game and explored other technologies that could help improve the learning opportunities for braille learners.

#### 4.4 Summary of Partnership

The team’s partnerships with these individuals and organizations were integral to the success of the overall program. The team was able to work collaboratively on the projects with both organizations. Close relationships helped the team to effectively analyze the needs of the communities involved in the projects, understand the information collected from this process, and make recommendations about what technology solutions might be possible. As technology development began, both partners worked with the team to provide feedback, leading to the final deliverables for the internship. Additionally, the work this summer helped to strengthen the connection between AUW and YPSA, which the team hopes will lead to continued collaboration in the long-term on not only the projects that were started by the iSTEP team, but also additional endeavors.

“Working with the iSTEP team has really given me the chance to be innovative in coming up with solutions for local challenges”

- Fahria Kabir, AUW Intern

## 5 Needs Assessment

The focus of the iSTEP internship, and the TechBridgeWorld research group as a whole, is to work collaboratively with communities to develop technology solutions that are accessible, sustainable, and community-appropriate. In order to develop community-appropriate solutions, research on needs and problems must also be community-focused. Our team utilized community-based participatory research (CBPR) principles in assessing the needs of both our community partners and jointly developing technology solutions to best meet the needs of the communities they serve through the monitoring and evaluation process.<sup>42</sup>

While there are many definitions of CBPR, most descriptions recognize seven key principles that guide how a research team interacts with a community. These principles include:

- Recognizing a community as a unit of identity
- Building on strengths and resources within the community
- Facilitating collaborative partnerships in all phases of the research
- Integrating knowledge and action for mutual benefit of all partners
- Promoting a co-learning and empowering process that attends to social inequalities
- Facilitating a cyclical and iterative process
- Disseminating findings and knowledge gained to all partners<sup>43</sup>

In the work this summer, the iSTEP 2010 team strove to incorporate these principles throughout the project in order to assess and analyze the needs of the communities served and develop the best possible solutions in collaboration with the partners.

### 5.1 Overview

The needs assessment and monitoring and evaluation team composed of four individuals – Jen Horwitz from the iSTEP team, and three students from AUW, Fahria Kabir, Binny Babu, and Zishrat Hasan. The needs assessment process with both partners took place over the first four weeks of the internship where the AUW interns played a critical role in the process. Their responsibilities included but were not limited to helping with language translation, trust-building with participants, interview and survey design, data collection, and data analysis. Listed below are the key milestones of the needs assessment process for each partner in chronological order.

#### Milestones for the AUW Needs Assessment Process

Week 1: Established communication with Access Academy teachers and students.

Week 2: Engaged participants in the project through focus group sessions with students and individual interviews with teachers and staff.

Week 3: Continued informational focus group sessions with students and individual interviews with teachers.

Week 4: Completed data analysis and disseminated needs assessment findings to the full team for review. Developed project proposal and brainstormed with TechBridgeWorld team.

### **Milestones for the YPSA Needs Assessment Process**

Week 1: Established communication with YPSA.

Week 2: Engaged participants in the project through a group interview with YPSA staff and volunteers and a group interview with advanced learners (secondary and university).

Week 3: Continued interviewing process through group interview sessions with new learners at the Chittagong Government School for the Blind. Held a group interview with YPSA staff, volunteers, and issue experts.

Week 4: Completed data analysis and disseminated needs assessment findings to the full team for review. Developed project proposal and brainstormed with TechBridgeWorld team.

In total, the needs assessment team met with 40 students, 7 teachers, and the program director from AUW's Access Academy. The team also met 41 visually-impaired individuals or experts, staff, and volunteers who support visually-impaired individuals through YPSA during the needs assessment process.

For both projects, the needs assessment team collaboratively developed interview scripts that not only aimed to gather information important to our understanding of community needs, but also employed language that was accessible and could be easily understood if translation was necessary. These scripts were used to collect a wide range of information for both projects, which was then analyzed by the team to determine key findings. The key information that was analyzed included points of information that were noted on a frequent basis, or that could be considered critically important to the development of a technology solution, such as power availability. These key findings then informed the technology solution development process through the creation of project proposals. These project proposals were vetted by TechBridgeWorld, the iSTEP 2010 team and our partners in order to determine a course of action for creating or customizing technology solutions to best meet community needs.



**Figure 9 - Needs Assessment team conducting an interview**

## 6 Project with AUW

### 6.1 AUW Needs Assessment Process

The needs assessment process began by introducing the project to Access Academy teachers and students during our first week of work. Introductory activities included a presentation to interested teachers during their weekly staff meeting and informational emails to both teachers and students introducing the team and the projects.

Following the team’s initial presentation and email to teachers, the needs assessment (NA) team received email responses from teachers interested in setting up individual interviews. The NA team planned for the interviews to include gathering information on the teacher’s course load, including subject and sections taught (A-I), what types of resources she or he used in their classes, including technology resources, and for which courses were assessment the easiest and hardest. At the end of each interview, the NA team asked the participant for referrals to other teachers as a recruitment tool for inviting other teachers to participate in interviews.

To facilitate gathering a large amount of student information in as short a time frame as possible, the NA team organized a series of focus group sessions. Each session was led by one member of the iSTEP team who was assisted by two AUW interns – one from the English Literacy Tools team and one from the needs assessment team. Including the AUW interns in these sessions helped put the participants at ease since many of the AUW interns are friendly with the Access Academy students, and because they were able to clarify certain points in language that was familiar and accessible to the students. Each session had a maximum of ten participants per session to allow time for each participant to be able to share her thoughts and ideas. Keeping these goals in mind, the needs assessment team developed an interview script that included the following areas:

- Basic student background information including why students had chosen to attend Access Academy
- Students’ self-described English literacy strengths and weaknesses, based on categories aligned with the Access Academy curriculum, including grammar, vocabulary, reading, writing, listening, and presenting
- Preferences in coursework
- Extracurricular interests
- Interactions with computers and mobile phones

By centering the focus group sessions around these areas, the team was able to better understand what types of technology (computer and/or mobile phone) were used most frequently by students and what that usage consisted of, which components of English literacy students believed they needed more practice in, which learning areas were enjoyed or not enjoyed by students, and what themes or topics might motivate or engage students.

“Partnering with the iSTEP team gives us the opportunity to interact with different cultures and learn from other students knowledgeable in the field of ICT for development. It is a new, exciting experience”

- Lutfun Nahar, AUW Intern

Students voluntarily signed up to participate in sessions through email responses to a “how to get involved” message from the team or on sign-up sheets displayed in the cafeteria – a space that all students dine in at least two or three times a day. During the first session, student participants were from the same geographic location and during introductions, they noted they had all attended school together prior to attending the Access Academy. As the discussion progressed, the students would often switch from English to their native language, discussing the question amongst themselves to decide on one answer for the group. The facilitator would often need to ask follow up questions to solicit individual responses but students seemed hesitant to share their individual opinions. After the first session the team revised the question set to include questions where participants were asked to write their answers on paper, which were collected at the end of the session, to better facilitate, honest, individual answers. This modification seemed to work well, and helped to mitigate the tendency to engage in group discussion to identify one answer.

## **6.2 Needs Assessment Data Analysis**

In total, the team was able to meet with 40 out of 137 students and 7 out of 13 teachers as well as the program director. The team analyzed the information collected from these sessions by creating compiled response documents that tracked feedback by question and by session. This allowed tracking the number of similar responses to a question and identifying trends in answers. The team used a process called text mining where a search feature is used to identify the number of times the same response is cited in compiled interview notes, proportional analysis to determine the size of a given response, and multiple peer review of interview notes where multiple people review the same set of notes to ensure that any important information has not been overlooked. These methods led to the identification of key outcomes listed below.

## **6.3 Needs Assessment Outcomes**

Overall, the needs assessment process yielded important information for the development of a project proposal. It became clear to the team that accessibility, the ability to support a variety of question types, and progress tracking were key desires for both students and teachers.

Teachers and program staff emphasized that they have limited time to dedicate to any additional work or responsibilities because they had to create much of their course content and class resources from a variety of sources, rather than a fixed textbook. These resources included on-line grammar or vocabulary exercises or quizzes, such as those available on the BBC’s Skillswise,<sup>44</sup> and converting word problems from a U.S. high school textbook into word problems that are culturally appropriate for the Access Academy student population. Therefore, teachers requested that the tool support easy entry of content, including limiting the number of steps it takes to enter a question into the system. Teachers also expressed a desire to have additional resources to monitor student progress in order to be able to better support a specific student or refine the content being presented to a class of students. One of the reasons they cited using online exercises and quizzes was because of the instant feedback that is available to students, and in some cases, teachers were able to view results for a given student’s progress.

Overall, students expressed that grammar and vocabulary are the most challenging areas to learn for English literacy, followed closely by listening comprehension. Students particularly expressed a desire for additional practice exercises focused on applying their knowledge in these areas, rather than exercises that clarified the students understanding of rules or guidelines. A unique need related to vocabulary was identified through conversations about quantitative reasoning. Students noted that this subject was particularly challenging, not because of the math or critical thinking skills required, but because of the vocabulary used in the class. When applying words such as “mean” in the context of probability for the first time, it could prevent them from being able to express their knowledge. When asked about their use of technology outside of class assignments, students noted that they use computers more than mobile phones for recreational purposes, as those who have mobile phones do not have models that support applications. Computer use outside of class assignments included activities such as playing games on Facebook where scores can be monitored and shared with friends, talking with friends, and playing on-line games that are helpful for class such as speed typing games and vocabulary question games such as Free Rice.<sup>45</sup> They found games such as Free Rice fun and engaging and speed typing games enjoyable because of the immediate feedback that the games provided on their skills.

## **6.4 Challenges and Considerations**

In analyzing these outcomes, the team also noted several important challenges and considerations. The main challenge that needed to be accounted for in a solution proposal was that approximately 75% of all incoming Access Academy students entered the program with no computer literacy. Within the first three weeks of the program this figure significantly decreases due to daily computer classes during Term 1 but this challenge indicated that any solution should be accessible to users with a lower computer literacy level. Additionally, the team was able to collect basic information on computer accessibility at AUW, given that students use computers for recreation outside of class. Currently, the school has one computer for every three students when both undergraduate and Access Academy students are on campus. The team was also able to learn that a limited number of students have their own laptops and are able to access to school’s wireless internet connection from their dorm rooms.

## **6.5 Related Work**

The survey of related work for the project with Asian University for Women included an examination of academic research papers and existing English literacy technology projects.

The idea of teaching language literacy with technology was envisioned in the 1950’s and first realized in the 1960’s and 1970’s.<sup>46</sup> Since then, technology has been implemented to teach English across the globe.

Project LISTEN was a pioneering English literacy project created by Carnegie Mellon researchers. The project, headed by Professor “Jack” Mostow, was designed to advance children’s reading skills by way of an automated Reading Tutor.<sup>47</sup> Project LISTEN (Literacy Innovation that Speech Technology Enables) records the utterances of English learners and provides feedback.<sup>48</sup> Users of

Project LISTEN can read stories as the tutor “listens” and gives them automatic feedback when they make a mistake.

Researchers from Carnegie Mellon tested Project LISTEN in an international development context in the form of Project Kané. Project Kané brought Project LISTEN to Accra, Ghana, and explored how technology could improve English literacy among children in the region. The project was designed specifically for students in Ghana and it verified the practicality of using automated tutors in developing communities.<sup>49</sup>

Like Project Kané, the iSTEP 2009 English Literacy Tools project taught English literacy in Africa. While partnering with the Mlimani School, the iSTEP 2009 project used technology to build literacy skills at primary schools in Tanzania. Unlike Project LISTEN, the iSTEP 2009 technology solution relied on mobile phones. The solution, based on needs of a local school in Tanzania, consisted of a mobile phone-based, quiz-like educational game and a web-based content authoring tool.<sup>53</sup>

Based on the needs assessment outcomes in Tanzania, the iSTEP 2009 interns concluded that a mobile phone game would be the most appropriate solution for the young learners. The solution provided two different soccer (football) animations, which were displayed depending on a user’s performance (Figure 10). Correct answers merited an animation of a scored goal. Incorrect answers displayed a kicker missing a goal. The questions consisted solely of multiple choice questions and the animations served as automatic feedback incentives for the young students.<sup>50</sup>



Figure 10 - iSTEP 2009 English Literacy Tools animations

The iSTEP 2010 English Literacy Tools partner, the Asian University for Women’s Access Academy, differed greatly from the Mlimani School. The Mlimani School taught primary school students while the Asian University for Women offered undergraduate and graduate degree programs in several fields including computer science.<sup>51</sup> The Access Academy students were not required to use mobile phones, and not all students owned one. Those Access Academy students who owned mobile phones had models that were not uniform in brand, operating system, or features. Students did not generally incorporate computer games into their studies. Meanwhile, teachers wanted an easy-to-use tool that would not add more work to their already busy schedules. Most students and teachers had access to personal computers and labs. Based on the needs assessment, the team decided that teachers and students would benefit most from a practice tool accessible from a laptop or PC.

Instead of developing upon the previous year’s mobile phone platform, the team determined that a web-based solution would be more appropriate for the current audience. The team then had to decide whether to create a new product from scratch or use an existing project. A small budget rendered many commercial products out of reach. Consequently, the team’s research focused on existing open-source solutions.

Teachers expressed a desire to develop a tool that would allow them to create different question types with an easy-to-use interface. Teachers wanted to display customized questions, monitor user performance, and maintain users and questions centrally. These features met the definition of a learning management system (LMS).<sup>52</sup> Popular open-source Learning Management Systems include Moodle and Sakai.

Moodle advertises itself as an open source project used by over 1,230,000 teachers in 214 countries. Teachers have created over 52,113,421 questions using Moodle.<sup>53</sup> This popular software has many question types including essay, matching, multiple choice, drag and drop, and true/false. Unfortunately, Moodle did not provide all of the question types that were outlined by teachers during the needs assessment at AUW: multiple choice, fill in the blank, reading, and listening questions.

The Sakai Project is another open source LMS that actually provides most of the question types required by AUW teachers.<sup>54</sup> However, the Sakai quiz and assessment features did not allow for automatic visual and audio feedback, another need expressed by students and teachers at AUW.<sup>55</sup>

Another popular open source e-Learning platform is Docebo. Developed by an Italian corporation of the same name, Docebo focuses on course delivery. Docebo did not meet the previously expressed needs and like many of the LMS packages reviewed, Docebo's primary usage was online course delivery. Docebo was not necessarily designed to be a practice tool to supplement traditional classroom teaching.<sup>56</sup>

The team briefly looked into utilizing or extending these open source systems, but because we wanted the flexibility to easily update code during iterative testing without the constraints of an underlying framework, the team did not choose to build upon one of these systems.

There are at least 100 other commercial learning management systems available to consumers.<sup>57</sup> Blackboard and Pearson's ECollege.com are two of the major commercial providers catering to higher education and other large enterprises. Neither company published pricing information on their website.

Within Bangladesh, there were several related projects successfully using technology to teach English literacy. The BBC has implemented a free English learning service directed at mobile phone users in Bangladesh called Janala. The service delivered one million lessons in three months, showing the popularity of listening exercises among English learners in Bangladesh. The BBC complemented Janala with English language television shows that had 5 million viewers in January of 2010.<sup>58</sup>

Another English language program in Bangladesh was English in Action. The program was an initiative attempting to provide English language training to 25 million Bangladeshis. The program has provided mp3 players with English lessons to primary school classrooms. The lessons were focused primarily at teachers, helping them to improve their curriculum at a low cost.<sup>59</sup> Given the popularity of these technology-based language learning tools in Bangladesh, there was a precedent for developing an English literacy tool at the Asian University for Women.

In order to provide a timely solution that could meet all of the community partner's needs, the team decided to develop a custom solution, focused on ease of use for teachers. By studying tools like

Project LISTEN, the iSTEP 2009 project, Moodle, and Janala, the team was able to make informed decisions about the design and development for the AUW Literacy Tools solution.

## 6.6 Solution Overview

The technology solution for the Access Academy (AA) is a web based practice tool that builds on the curriculum at AA and has two types of primary users: teachers and students. In order to address and meet their needs, the team designed separate interfaces for the two groups.

### 6.6.1 Teacher Interface

The main functions of the teacher interface consist of:

1. Creating and managing different question formats (Question Manager)
2. Tracking student performance (Teacher Dashboard)

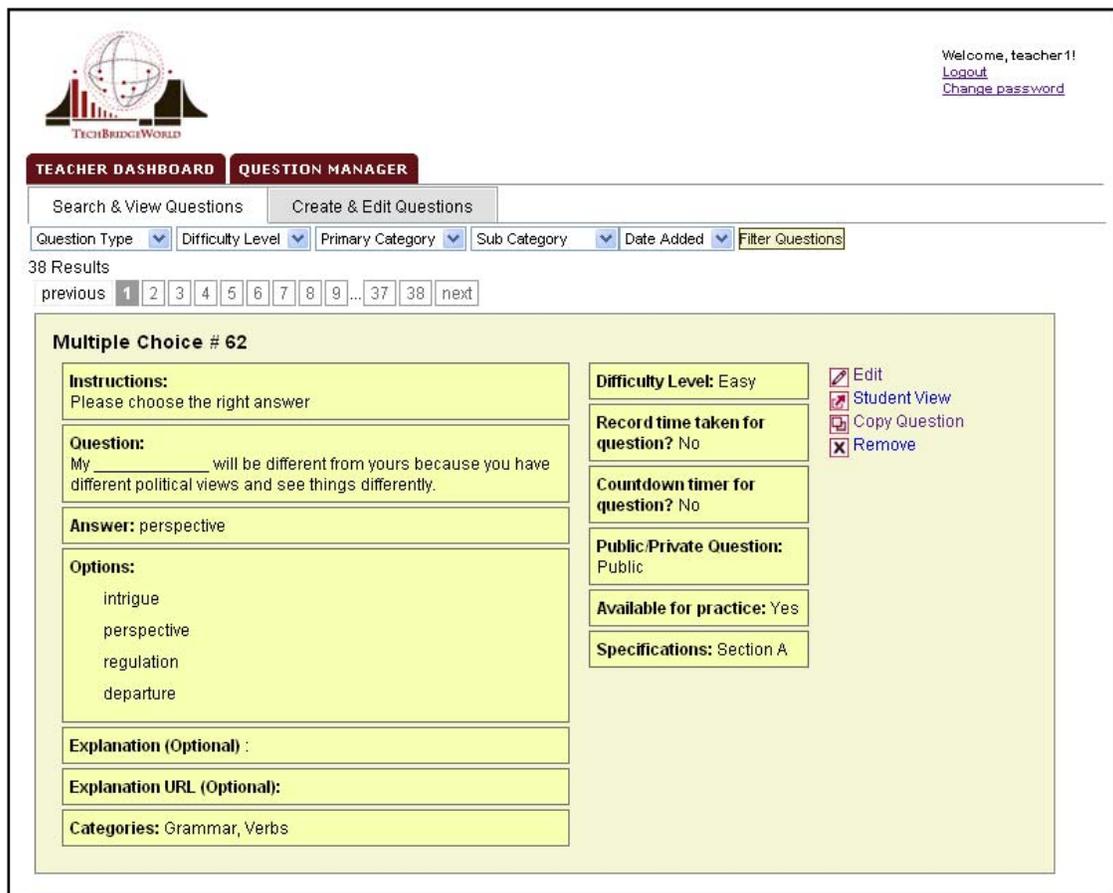


Figure 11 - The teacher interface has two views - Teacher Dashboard and Question Manager, as shown in the tabs in the screenshot. The above screenshot shows the Question Manager view of the teacher interface.

To provide this functionality, the teacher interface has two views: Question Manager and Teacher Dashboard. [Figure 11](#) below is a screenshot of the teacher interface.

The Question Manager view allows the teacher and/or teaching assistant to create, edit, view and delete questions. It also provides the functionality to copy a question, which gives users the flexibility to make changes to an existing question and save it as a new question. The copy question function reduces the burden on teachers who have to create several questions of a similar type. There are four question formats supported by the solution, which were designed based on the curriculum requirements:

- *Multiple Choice Questions*: This question type can be used to reinforce concepts taught in grammar, vocabulary, reading (such as identifying the topic sentence in a paragraph) or quantitative reasoning questions. For example,

**Q: What is the antonym of ‘busy’?**

- a) *Industrious*
- b) *Idle*

- *Fill in the Blanks*: This question type helps provide additional practice in grammar, especially with prepositions, tenses and verbs. For example,

**Q: Fill in the blanks with the appropriate answer from in/on/at.**<sup>60</sup>

- a) *I'll be ready to leave \_\_\_\_\_ about 20 minutes.*
- b) *I think she spent the entire afternoon \_\_\_\_\_ the phone.*

- *Reading Comprehension*: This question type can be utilized to test students’ understanding in reading assignments issued in the ‘Reading and Writing’ course. Students are tasked with excerpts, papers, and journals to read and questions to answer accordingly. The tool enables teachers to copy and/or paste a reading passage and ask multiple choice questions based on the passage. For example,

“Picture-taking is a technique both for annexing the objective world and for expressing the singular self. Photographs depict objective realities that already exist, though only the camera can disclose them. [...] This nostalgia for some pristine state of the photographic enterprise is currently widespread and underlies the present-day enthusiasm for daguerreotypes and the work of forgotten nineteenth-century provincial photographers. Photographers and viewers of photographs, it seems, need periodically, to resist their own knowingness.”

**Q: According to the passage, interest among photographers in each of photography's two ideals can best be described as**

- a) *rapidly changing*
- b) *cyclically recurring*
- c) *steadily growing*
- d) *unimportant to the viewers of photographs*

- *Listening Comprehension*: This question type can be utilized to test students’ understanding of assigned videos or audio clips in the ‘Listening & Presentation’ course. Students are tasked with videos to watch and/or audio clips to listen to and questions to answer accordingly.

Currently without the tool, teachers download the audio and video files onto a USB drive and students take turns accessing the drive to complete the assignment. The technology solution allows teachers to either link to an audio/video file on the internet, or record the passage required from which multiple choice questions are to be answered by students. The audio/video will be available to all students via the web application which solves the problem of manually distributing files among students. For example,

Watch Eric Mead’s TED video and answer the following questions.<sup>61</sup>

**Q: What is the best definition of the word ‘placebo’**

- a) a fake pill
- b) a therapy
- c) magic
- d) a secret

Additionally, the solution provides teachers with the option to make questions available to a specific group of students. Since teaching techniques and material differ for each section, this option helps teachers organize, tailor and specify questions for students in a particular section.

The Teacher Dashboard view allows the teacher to track overall student performance as well as student performance in the targeted areas of grammar, vocabulary, listening and reading (as shown below in Figure 12). Teachers can also view the performance of a single student.

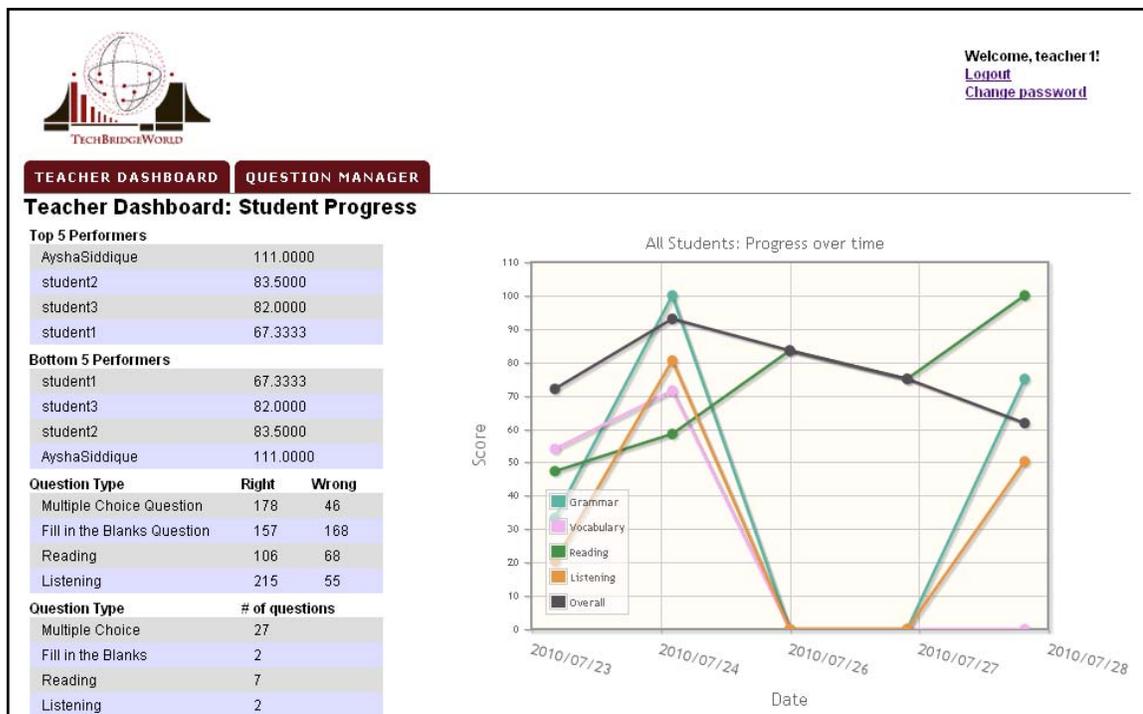


Figure 12 - Screenshot of the Teacher Dashboard view of the teacher interface.

## 6.6.2 Student Interface

The student interface allows the student to practice questions, receive feedback and track their performance over time. Teachers can specify questions to particular students by formulating questions designated for specific groups. Students can also choose from a category of questions

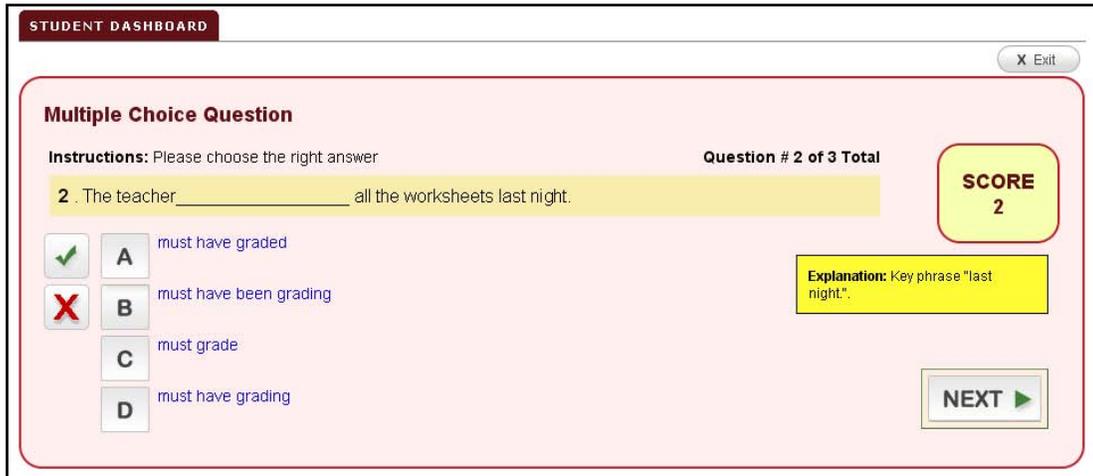
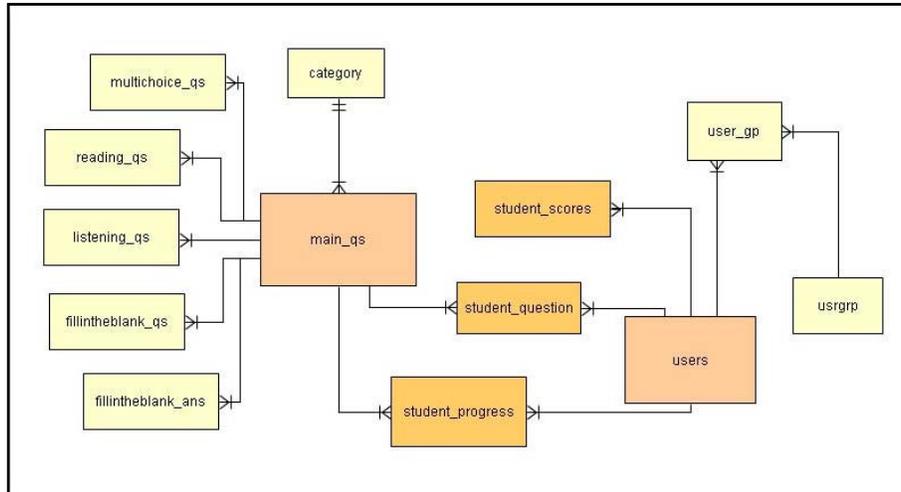


Figure 13 - Screenshot of the student interface. The student gets feedback for the wrong answer.

that they would like to practice: grammar, vocabulary, listening and reading, or they can choose the mixed mode where they get questions from all categories. For each question they attempt, they receive feedback for their input – they are notified of a wrong answer via a red cross and a right answer via a green tick. There is also audio feedback in the form of short sound clips. In addition, students can obtain an explanation for the answer if the teacher has provided a text explanation or URL while creating the question. This is demonstrated in the Figure 13. Students can also view their overall progress as well as progress in areas of grammar, vocabulary, reading and listening.

## 6.7 Technical Development

The implemented technology solution, which is a web-based practice tool for the students at Access Academy, used various technologies to develop the back-end and front-end. The back-end was developed using an open source LAMP (Linux, Apache, MySQL, and PHP)<sup>62</sup> stack that provides for the central functionality of the web application. The front-end features of the solution were developed with JavaScript and the jQuery JavaScript<sup>63</sup> framework that handled the animation, dynamic graphics and events. The team decided to choose this development framework as the technical members in the team had prior experience with these technologies and the AUW technology systems could support and sustain these technologies in the future.



**Figure 14 - Entity Relationship Diagram showing the relationship between the different components of the database backend.**

We developed the web application to function properly on browsers such as Internet Explorer, Firefox, Chrome and Safari. However, the user interface and the various plug-ins and technologies employed in the development of the web application function best when viewed with Mozilla Firefox. Since A UW computers have Firefox installed on them, we recommended using Firefox for best results. Conducting further cross-browser testing and development are included in the plans for future work (See 6.10).

Figure 14 above illustrates the relationship between the different components in the database backend. Table 2 below gives a brief description of all the components in the database. The practice tool has four main modules: authentication, question manager, practice mode, and evaluation. The components outlined in Table 2 have been designed to allow for the implementation of these modules, which are discussed in further detail in the following sections.

Table name	Description
<b>Users</b>	Contains information about all the users in the database
<b>Groups</b>	Contains information about all the user groups in the database
<b>user_group</b>	Contains information about the user and group relationship, i.e. specifies which user belongs to which group
<b>main_qs</b>	Contains information about the questions that are common to all question types – for example difficulty level, primary category, etc. All of the question types are linked back to this table via the question ID.
<b>multichoice_qs</b>	Contains information specific to the multiple choice questions – question, answer, and the answer options
<b>reading_qs</b>	Contains information specific to the reading questions – passage, number of subquestions (which are multiple choice questions linked together by the question ID)
<b>listening_qs</b>	Contains information specific to the listening questions – audio file, YouTube link, number of subquestions (which are multiple choice questions linked together by the question ID)
<b>fillintheblank_qs</b>	Contains information specific to the fill in the blanks question - the passage with blanks and the number of blanks
<b>fillintheblank_ans</b>	Contains information specific to the fill in the blanks answers – the answer, answer options and the ordering of the blank in the passage. The answers are linked back to the fill in the blank question by the question ID.
<b>student_progress</b>	Contains information about all the questions attempted by a particular student using the tool.
<b>student_question</b>	Contains information about which questions are specified to which students.
<b>student_scores</b>	Contains information about the scores achieved by students using this practice tool.

Table 2 - Description of components in the database

### 6.7.1 Authentication

The authentication module was implemented to track student and teacher activity on the application and provide useful analytics for tracking performance. The authentication was designed to limit access to the teacher interface to only AA teachers and to allow AA students to create unique accounts so they can use the student interface and track their individual progress.

When a user registers to use the application, the account information is stored and maintained in the database via the *users* table (shown below in Table 3 ). The application supports different types of user accounts – student, teacher, teaching assistant and the administrator (or admin) account. The teaching assistant account was created for use by the undergraduate students at AUW who can help the AA teachers with question entry within the practice tool. The administrator account allows someone in a management position to view and manage all student and teacher account information. For all the user account types, the name, user name, and email are stored in the database. The passwords entered are hashed before storing them in the database.

A unique hashed time value based on the time the user was created provides a unique value with which to identify the user.

Field	Type	Description
<b>Id</b>	INT	User ID
<b>name</b>	VARCHAR	Name of the user
<b>login</b>	VARCHAR	User name or login of the user
<b>password</b>	VARCHAR	Password, which is stored in the hashed format to maintain security.
<b>email</b>	VARCHAR	Email address of the user
<b>type</b>	ENUM['student', 'teacher', 'admin', 'TA']	Type of the user account
<b>section</b>	VARCHAR	Section that the user belongs to (if user is a student)
<b>start_date</b>	TIMESTAMP	Date that the user joined the tool
<b>last_login</b>	TIMESTAMP	Date that the user last logged into the tool
<b>confirmed</b>	TINYINT	Confirmed account i.e. user has read and agreed to IRB consent
<b>userhash</b>	VARCHAR	Unique hashed value of the local time when the user account is created

Table 3 - Description of the 'users' component of the database

#### 6.7.1.1 Creating user accounts

Students can create user accounts by clicking on the “Register” link from the homepage, which presents a link asking students for their name, username, password, email address and class section (i.e. the class (or section) they are grouped into at AA based on their English proficiency). A screenshot of the student registration form is shown below in [Figure 15](#).

**ELT Student Registration Form**

Name:

Section:

E-mail:

Username:

Password:

Confirm password:

**Voluntary Consent**

Ideal candidates for this study are university-level students studying in Bangladesh. Students will not be included or excluded based on their current literacy level.

**Risks**

The risks and discomfort associated with participation in this study are no greater than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests.

By clicking on submit below, you agree that the above information has been explained to you and all your current questions have been answered. You understand that you may ask questions about any aspect of this research study during the course of the study and in the future. By signing this form, you agree to participate in this research study.

Figure 15 - Student Registration Form

The admin account has been created by the iSTEP interns and must be managed by AUW faculty or staff. The teacher and teaching assistant accounts are created on invitation by the admin who enters the name, username and email address of the user. The teacher and teaching assistant accounts have access to the teacher interface that allows them to insert new questions and track the overall progress of students, thereby making changes to the database. Therefore, it is important that these accounts are monitored and restricted to teachers at Access Academy by making it invitation-only.

All accounts are marked as unconfirmed upon creation. The user receives a confirmation email which has the copy of the Carnegie Mellon Institutional Review Board (IRB) consent form. The consent form details that the application is part of a research project and the user activity will be tracked and used for research purposes. The consent form further explains the risks and benefits of the study. If the user understands and wishes to participate under the conditions of the IRB, they can click on the confirmation link in their email and the account consequently gets marked as 'confirmed'. This step is important to make sure that the research is conducted under compliance with the IRB, i.e. it is ethical and performed with the consent of the participants, and to make sure that all the data collected through the tool can be analyzed and used for publication. Given that the tool is currently part of a research project at Carnegie Mellon, it is not possible for a user who does not agree with the IRB consent form to use the tool.

### 6.7.1.2 User Roles and Access Restrictions

The admin has access to all pages within the application. The admin can create accounts and invite users to register with the application. Additionally, the admin can view a list of all the members in the database, edit their details (except for the password, users can reset their own passwords) and delete accounts. The admin can create and delete user groups and manage the users in the user groups. All of this is done via the Control Panel view for the admin, which is shown in Figure 16.

Welcome, admin!  
[Logout](#)  
[Change password](#)

**TEACHER DASHBOARD** **QUESTION MANAGERS** **STUDENT DASHBOARD** **CONTROL PANEL**

**Control Panel**

Create a new user group:

ID	Name	Username	E-mail	Type	Section	Joined on	Edit	Remove
<input type="checkbox"/>	15	student1	student1	aysha.siddique@gmail.com	student	A	2010-07-24 14:47:43	<a href="#">Edit</a> <a href="#">Remove</a>
<input type="checkbox"/>	14	teacher1	teacher1	aysha.siddique@gmail.com	teacher		2010-07-24 14:48:28	<a href="#">Edit</a> <a href="#">Remove</a>
<input type="checkbox"/>	16	admin	admin	aysha.siddique@gmail.com	admin		2010-07-24 14:49:19	<a href="#">Edit</a> <a href="#">Remove</a>
<input type="checkbox"/>	17	tbw	tbw	aysha.siddique@gmail.com	TBW		2010-07-24 14:49:56	<a href="#">Edit</a> <a href="#">Remove</a>
<input type="checkbox"/>	19	teacher3	teacher3	aysha.siddique@gmail.com	teacher		2010-07-24 14:50:41	<a href="#">Edit</a> <a href="#">Remove</a>
<input type="checkbox"/>	20	student2	student2	aysha.siddique@gmail.com	student	A	2010-07-24 14:51:18	<a href="#">Edit</a> <a href="#">Remove</a>
<input type="checkbox"/>	21	student3	student3	aysha.siddique@gmail.com	student	C	2010-07-24 14:51:44	<a href="#">Edit</a> <a href="#">Remove</a>
<input type="checkbox"/>	22	student4	student4	aysha.siddique@gmail.com	student	C	2010-07-24 14:52:18	<a href="#">Edit</a> <a href="#">Remove</a>
<input type="checkbox"/>	33	AyshaSiddique	ayshas	aysha.siddique@gmail.com	student	A	2010-07-24 14:46:42	<a href="#">Edit</a> <a href="#">Remove</a>
<input type="checkbox"/>	50	Test Teacher	testteach	aysha.siddique@gmail.com	teacher		2010-07-29 04:55:30	<a href="#">Edit</a> <a href="#">Remove</a>
<input type="checkbox"/>	49	Test Student	testst	aysha.siddique@gmail.com	student	A	2010-07-29 04:22:39	<a href="#">Edit</a> <a href="#">Remove</a>
<input type="checkbox"/>	51	Brian	bsym	brian.j.sym@gmail.com	teacher		2010-07-29 07:59:58	<a href="#">Edit</a> <a href="#">Remove</a>
<input type="checkbox"/>	52	test	test	jrmuller@gmail.com	student	a	2010-07-29 13:21:07	<a href="#">Edit</a> <a href="#">Remove</a>

Add users to user group:

(Teacher / Teaching Assistant)

ID	Group Name	Remove
10	<a href="#">Teachers</a>	<a href="#">Remove</a>
11	<a href="#">Students</a>	<a href="#">Remove</a>
4	<a href="#">Section A</a>	<a href="#">Remove</a>
5	<a href="#">Section C</a>	<a href="#">Remove</a>
7	<a href="#">Section B</a>	<a href="#">Remove</a>

Students				
ID	User ID	Username	Type	Remove
27	15	student1	student	<a href="#">Remove from group</a>
28	20	student2	student	<a href="#">Remove from</a>

Figure 16 - Control Panel view for the admin user account

The teacher account can view the teacher interface and the student interface and has rights to add questions and view student progress. The teaching assistant account can access only the Question Manager view which allows the user to add questions. This separation of access allows teaching assistants to create questions, but not view other student's performance. Table 4 below summarizes the access rights of all user account types on the application.

If a user tries to access a page to which they do not have rights, an error message is displayed that says "Sorry! You do not have permission to view this page." This is done via SESSION variables in PHP that keep track of the ID, login and account type of the user that is currently logged in. Every page checks for the user account type and grants/restricts access accordingly.

Account Type	Access Levels
<b>Admin</b>	<ul style="list-style-type: none"> <li>Has access to all pages</li> <li>○ Can add/delete users from the application</li> <li>○ Can edit user details</li> <li>○ Can create user groups</li> <li>○ Can add/delete users to/from user groups</li> <li>○ Can view the Teacher Dashboard and access all student performance information</li> <li>○ Can view Question Manager and create new questions</li> <li>○ Can view Student Dashboard</li> </ul>
<b>Teacher</b>	<ul style="list-style-type: none"> <li>○ Can view the Teacher Dashboard and access all student performance information</li> <li>○ Can view Question Manager and create new questions</li> <li>○ Can view Student Dashboard</li> </ul>
<b>Teaching Assistant</b>	<ul style="list-style-type: none"> <li>○ Can view the Question Manager only</li> </ul>
<b>Student</b>	<ul style="list-style-type: none"> <li>○ Can view the Student Dashboard only</li> </ul>

Table 4 - User account type and access levels

### 6.7.1.3 User groups

User groups have been implemented to allow teachers to group students and assign questions specific to those groups. At the Access Academy, students are grouped into letter-based sections that are dependent on English proficiency. During the needs assessment discussions, teachers explained the benefits of being able to specify questions for different user groups because each section is taught by a different teacher using different techniques and materials.

The information for the user groups is stored in the *usrgrp* (Table 5 ) and *user\_group* (Table 6 ) components of the database. The admin account can create user groups by specifying a name for the group, which is saved in the database with a unique ID for the group. A user can belong to many groups. For example, a user can belong in the general group “Students” and to the specific group “Section A”. A user group can have many users. Therefore, each user and group combination has to be saved as a uniquely identifiable record in the database, and this can be done by saving the ID’s of the user and the group in the *user\_gp* table. Further details of the content in these tables are described below.

Field	Type	Description
<b>Id</b>	INT	Group ID
<b>group_name</b>	INT	Name of the group

Table 5 - Description of the groups (usrgrp) table in the database

Field	Type	Description
<b>Id</b>	INT	Row ID
<b>user_id</b>	INT	User ID
<b>group_id</b>	INT	Group ID – i.e. ID of the group that the user belongs to.

Table 6 - Description of the user groups (user\_gp) table in the database

The admin can add users to specific groups, which is done by selecting a list of users and the user group to which they need to be added. For every user in that list, the ID's of the user and the group are saved in the database to indicate that the user belongs to that group.

The purpose of user groups is to allow teachers to specify questions for a group of students. This information is maintained in the *student\_question* (Table 7) component, which keeps track of the mapping between question assignments and students. In the current implementation, it is only possible to specify a question for a single user group. Similar to user groups, this can be done by saving the ID's of the student and the question into the database to indicate that the question has been assigned to the student. This is stored by student ID so as to make it easier to select questions to display for the student to practice in the practice mode (see Section 6.7.3).

Field	Type	Description
<b>Id</b>	INT	Row ID
<b>st_id</b>	INT	Student ID
<b>qs_id</b>	INT	Question ID
<b>available</b>	INT	Is the question available for practice for this particular student?
<b>ans_right</b>	INT	How many times has the student answered this question correctly? (default value – 0)
<b>Hide</b>	INT	Has the student opted to 'hide' the question? (default value – 0)
<b>added_on</b>	INT	Timestamp for when the question was specified for the student

Table 7 - Description of the *student\_question* component of the database

When a question is specified for a user group, then for every user in that group, the ID's of the user and the question are saved in the database. When the question is *edited* to assign it to a different group, the user group that the question was originally specified for is saved and for every user in that group, the relationship between the question and the user is removed from the *student\_question* table by matching the question ID and user ID. Following that, for every user in the new user group, the IDs of the user and question are saved in the database.

Since the user is linked to both user group and questions, some database dependency issues arise when a user group is deleted or when a new user is added to the user group.

- When a user group is deleted, then all questions that were specified for that user group must be updated so that they can be available for all students, and not a specific user group.
- When a user is added to a user group, then for every question that is specified for that user group, a new relationship between that user and question are saved in the database by specifying the user and question IDs.

### 6.7.2 Question Manager

The question manager allows the teacher and teaching assistant to create and manage different kinds of questions and make them available for students to practice.

### 6.7.2.1 Creating questions

The tool supports four formats of questions: multiple choice, fill in the blanks, reading comprehension and listening comprehension. All of the questions require some common details, such as primary category, secondary category, instructions and difficulty level. Primary category is made mandatory because the evaluation metrics are based upon the primary categories of grammar, vocabulary, reading and listening (See Section 6.7.4 ). Optionally, teachers can select a secondary-category from the existing list of categories or add a new category to the list. Teachers can also specify an explanation and a corresponding URL for each question that students can refer to for extra information.

Field	Type	Description
<b>Id</b>	INT	Question ID
<b>qs_type</b>	ENUM['Multiple Choice', 'Fill in the Blanks', 'Reading', 'Listening']	Type of the question
<b>instructions</b>	VARCHAR	Instructions/Directions for the question
<b>diff_level</b>	ENUM['Easy', 'Intermediate', 'Hard']	Difficulty level of the question
<b>primary_cat</b>	ENUM['Grammar', 'Vocabulary', 'Reading', 'Listening']	Primary category of the question
<b>secondary_cat</b>	VARCHAR	Secondary category of the question
<b>explanation</b>	VARCHAR	Explanation for the answer
<b>url</b>	VARCHAR	URL (For external resources)
<b>available</b>	INT	Is the question available to students for practice? (1 – available, 0 – unavailable)
<b>public</b>	INT	Is the question public or private to other teachers? (1 – public, 0 – private)
<b>usergrp_id</b>	INT	The ID of the group that this question is specified for
<b>added_by</b>	VARCHAR	The username of the teacher/teaching assistant that added this question
<b>added_on</b>	TIMESTAMP	Date and time that this question was added on

Table 8 - Description of the main\_qs component of the database

Teachers can decide to make a question available or unavailable for practice. This allows a teacher to plan ahead and enter questions using the tool that will be covered in class only at a later date. The questions can be made public to other teachers or private, in the event that these are questions that will be used for testing purposes\*.

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\* Developer's note: We have allowed the option to make questions public or private to other teachers based on teacher's needs. However, in the current implementation, we have not made use of that feature because a testing component has not been implemented.

By default, all questions are made available and public. As discussed earlier, the teachers can specify the questions for a certain user group by specifying the group name. All of this information is stored in the *main\_qs* component of the database (described in Table 8 ). The question ID from this component is used to link the various question types together. The question entry form for all question types are validated by a JavaScript function that makes sure all the mandatory fields are filled-in and notifies the user of any missing fields. This ensures that the server side functions are not exposed to missing or incorrect input.

Next, the four different formats of questions, their database design and views are discussed in detail.

### Multiple Choice Questions

To create a multiple choice question, in addition to the required details mentioned above, the teacher must specify the question, provide at least two and at most eight answer options and specify the correct answer for the question. These requirements were designed after studying sample curriculum materials from the teachers. The question entry form for multiple choice questions can be seen in Figure 17. In order to provide a clean interface with only necessary elements displayed, “Add Answer” and “Remove Answer” buttons execute JavaScript functions that add and remove input boxes.

**Create New Multiple Choice Question**

Choose the main category:

Choose the sub category:   Or enter a new one:

Instructions:

Question:

Answer:   Check if correct

Answer:   Check if correct

Explanation: (optional)

Explanation Url: (optional)

Choose the difficulty level:

Make question available for practice?: Yes:  No:

Make question available for user groups:

Make question public to all teachers?: Yes:  No:

Figure 17 - Multiple Choice question entry form

Field	Type	Description
Id	INT	ID of the multiple choice question
qs_id	INT	ID of the main_qs
Qs	VARCHAR	Question
Ans	VARCHAR	Answer
Op1	VARCHAR	Option 1 (mandatory)
Op2	VARCHAR	Option 2 (mandatory)
Op3	VARCHAR	Option 3
Op4	VARCHAR	Option 4
Op5	VARCHAR	Option 5
Op6	VARCHAR	Option 6
Op7	VARCHAR	Option 7
Op8	VARCHAR	Option 8
Is_subqs	INT	Is it a subquestion of a reading or listening question? Is_subqs = 1, if this multiple choice question is used as a subquestion of a reading or a listening question

Table 9 - Description of the multichoice\_qs component of the database

The information specified in the multiple choice question entry form is stored in the *multichoice\_qs* component of the database (described in Table 9). The multiple choice question links back to the main question with the question ID. The view for a multiple choice question is implemented displaying question data stored in the database as shown below in Figure 18.

**Multiple Choice # 62**

<p><b>Instructions:</b> Please choose the right answer</p>	<p><b>Difficulty Level:</b> Easy</p>
<p><b>Question:</b> My _____ will be different from yours because you have different political views and see things differently.</p>	<p><b>Record time taken for question?</b> No</p>
<p><b>Answer:</b> perspective</p>	<p><b>Countdown timer for question?</b> No</p>
<p><b>Options:</b>  <ul style="list-style-type: none"> <li>intrigue</li> <li>perspective</li> <li>regulation</li> <li>departure</li> </ul> </p>	<p><b>Public/Private Question:</b> Public</p>
<p><b>Explanation (Optional) :</b></p>	<p><b>Available for practice:</b> Yes</p>
<p><b>Explanation URL (Optional):</b></p>	<p><b>Specifications:</b> Section A</p>
<p><b>Categories:</b> Grammar, Verbs</p>	<p> <input type="checkbox"/> Edit  <input type="checkbox"/> Student View  <input type="checkbox"/> Copy Question  <input checked="" type="checkbox"/> Remove </p>

Figure 18 - View of a multiple choice question

## Fill in the Blank Question

The fill in the blank question type allows teachers to create questions with up to six blanks, where each blank can have between one and seven answer options. If only one answer is specified for the blank, the blank is displayed as an input text box and if there is more than one answer option, the blank is displayed as a drop down menu. The design of the fill in the blank question has been modeled after AUW's AA curriculum and attempts to keep the user interface as simple as possible. In order to create a clean user interface that only includes elements currently in use, a jQuery script was used to hide input fields until the teacher decides to enable them. As the teacher adds new blanks to a passage, an indicator in the form of “\_1\_”, “\_2\_”, “\_3\_”, “\_4\_”, “\_5\_”, and up to “\_6\_” is entered into a text box. Each indicator corresponds to a set of possible answers that are entered by the teacher via inputs that are revealed as each new blank is inserted as shown in Figure 19.

Figure 19 - Fill in the blanks question entry form

Field	Type	Description
Id	INT	ID of the fill in the blank question
qs_id	INT	ID of the main_qs
qs	VARCHAR	Question

Table 10: Description of the fillintheblank\_qs component of the database

Field	Type	Description
Id	INT	ID of the fill in the blank answer
qs_id	INT	ID of the main_qs
correct_answer	mediumtext	Correct answer to the question if drop down
ans1	mediumtext	Option1 - correct answer if input, option if a drop down
ans2	mediumtext	Option 2
ans3	mediumtext	Option 3
ans4	mediumtext	Option 4
ans5	mediumtext	Option 5
ans6	mediumtext	Option 6
ordering	INT	Tells in which order the blank appears in the passage

Table 11 - Description of the fillintheblank\_ans component of the database

The number of blanks associated with each question is not stored explicitly. Locations of the blanks are noted within the text with the “\_#\_” placeholders. The ordering field in the “fillintheblank\_ans” specifies in which order the blanks appear. The information specified in the fill in the blanks question entry form is stored in the *fillintheblanks\_qs* and *fillintheblanks\_ans* component of the database (described in

Table 10 and Table 11 ). A passage can contain many blanks, and each blank can contain a list of answer options. Therefore, the answers for each blank of the fill in the blanks questions are stored separately and links back to the fill in the blanks question and the main question with the question ID. The view for a fill in the blanks questions is implemented by displaying question data stored in the database as shown below in Figure 20.

Figure 20 - View of a Fill in the Blank question

## Reading Question

To create a reading question, in addition to the required details, the teacher must specify the passage and at least one subquestion, which is a multiple-choice question. The subquestion must have at least two answer options specified, which is the requirement for creating a

multiple choice question. The subquestion is linked to the main question and the reading question with the question ID. The question entry form for reading questions can be seen in [Figure 21](#).

**Figure 21 - Reading question entry form**

Field	Type	Description
Id	INT	ID of the reading question
qs_id	INT	ID of the main_qs
passage	VARCHAR	Question
num_subqs	VARCHAR	Number of sub questions for the reading question

**Table 12 - Description of the reading\_qs component of the database**

The information specified in the reading question entry form is stored in the *reading\_qs* component of the database (described in

[Table 12](#)). Multiple choice subquestions are associated with each reading question. The view for a reading question is implemented by displaying question data stored in the database as shown in [Figure 22](#).

Reading Comprehension # 102	
<p><b>Instructions:</b> Read the following passage and answer the given questions</p> <p><b>Passage :</b> The Star Llama by Jan Mike Once there was a young Inca boy. He had no family except for an old llama. Each day the boy and his llama walked many miles, looking for a home. Each night they curled up together and slept. But one starry evening, the old llama died. The boy buried his friend next to an icy stream. Then he sat under a tree and cried. What would he do? He had no family and no home. The boy cried for a very long time. But there was no one to comfort him. There were only the stars in the sky. Suddenly, the sky filled with bright light. The boy held his breath. He was afraid to move. One bright star fell to the ground. Slowly, the star took the shape of the old llama. She bent her head and drank from the stream. She looked at the boy and smiled. As she jumped back into the sky, bits of llama wool fell. As the Sun began to rise, the boy picked up the soft, warm wool. It glowed in his hands like starlight. He carried the wool to the city and sold it. With the money, he bought a house. He bought two young llamas. He never forgot the star llama. And he was never lonely again.</p> <p><b>Question:</b> Why does the boy cry when the old llama dies?</p> <p><b>Answer:</b> because the old llama is his only family</p> <p><b>Options:</b></p> <ul style="list-style-type: none"> <li>because he is afraid of the dark</li> <li>because he is always sad</li> <li>because the old llama is his only family</li> <li>because he is lost</li> </ul>	<p><b>Difficulty Level:</b> Easy</p> <p><b>Record time taken for question?</b> No</p> <p><b>Countdown timer for question?</b> No</p> <p><b>Public/Private Question:</b> Public</p> <p><b>Available for practice:</b> Yes</p> <p><b>Specifications:</b> Section B</p> <p><a href="#">Edit</a> <a href="#">Student View</a> <a href="#">Copy Question</a> <a href="#">Remove</a></p>

Figure 22 - View of a reading question

### Listening Question

Listening Questions are designed so that students can listen to an English language passage and answer one or multiple questions based on the listening passage. During the needs assessment process, AUW teachers and students specified a preference for watching YouTube videos for this purpose, specifically TED (Technology, Entertainment, Design) conference videos posted on YouTube. Though there are many video hosting sites to choose from, YouTube is very robust and is able to handle a lot of traffic as the world's third most-visited video hosting site.<sup>64</sup> Most recognizable educational institutions have channels and lectures posted on YouTube, including Carnegie Mellon, Stanford University, and Harvard University. YouTube provides a rich API, and therefore, videos from YouTube can be embedded directly into the student interface. By embedding videos through YouTube, the Listening Questions avoid popping out a new window, which may have distracting elements such as related videos, advertisements, and potentially inappropriate content.

In addition to listening to passages from YouTube videos, teachers can also record passages themselves. The question manager provides a Java applet which records audio clips up to 60 seconds long. The audio files are saved with the ".wav" extension on the server and the file name is stored in the database and associated with the listening question. The Java applet is a free version of the ListenUp recorder by Javasonics.<sup>65</sup> Teachers must enable the java applet to be run on their computer and students must be able to play wav files on their computer in order to use this feature, or else an empty white page will be displayed in the java applet frame. If AUW teachers decide that they would like to be able to record passages longer than 60 seconds, they can purchase a standard license (retail \$485.00, which qualifies for a 50% educational discount) which would allow them to record audio files of extended lengths. Other options include recording audio or video files on YouTube and providing a link for the listening question. Audio recording was implemented because the teachers are used to

recording passages in their own voice and distributing it to students as exercises. Videos were not that popular among teachers, and additionally, it would take up a lot of time and server space to upload videos.

To create a listening question, in addition to the required details, the teacher must either record a passage or submit a link to a YouTube video and provide at least one subquestion, which is a multiple choice question. The validation form for the listening question will detect if a teacher tries to enter both a YouTube video and a listening passage, and will deny submission. The form will also check to make sure that the YouTube video URL is accurate by checking to ensure that it has the “www.youtube.com/watch?=” prefix. This is done in order to maintain database integrity and ensure that the video is embedded properly. The question entry form for the listening question can be seen in [Figure 23](#).

Figure 23 - Listening question entry form

Field	Type	Description
Id	INT	ID of the listening choice question
qs_id	INT	ID of the main_qs
audio_file	VARCHAR	File name of the .WAV files stored in the uploads folder on the server: ex) message1279673889.wav
youtube	VARCHAR	11 digit YouTube video code
num_subqs	VARCHAR	Number of sub multiple choice questions associated with the listening question

Table 13: Description for the listening\_qs component of the database

The information specified in the listening question entry form is stored in the *listening\_qs* component of the database (described in

Table 13). The multiple choice questions link back to the listening question and the main question with the question ID. The question view is shown below in Figure 24.

Listening Comprehension # 199	
<p><b>Instructions:</b> Watch Eric Mead's TED video and answer the following questions.</p>	<p><b>Difficulty Level:</b> Easy</p>
	<p><b>Record time taken for question?</b> No</p>
	<p><b>Countdown timer for question?</b> No</p>
<p><b>Question:</b> What is the best definition for the word placebo</p>	<p><input type="checkbox"/> Edit <input type="checkbox"/> Student View <input type="checkbox"/> Copy Question <input checked="" type="checkbox"/> Remove</p>
<p><b>Answer:</b> a fake pill</p>	<p><b>Public/Private Question:</b> Public</p>
<p><b>Options:</b></p> <ul style="list-style-type: none"> <li>a fake pill</li> <li>a therapy</li> <li>a secret</li> <li>magic</li> </ul>	<p><b>Available for practice:</b> Yes</p>
	<p><b>Specifications:</b> Section A</p>

Figure 24 - View of a listening question with a YouTube video

### 6.7.2.2 Editing/Duplicating/Deleting Questions

For editing and duplicating a question, the form is pre-populated by pulling the necessary values from the database. In the case of edit, the values in the database are updated with an UPDATE query, and in the case of a duplicate, a new question is created and inserted into the database. Validation code has been implemented to check for exact duplicate questions being entered into the database. For all question types except the multiple choice question, there are 2 or more tables involved. For example, for the reading question, there can be multiple choice subquestions that are linked back to the reading question. Therefore, when deleting a reading question, the multiple choice subquestions have to be deleted first, followed by the reading question and the main question. Similar steps are taken when deleting listening and fill-in-the-blanks questions. Deleting a question also requires that all the entries in the *student\_question* table (that specify which questions are specified to a student) with that question ID are also deleted because the question will no longer be available to any student. There are no permissions related to deleting questions, and users may delete questions by other users if they are incorrect or misleading.

### 6.7.2.3 Filtering Questions

Teachers can view questions based on filters such as primary category, type of question and date added. The functionality for search is carried out by querying the database based on the filters. The view for the search page is shown in Figure 25.

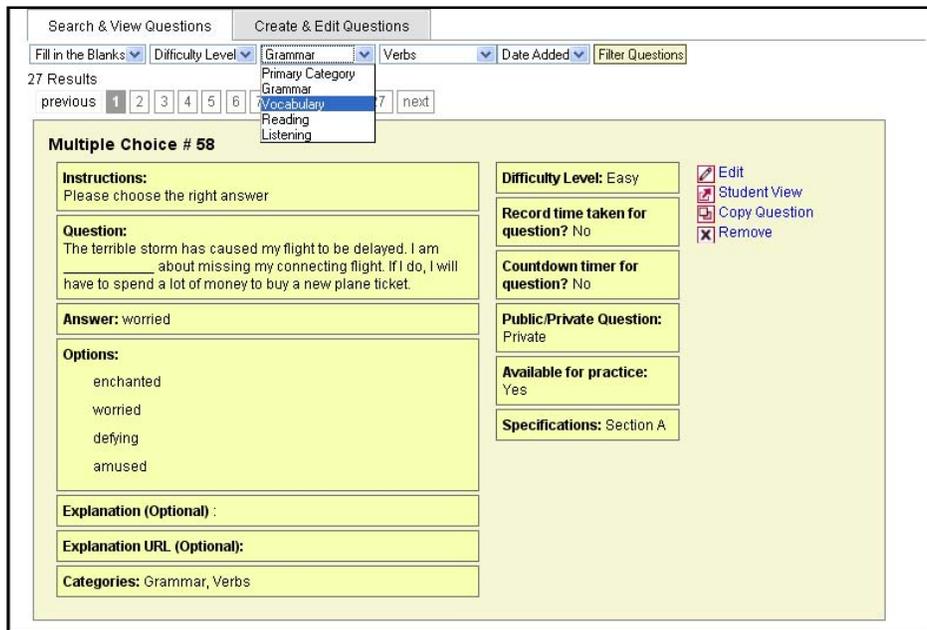


Figure 25 - View for the search page

### 6.7.3 Practice Mode

The practice mode allows students to exercise their skills, obtain automatic feedback, and receive scores on their responses.

On the ‘Student Dashboard’, students choose the category of questions they want to practice – Grammar, Vocabulary, Reading and Listening. They also have an option of practicing “All Types”, which is the mixed mode that selects questions from all categories. For whichever mode is chosen, a student gets questions from the *student\_question* table that match the student ID (which is the ID of the student that is currently logged in) and the criteria of the category selected.

#### 6.7.3.1 Student View and Feedback

All of the question types have a unique student view to allow for capturing the student’s input and providing audio-visual feedback for the answer provided. Every question type provides visual feedback for the right and wrong answer, and audio feedback that are executed via Javascript with sounds that indicate success and failure. An important feature of the student view is the score counter that displays the cumulative session score for the student, i.e. the number of questions answered correctly in that practice session. Also, every question type has a “Next” button that is displayed after the student’s answer is processed and its function is to lead the student to the next question. The views and feedback system used for the different question types are discussed below.

## Multiple Choice Question

**Multiple Choice Question**

**Instructions:** Please choose the right answer **Question # 4 of 5 Total**

4 . The teacher \_\_\_\_\_ all the worksheets last night.

**A** must have graded

**B** must have been grading

**C** must grade

**D** must have grading

**SCORE**  
2

Figure 26 - Student view of multiple choice questions

For Multiple Choice Questions, the question and the answer options are displayed to the student (as shown in Figure 26). A hidden radio form is used to record the answer provided by the student, which is immediately evaluated. If the answer provided is correct, a green tick is displayed next to the answer option to indicate that as the right answer. If the answer provided is incorrect, a red cross is displayed next to the answer option that the student selected and a green tick is displayed next to the correct answer. The score counter gets incremented by 1 for every correct answer provided by the student. The green tick, red cross, and score counter are the visual feedback that the student receives for their response. There is also corresponding audio feedback for the right and wrong answers. Correct answers emit a pleasant high-pitched sound, while wrong answers emit a shorter sound of low tone. These sounds were chosen because they were similar to the kinds of sounds made in desktop applications that students will later use throughout their AUW studies. Additionally, an explanation for the question pops up if the teacher has specified a text explanation or URL. This explanation appears whether the answer is correct or incorrect. After the student has recorded their answer and the feedback is received, the “Next” button is displayed (as shown in Figure 27). When the student clicks on “Next”, the score and answer is stored in the database and the next question is displayed on screen.

**Multiple Choice Question**

**Instructions:** Please choose the right answer **Question # 4 of 5 Total**

4 . The teacher \_\_\_\_\_ all the worksheets last night.

**A** must have graded

**B** must have been grading

**C** must grade

**D** must have grading

**SCORE**  
2

Explanation: Key phrase "last night."

**NEXT** ►

Figure 27 - Feedback on multiple choice questions

Fill in the Blanks Question

**Fill in the Blank Question**

**Instructions:** Fill in the Blanks **Question # 2 of 28 Total**

2 . I am  going to  in  market.

**SCORE**  
0

**CHECK**

Figure 28 - Student view of a Fill in the Blanks question

Fill in the blanks questions are displayed to the student as a passage with a series of inputs (or blanks) embedded within the text. The instructions will prompt a student to either type text into an input text box or select the correct answer from a drop down list (as shown in Figure 28). After the student selects or inserts text into each of the blanks she can click the “Check” button to receive feedback. Each blank is treated as a subquestion of the fill in the blanks question, and there are multiple subquestions appearing in the view for the fill in the blanks question. Because a student may get some but not all of the questions correct, audio feedback was disabled on this question type. Clicking on “check” prompts an evaluation of all the answer inputs; each blank that is answered correctly gets a green border, whereas each blank that is answered incorrectly gets a red border, as demonstrated in Figure 29. The score counter gets incremented by the total number of blanks filled in correctly. After the student has recorded her answers and received the feedback, the “Next” button is displayed. When the student clicks on “Next”, the score and answer is stored in the database and the next question is displayed on screen.

**Fill in the Blank Question**

**Instructions:** Fill in the Blanks

**Question # 2 of 28 Total**

**SCORE**  
1

2. I  going to  market.

Figure 29 - Feedback for Fill in the Blanks question

Reading Question

The reading question is split into as many screens as there are subquestions. In each of the screens, the passage is displayed along with one subquestion (which is in the format of a multiple choice question). After reading the passage, the student answers the multiple choice question as described earlier and receives immediate visual and audio feedback. Since reading passages can be quite long, it was decided to have only one question per page for the sake of visual consistency and reading comfort. When the student clicks on “Next”, the next subquestion for the same reading passage is displayed. When the last subquestion for that passage is answered, clicking “Next” displays the next question. The student view for a reading question is shown in Figure 30.

**Reading Passage Question**

*Question #2 of 3 for this reading passage.*

**Instructions:**

**Question # 2 of 4 Total**

**SCORE**  
2

The victory of the small Greek democracy of Athens over the mighty Persian empire in 490 B. C. is one of the most famous events in history. Darius, king of the Persian empire, was furious because Athens had interceded for the other Greek city-states in revolt against Persian domination. In anger the king sent an enormous army to defeat Athens. He thought it would take drastic steps to pacify the rebellious part of the empire. Persia was ruled by one man. In Athens, however, all citizens helped to rule. Ennobled by this participation, Athenians were prepared to die for their city-state. Perhaps this was the secret of the remarkable victory at Marathon, which freed them from Persian rule. On their way to Marathon, the Persians tried to fool some Greek city-states by claiming to have come in peace. The frightened citizens of Delos refused to believe this. Not wanting to abet the conquest of Greece, they fled from their city and did not return until the Persians had left. They were wise, for the Persians next conquered the city of Etria and captured its people. Tiny Athens stood alone against Persia. The Athenian people went to their sanctuaries. There they prayed for deliverance. They asked their gods to expedite their victory. The Athenians refurbished their weapons and moved to the plain of Marathon, where their little band would meet the Persians. At the last moment, soldiers from Plataea reinforced the Athenian troops. The Athenian army attacked, and Greek citizens fought bravely. The power of the mighty Persians was offset by the love that the Athenians had for their city. Athenians defeated the Persians in archery and hand combat. Greek soldiers seized Persian ships and burned them, and the Persians fled in terror. Herodotus, a famous historian, reports that 6400 Persians died, compared with only 192 Athenians

2. Darius took drastic steps to \_\_\_ the rebellious Athenians.

A weaken

B destroy

C calm

D placate

Figure 30 - Student view for a reading question

## Listening Question

The listening question is similar to the reading question in that it is split into as many screens as there are subquestions. Instead of a passage, the students are asked to listen to a passage either in the form of a YouTube video or an audio file recorded by the teacher. After listening to the passage, the student answers the multiple choice question and receives immediate visual and audio feedback as mentioned earlier. Similarly, the “Next” button leads the student to the next subquestion for the listening passage and after the last subquestion is answered, it displays the next question. The student view for a listening question with an audio file is shown in [Figure 31](#), and with a video file is shown in [Figure 32](#).

### Listening Passage Question

Question #1 of 3 for this listening passage.

**Instructions:** Read the poem by Emily Dickinson and answer the questions.

Question # 1 of 1 Total

SCORE  
0



1 . Who is Emily Dickinson writing to?

- A The world
- B The news
- C Nature
- D Her hands

Figure 31 - View of a listening question with an audio passage

**Listening Passage Question**

Question #1 of 2 for this listening passage.

**Instructions:** Watch Eric Mead's TED video and answer the following questions.

**Question # 2 of 3 Total**

**SCORE**  
0

2. What is the best definition for the word placebo

- A a fake pill
- B a therapy
- C a secret
- D magic

Figure 32 - View of a listening question with an embedded YouTube video

### 6.7.3.2 Scoring

For each question or subquestion that the student attempts, the *student\_progress* table (described in

Table 14) is populated with the appropriate values after checking the answer provided by the student. The ID's of the question and subquestion, the answer provided and the category of the question is saved along with the answer provided by the student and an indication of whether it was right or wrong. In the long term usage of the tool, querying this table will allow the application to analyze different metrics on what categories students find most difficult, the most common mistakes made by students, the number of times a particular question was attempted and so on (See 6.10 for more details).

Field	Type	Description
<b>Id</b>	INT	Row ID
<b>st_id</b>	INT	Student ID
<b>qs_id</b>	INT	Question ID
<b>subqs_id</b>	INT	Sub Question ID
<b>qs_type</b>	VARCHAR	Question Type – Grammar, Vocabulary, Reading or Listening
<b>Is_right</b>	INT	Did the student get the answer right?
<b>ans_provided</b>	VARCHAR	Answer provided by the student
<b>date_answered</b>	DATETIME	Date the question was answered on

Table 14 - Description of the *student\_progress* component of the database

Additionally, when the student completes the practice mode, the score recorded in the score counter also gets saved in the *student\_scores* table. The needs assessment process revealed that students are motivated to get better grades, so students are able to see the percentage of questions they have answered correctly. The percentage is calculated by dividing the total number of right answers (obtained from the score counter) by the total number of questions attempted. Similarly, percentages are calculated for each category. For example, the grammar percentage is calculated by dividing the total number of grammar questions answered correctly by the total number of grammar questions attempted. The score and the percentages are stored in the *student\_scores* table (shown in Table 15).

Field	Type	Description
<b>id</b>	INT	Row ID
<b>St_id</b>	INT	Student ID
<b>date</b>	DATETIME	Date
<b>total_score</b>	INT	Total Score obtained in that session
<b>qs_attempted</b>	INT	Total number of questions attempted that session
<b>Percent</b>	DECIMAL	Percentage obtained
<b>grammar</b>	DECIMAL	Grammar percentage
<b>vocabulary</b>	DECIMAL	Vocabulary percentage
<b>reading</b>	DECIMAL	Reading percentage
<b>listening</b>	DECIMAL	Listening percentage

Table 15 - Description of the *student\_scores* component of the database

## 6.7.4 Evaluation

Teachers and students both expressed a desire to be able to track performance over time. The scores and percentages stored in the *student\_scores* table allow us to create a visual representation of student progress over time. This module has been implemented in both the teacher and student dashboard and is discussed below.

### 6.7.4.1 Teacher Dashboard

In the Teacher Dashboard, teachers can track the performance of all students, a particular student or a particular user group in the form of graphs. This feature was implemented by calculating the average of percentages for each date. Similar calculations were done for grammar, vocabulary, reading and listening percentages as well. These raw numbers are converted to graphical format using jqPlot<sup>66</sup>, a plug-in for the jQuery framework. Line graphs are created “on the fly” and show user scores (score range on the y-axis) over time (date on the x-axis). Below are more details on how this was implemented for the different subject-area categories:

#### Tracking Progress of All Students

Teachers can view a visual representation of how the overall performance of all the students has improved over time. This was implemented by calculating the average of percentages of all students for each date. Figure 33 shows the progress of all students in the tool.

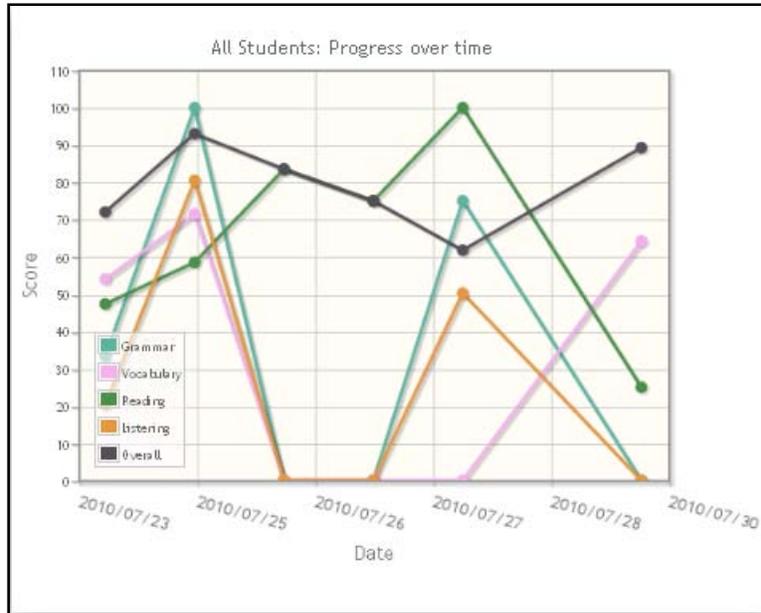


Figure 33 - Image showing the progress of all students over time

### Tracking progress of a particular student

Teachers can view a visual representation of how the performance of a particular student has improved over time. To view this information, the teacher has to fill out the form on the Teacher Dashboard and search by student's name. This brings up a graph based on the averages of percentages scored by that student over time. Figure 34 shows the progress over time for a fictional student named 'Aysha Siddique'.

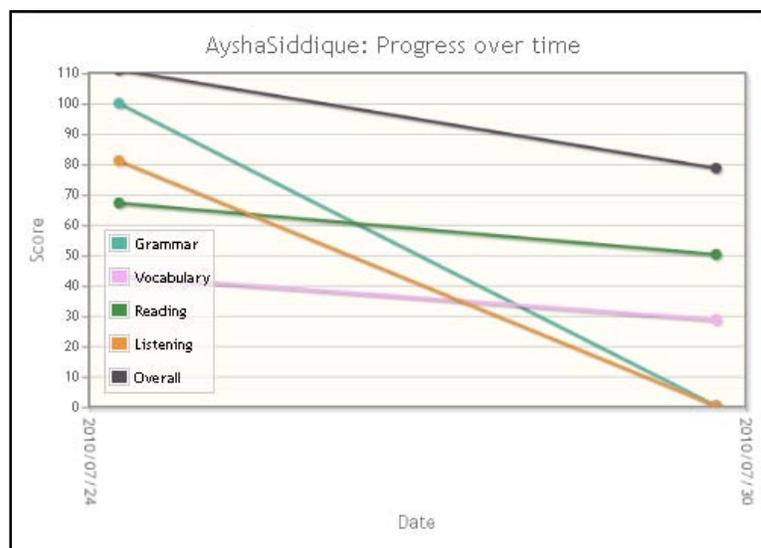


Figure 34 - Figure showing the progress of a particular student over time

## Tracking progress of a group of students

Teachers can also track the performance of a particular user group. This is helpful if the teacher wants to know how her class is doing in the grammar category. To view this information, the teacher has to specify the user group, and this brings up a graph based on the averages of percentages scored by students in that user group over time. Figure 35 graph below shows the progress over time for 'Section A'. Currently, the date range displayed shows an all-time view of student performance and the date range cannot be adjusted.

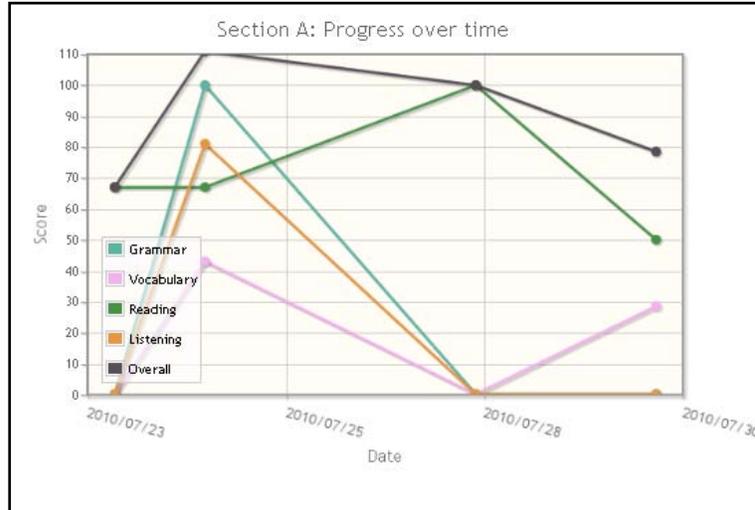


Figure 35 - Figure showing the progress of a group of students over time

The Teacher Dashboard also includes metrics on the top 5 and bottom 5 performers which are extracted from student scores. Moreover, it also includes data on the question types; the number of questions in each question type and the number of times students got questions right or wrong for each question type. This can help the teacher figure out what the students are most comfortable with and what they find challenging.

### 6.7.4.2 Student Dashboard

In the Student Dashboard, students can view a similar graph of their overall progress and progress in each category (as shown in **Error! Reference source not found.**). This can help students evaluate their strengths and weaknesses so they can focus their time and effort on particular categories.

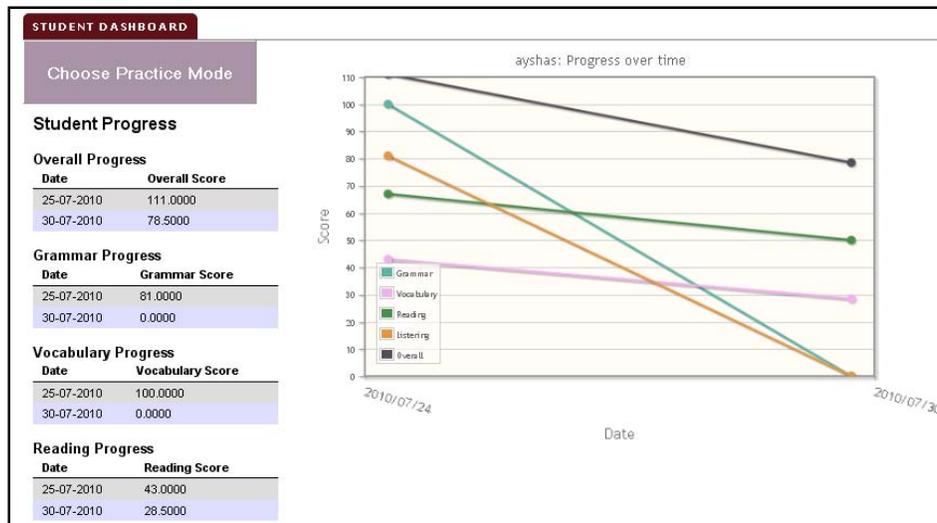


Figure 36 - Tracking progress view from Student Dashboard

The development of these modules was done iteratively so as to allow for initial testing with students and teachers who were available for testing during a limited period of time. The testing section below describes the iterative testing process and how that further influenced the development process.

## 6.8 Monitoring & Evaluation Process

### 6.8.1 Iterative Testing

Iterative testing was conducted with both teachers and students to inform the development process of the tool. During this phase of the project, the team faced a short time frame to conduct testing sessions, due to the internship program's schedule, and other challenges such as final exams and other end of the year preparations.

For the iterative testing sessions with students, the team aimed to maintain a participation level of at least 40 students from various class levels. The team expected participation to fluctuate from the needs assessment phase, especially due to the fact that iterative testing occurred in the week before and during final exams. However, these challenges proved greater than anticipated and the team was only able to interview and observe 19 students for the iterative process. While this was a reduced pool of students, the tool will ideally be deployed over the long term so the reduced amount of information collected during this phase will be balanced out through long term data collection and technology refinement.



**Figure 37 - An AYW intern facilitates an interview with an Access Academy student tester**

The iterative testing process for students began with an email communication sent from the team to all Access Academy students, via Program Director, Ms. Kathy Schneider, updating them on the technology development process and informing them that they could sign up to participate in testing sessions the following week.

The first test session was held when the multiple choice mode was made available and the tool's scoring system kept count of how many of the student's answers were correct. Key feedback received from this session included a desire for the correct answer to be indicated, in addition to the answer selected, the score to delineate the number of correct answers out of the total number of questions completed, and to be able to see explanations of why a wrong answer is incorrect. The next two test sessions tested the tool with modifications to the scoring system and answer display, integrating feedback from the first session, and the introduction of the reading comprehension question type. The final iterative test sessions occurred during the tenth week of the internship program in order to test the tool's effectiveness on the AYW server and the introduction of user authentication.

For the iterative testing sessions with teachers the aim was to maintain a 60% participation level, which was met. Iterative test sessions with teachers took place in the last 10 days of the program. The key outcomes from teacher testing sessions included a desire for the question difficulty rating system to be simplified to a system such as easy, medium, and hard.

### **6.8.2 Evaluative Data Collection**

We hope that in the future, TechBridgeWorld will be able to build on the tool created this summer and to enhance its capabilities. Part of this process will ideally include long-term evaluation of the effectiveness of the tool. The hope is that the impact of the tool will be able to be monitored by AYW and TechBridgeWorld at least during the next year, if not longer. The recommendation is that evaluation be based on analysis of student progress for the incoming 2010-2011 class versus past classes.

## 6.9 Deployment and Sustainability

In order to deploy the web-based practice tool at AA and to ensure its sustainability, the TechBridgeWorld team held conversations with key stakeholders: Mr. John Jordan, who has been appointed as the Director of Access Academy for the next academic year, and Ms. Fatema Haque, who is an AA teacher and has also been promoted to the role of IT specialist. Ms. Haque, in addition to teaching reading, writing and presentation, also teaches a computer skills class in the first term in which she orients new computer users to Microsoft Office, internet research, email and other online services. She mentioned that it would be a good idea to introduce the practice tool in the Computer Skills class once they have covered the basics of computer usage. Also, our conversations with teachers during testing sessions indicated positive interest in the practice tool and a keenness to deploy this in their classes.

Discussions with the stakeholders determined that since this tool supports different question formats, it would not be limited to any particular class and can be used across AA. The tool could serve as a resource for teachers in the future and as a resource to sustain institutional memory. Therefore, there is incentive for AA teachers to use this tool and Mr. Jordan verbally committed to encouraging the integration and use of the tool in the classes at AA for the next academic year. Ms. Haque has taken the lead on maintaining content on the practice tool and coordinating any issues with the TechBridgeWorld team. This means that she will serve as the administrator for the tool. Additionally, we have set up monthly communication protocols between the key stakeholders at AA and TechBridgeWorld. The communication medium used will be email and Skype. These have been set up to allow for the AA stakeholders to contact TechBridgeWorld for any technical assistance that is external to basic maintenance.

In order to further help the integration of the tool into the curriculum and to orient the teachers with the tool, a user manual has been prepared (see Appendix, Section **Error! Reference source not found.**) that includes screenshots and detailed instructions on how to use the tool. The manual gives instructions for creating, editing, duplicating and removing questions for teachers, and explains how to add or delete users and user groups for admins. It also explains how to specify a question for a specific user group and how to interpret the evaluation graphs.

Currently, the practice tool is hosted on the TechBridgeWorld server and the staff from TechBridgeWorld will be providing maintenance and technical assistance while the tool is still under development and testing. Future plans to migrate the practice tool to the AUW server will be initiated and communicated to the AUW IT staff so that TechBridgeWorld can transfer complete control of the tool over to AA and begin a longer-term evaluation of the tool's use and effectiveness.

## 6.10 Future Work

The web-based practice tool for the Access Academy is currently a functional tool that allows students to practice questions entered by their teachers and get immediate feedback on their performance. However, it is just the backbone for a very powerful tool that could be used for practice and assessment, meeting several needs of the Access Academy community. We have produced a list of recommendations for the TechBridgeWorld team that will be moving forward with this project.

**Make questions “unavailable” when deleting a user group:** Currently, when a user group gets deleted, the questions specified for that user group are made available to all user groups. However, that would not be useful if the teacher is planning on using those questions as a test for the user group. Therefore, it would be useful to mark a question as unavailable for practice if a user group is deleted.

**More Question Types:** Adding more question types such as “Drag and drop” and “Clickable words” will add value in terms of practicing grammar and vocabulary exercises.

**More Evaluation Metrics:** Adding evaluation metrics aside from percentages would make the assessment side of the tool much stronger and useful for teachers. For example, display questions that students have answered incorrectly at least five times, questions that all students have found extremely easy, figure out the most common incorrect answers provided by students, etc. These additional evaluation metrics will help the teachers understand the performance of their students much better.

**Adaptive Difficulty Level:** Currently, questions are displayed to the students in the order they appear in the database without determining the student’s level of expertise. It would be beneficial to have a component that can place students at levels based on their performance and proceed to give them questions appropriate to their knowledge level.

**TBW page for monitoring and evaluation:** In order for TechBridgeWorld to carry out monitoring and evaluation of this project in the future, a TechBridgeWorld page can be created that will display essential statistics that are essential to be collected on a weekly, monthly and yearly basis. For example, statistics like the number of active users per week, number of questions entered per week, number of student responses per week, etc. would be really useful to know to estimate the effectiveness of the tool. This would help TechBridgeWorld carry out monitoring and evaluation without actually viewing any individual student’s scores or progress.

**Test Sets:** The use of the ELT as a testing/homework tool would be extremely valuable for the Access Academy. Currently, teachers are burdened with a lot of paperwork and grading and if the ELT project can include a “test set” of questions for homework and exams for student practice, it would significantly ease their burden. It would also be helpful for students to get faster feedback from teachers via the tool. Additionally, recording the amount of time it takes a student to answer a question or giving a countdown for answering a question would help teachers understand more about the difficulty level of a question from each student’s perspective.

**Game Component:** Adding a game component to the tool would also make it more fun and interesting for students to practice their English exercises. From the needs assessment, we gathered that students like social gaming and competing with their friends. A Facebook style ranking game could be added to make it interesting for students and increase their motivation to use the tool beyond the required assignments from teachers.

**Accessibility for the Visually Impaired:** This recommendation arose because YPSA expressed interest in making the English Literacy Tools project available for the visually impaired. Developers in the future should make sure that the features in the tool are accessible to the visually impaired

community by adding more sounds, alternate text for images, and making sure that the application is compatible with screen reading software.

**Cross-Browser Stability:** Even though the web application was originally developed for all browsers, it works best with Mozilla Firefox. We have conducted some cross-browser testing and enhancements, but further cross-browser testing may be necessary in the future.

**Migration to AUW Server:** The practice tool currently resides on the TechBridgeWorld server in Pittsburgh. This makes the application a little slower for the users at AA. We moved the practice tool to the AUW server and had users test it out for two days. The migration was easy and successful and was carried out as a proof of concept to determine if the AUW server could support such a tool in the future. TechBridgeWorld will continue with developing and testing the tool, and once a stable version is available for release, TechBridgeWorld will communicate with AUW and migrate the practice tool to the AUW server.

## 7 Projects with YPSA

### 7.1 BWT Needs Assessment

The needs assessment work with YPSA was a collaborative and dynamic process. YPSA reached out to their social and professional networks in order to involve a wide audience in the needs assessment process. The A UW interns not only translated interviews, but helped draft interview scripts, reviewed materials for ease of translation and clarity, and collected data during all interview sessions. Their expertise was an invaluable resource that significantly contributed to the success of the needs assessment process.



Figure 38 - iSTEP Interns, A UW Interns,

Work with YPSA began during the first week in Chittagong. The needs assessment process began with an initial introductory meeting with YPSA, followed by several group interview sessions with YPSA staff and volunteers, beginner and advanced braille learners, and braille issue experts. The needs assessment team developed interview question scripts to gain an overall understanding of YPSA and its partners, what types of assistive technologies are used by visually impaired individuals in Bangladesh, and what types of assistive devices might be helpful for community members served by YPSA.

The team held an information gathering session with Mr. Vashkar Bhattacharya, volunteers and staff members affiliated with the IRC D program, and issue experts affiliated with YPSA. This group interview focused on learning more about how YPSA works with the visually impaired community in Bangladesh and with other organizations.

Following this session with assistance from YPSA, the team held an interview session with young adult braille learners (including both new learners and advanced learners) to demonstrate the BWT. During the session, participants were divided into two groups, one comprised of university students and other adults, and the second group comprised of middle and high school students. The A UW interns facilitated the conversation using previously vetted question sets to learn about their experience as visually impaired learners in Bangladesh. The team also sought feedback on the BWT, specifically ideas regarding how the BWT could be customized for use in Bangladesh or modified to meet needs the learners face.

Then YPSA arranged an additional interview session with new learners, classes 1-5 (equivalent to grades 1-5 in the American education system), at the Chittagong Government School for the Blind. The students at the school rarely receive visitors and were enthusiastic about interacting with the

team. With the help of the AUW interns, the team demonstrated the BWT and learned about their favorite animals (for possible implementation in the BWT sounds game) as well as which subjects they study in school and what they like or find challenging about learning braille.

## **7.2 Needs Assessment Data Analysis**

### **7.2.1 Community Needs**

The information collected through the needs assessment process was analyzed using methods similar to those used with the English literacy tools project. Data was sorted by question and by interview session to allow for text mining and multiple peer review. The needs identified through the analysis varied depending on the age of the audience. One desire expressed was for technology that is accessible to the visually impaired in Bangladesh in the primary language Bangla. The process also identified two primary communities that could be impacted by this project – YPSA and the Chittagong Government School for the Blind.

Since a braille cell for a character or letter consists of six embossed dots, new learners from all age groups noted that recognizing such dots was challenging. Moreover, learners expressed that it could be challenging to recognize which dot within the cell they were using. They also noted that recognizing dot placement from cell to cell could be difficult, as braille cells on a traditional slate for writing braille are very close together. Therefore for Braille learners, it can be confusing to keep track of which cell they are using in addition to which dot they are using. New learners also emphasized that one of the greatest challenges they faced was the amount of time it takes to memorize braille. On the other hand, young adult learners noted that their priority was to learn how to use computers since colleges do not provide braille textbooks nor do they accept papers written in Braille. Thus learning braille was not a priority for this group.

Like new learners from all age groups, advanced learners noted that one of the most challenging aspects of learning braille is the time to memorize it and the difficulty of telling the cells apart when writing. While advanced learners were receptive to the tutor demonstration, they suggested that it would be helpful to have access to audio Bangla books since the current resources available through YPSA were only available in English.

In speaking with issue experts, the challenge of memorization was reiterated. They also emphasized the need for Bangla language tools for the visually impaired community in the country. The team learned from the issue experts that Bangla braille differs from English braille because it has multi-cell characters. When these characters are not appropriately identified, or demarcated, meanings change. Therefore any solution involving the writing of Bangla braille would need to account for the multi-cell nature of the language. Furthermore, the issue experts noted that it would be helpful to have audio Bangla books or resources for learners of all ages since braille printed resources are often scarce. The issue experts also suggested Bangla audio instructions for the BWT. They were particularly interested in a standalone version of the tutor because of a lack of computers and because of regular power failures in the community. Moreover they suggested the development of a sentence writing mode and a basic math mode (basic calculator functions) for the tutor.

During the needs assessment process, constituents requested for other projects to be evaluated as potential outcomes over the ten-weeks. The team evaluated Bangla Text-to-Speech software and audio calculators but considered the projects outside the scope of the ten-week internship (see 7.3.3 Other Related Work section).

#### **7.2.1.1 Recommendations for Projects with YPSA**

Based on the needs assessment, the team selected multiple solutions that could best meet the needs of community members. For the primary component, the team recommended modifying the BWT to support Bangla braille and to include Bangla audio instruction. The team also recommended updating the animal sounds game on the tutor to include culturally relevant animal sounds and to update other modes as appropriate. Also the team suggested creating a Bangla-language update to the DAISY software that YPSA could utilize to create audio books from print resources that could be used by visually impaired learners as well as the illiterate. This proposal would enable advanced learners to access important information, such as college text books, thereby helping to meet needs not addressed by the BWT.

#### **7.2.2 Challenges and Considerations**

The needs assessment process identified challenges the communities face on a daily basis. Power failures were a significant issue for anyone living in Bangladesh. When rolling blackouts were initiated, any organization or school without back-up power supplies (which includes YPSA and the Government School for the Blind) was unable to operate any resources requiring power from the grid. Additionally, the Government School for the Blind had only three computers – two for administrative purposes and one that was student-accessible and operated in the DOS environment. All of which were totally reliant on power availability. A final consideration was resources available to YPSA and the Government School for the Blind. The School was understaffed and lacks sufficient facilities and financial resources. The Government School for the Blind was designed to house and teach 15 students. However, the School had 37 pupils and had only two teachers. Furthermore the School was dependent upon external donations in order to meet its financial obligations.

### **7.3 Related Work**

#### **7.3.1 DAISY Materials and AMIS**

DAISY or Digital Accessible Information System is a series of projects and standards for digital talking books designed to increase accessibility through the use of audio technology.<sup>67</sup> The DAISY flagship project establishes a standard for digital talking books supporting the navigation and playback of audio books.

To increase access to DAISY audio books, the DAISY consortium developed the AMIS software. Adaptive Multimedia Information System (AMIS) is an open-source DAISY audio book reader that supports advanced audio book navigation. The tool highlights words as they are read.<sup>68</sup> This interface allows the audio books to be navigated very quickly by visually impaired users and

helps low literacy users improve their reading ability as they see the words that are being read aloud. Additionally, AMIS supports multiple languages including English, Chinese, and French.<sup>69</sup> Through the usage of DAISY and AMIS, YPSA has amassed a wealth of resources and made them available to users through their ICT and Resource Centers for the Disabled as part of a three-year plan that is currently being developed in Bangladesh.<sup>70</sup>

### 7.3.2 Braille Writing Tutor

In Spring 2006, two Ph.D. students at the Carnegie Mellon Robotics Institute began working on a project to assist with braille education. Through TechBridgeWorld's V-Unit program, Nidhi Kalra and Tom Lauwers developed the Adaptive Braille Writing Tutor

as a means of addressing illiteracy issues in visually impaired communities throughout the developing world. Kalra and Lauwers wanted to create a tutor that taught students to write braille. By providing audio feedback, the tutor could encourage students to improve their braille writing skills through lessons and game modes. The tutor was designed to simulate a slate and stylus, the equivalent of a pen and paper for writing braille. Braille writers place a paper inside of a plastic or metal slate, which separates the paper into braille cells, and the stylus is used to imprint individual cells. Driven to make a low-cost, low-power tutor that mimicked the feel of a slate and stylus, Kalra and Lauwers created the first iteration of the Braille Writing Tutor (BWT).<sup>71</sup> It was first deployed at the Mathru School for the Blind.

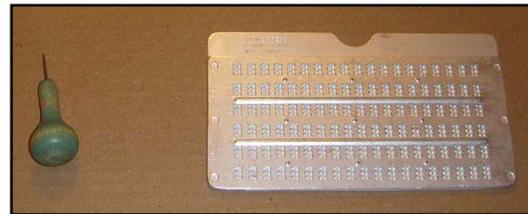


Figure 39 - Slate and Stylus (Source: Wikipedia)

With the success of the tutor at the Mathru School, TechBridgeWorld began to incorporate feedback from an ongoing series of studies primarily led by Nidhi Kalra, Tom Lauwers, Tom Stepleton, Daniel Dewey, Imran Fanaswala, and Freddie Dias.

The Braille Writing Tutor Version 2 consists of a square electronic slate.<sup>72</sup> This electronic slate is made up of 2 rows of 32 braille cells with 16 cells per row designed to emulate the experience of using a traditional slate and stylus. Users may use any stylus that can properly penetrate the holes and connect the two boards that make up the slate portion of the tutor. In addition, the BWT has six buttons in the center of the device representing a large braille cell for younger learners. Additionally there is a button on each side of this large cell for confirmation and to navigate through the different modes of the tutor.



Figure 40 - Version 2 of the Adaptive Braille Writing Tutor

The BWT software is written in C++. The current version of the software contains support for multiple languages including English, French, Arabic, Swahili, and Chinese. Further, the tutor is often initialized with sound files that are recorded in a local accent to maximize understandability for local users. The software version last modified in Tanzania has 12 modes for the tutor that

includes modes to learn dots, letters, and numbers as well as games to practice writing simple words.

### 7.3.3 Other Related Work

The BWT is unique in that it is an inexpensive tool that teaches visually impaired users to write braille as if using a slate and stylus. Other tools such as the Talking Tactile Tablet (retail \$699.00)<sup>73</sup> or the Talking Braille Tutor (retail \$295.00)<sup>74</sup> are also appropriate for visually impaired learners but are usually cost-prohibitive for users in developing communities.

Learning to write braille using an automated tutor is a novel application in Bangladesh and implementing the BWT with community partners in Chittagong was a unique opportunity. While researchers have proposed patterns and algorithms to develop a Bangla Braille Information System<sup>75</sup>, no research on the use of teaching Bangla braille writing with an automated tutor was found. Still, some institutions have implemented technologies that assist the visually impaired community in Bangladesh. The organization Webel Mediatronics Limited has installed four computer-based braille-training systems in Bangladesh.<sup>76</sup> Additionally, they have developed software for printing Bangla books and have a small library of Bangla braille books available by request.

At one point an audio calculator was proposed but screen reading compatible calculators are widely available online and buying or building a stand-alone audio calculator was financially infeasible.<sup>77</sup> Additionally, BRAC University has been developing Bangla Text-to-Speech software although it is still being developed and is outside of the scope for the iSTEP ten-week internship.<sup>78</sup>

## 7.4 Solution Overview

Based on the recommendations from needs assessment, the team decided to work on two projects with YPSA, assisting with a Bangla translation for AMIS and modifying the BWT to include Bangla braille.

The DAISY website included an easy to follow step-by-step process for adding a language translation to AMIS. To accomplish this, the team emailed the AMIS development team and received permission to continue a previously started Bangla translation. The A UW interns conducted the translation while the team helped ensure they had all of the technical materials and resources to complete the translation.

For the BWT, the younger learners at the Government School for the Blind provided an excellent potential audience. Moreover, the implementation of the Bangla language on the BWT would be especially beneficial when a stand-alone version of the BWT is released. The A UW interns facilitated the translation of text and audio as necessary for the BWT as well as helped clarify specifics of the Bangla language. The BWT had never been translated for a language that must interpret two cells as a single character. In Bangla, there are two such characters, “ri” and “khônḍo tô.” The BWT had to be adapted to recognize whether or not the letter being written was part of a two celled character. Additionally, there is the issue where a consonant followed by a vowel changes the vowel to a shorter

form. Ten of the eleven Bangla vowels have this short form. Thus the tutor needed to ensure that the correct short and long vowel sounds are used when spelling out words.

The tutor had previously only been translated to languages in which the linguistic structure of a sentence was formatted in the subject-verb-object order. However, Bangla is a subject-object-verb language. When working in modes like learning letters, the tutor would say “To write the letter: ri,” but in Bangla the tutor should actually say “ri, to write the letter.” Addressing these issues was critical to the development of a BWT that would be relevant in Bangladesh.

## 7.5 Technical Development

### 7.5.1 DAISY AMIS Software

The AMIS website included an easy to follow step-by-step process for language translation. First, the repository was checked for the Bangla translation previously started and permission was sought to access the DAISY LION database.<sup>79</sup>

After receiving permission the team was able to access the database where the current state of translations is stored.

<p>Not available</p>	<p>Enter the translation below. Remember to <b>Save</b>.</p> <p>পড়ুন, যা হচ্ছে না</p> <p>Remarks from you:</p> <p>1288</p>	<p><a href="#">Audio (click to play)</a></p> <p>Choose an MP3 file:</p> <p>Choose File No file chosen</p>	<p>Status:</p> <p>OK</p> <p>TODO</p>	<p>Save</p>
<p>This folder can not be created. Please double check.</p>	<p>Enter the translation below. Remember to <b>Save</b>.</p> <p>এই ফোল্ডারটি তৈরি হচ্ছে না। নম, এ করে আবার যাচাই করুন।</p> <p>Remarks from you:</p> <p>1287</p>	<p><a href="#">Audio (click to play)</a></p> <p>Choose an MP3 file:</p> <p>Choose File No file chosen</p>	<p>Status:</p> <p>OK</p> <p>TODO</p>	<p>Save</p>

Figure 41 - Updating the LION Database

The LION database lists phrases in English and asks users to write translations in a box as well as to include an audio recording. The text will replace all of the message boxes and menus so that users can read all of the phrases in their own language and then audio files are used so that visually impaired or low literacy users can also hear all dialog boxes and instructions utilized. When each item is finished, the status is updated from TODO to OK (Figure 41). Beyond translating dialog boxes, the LION database also invites users to set new shortcut keys that make sense for the local language. For example, Ctrl+O is open for most English software but this may not make sense in a language where “open” does not begin with an O sound.

AUW interns Shumana Chowdhury and Lutfun Nahar translated all the text into Bangla. The team requested approval from Mr. Vashkar Bhattacharya for all of the translations. Vashkar has significant experience with AMIS and is able to approve correct translations that do not have a clear corollary in Bangla. As part of the process, the team worked with the AUW interns to install the Python<sup>80</sup>, UltraEdit<sup>81</sup>, and Visual C++ Express<sup>82</sup> software components that were necessary for the compilation process. The team also worked to ensure the partners understood the remaining steps of the process so they would know how to complete the translation after the iSTEP team left. These resources were also provided to YPSA, including installation instructions for the software in case the current AUW interns became unavailable in the future.

### 7.5.2 Braille Writing Tutor Translations

The many translations of the BWT to other languages proved to be a great asset but there were several software changes necessary to add the Bangla translation. As previously noted, Bangla presented new challenges that separated it from other languages that have been previously implemented. As a result, it was important to keep in mind what adjustments were necessary for addressing these new issues that Bangla presented while also retaining backwards compatibility for languages previously implemented. For translations of phrases and module names, Shumana and Lutfun performed the initial translating that was later evaluated by YPSA project administrators. Shumana also assisted by recording new Bangla narrations for the Braille Tutor that were tested during the internship.

### 7.5.3 Two-Cell Letter Problem

The BWT's library contained only languages in which all letters could be written with only one cell. As can be seen in Figure 42, "ri" and "khônḍo tô" both require two cells to write and posed problems for this version of the software. Thus the tutor was modified to handle two-cell characters while still retaining backwards compatibility with English and other language modes where two cell letters do not exist.

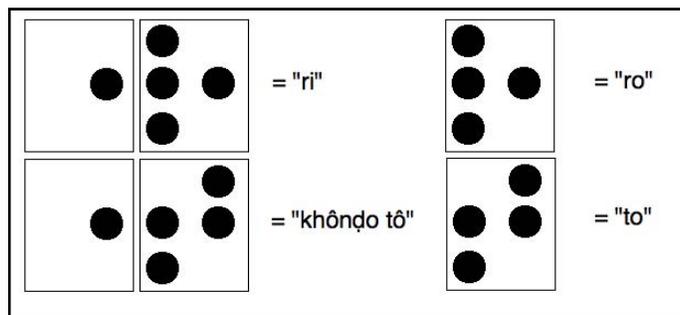


Figure 42 - Mappings in Bangla Braille

The initial software mapping of the Bangla characters to braille cells excluded the two-cell Bangla letters "ri" and "khônḍo tô." In order to add "ri" and "khônḍo tô" to the BWT character set in Bangla braille, the implementation exploited the fact that they have the same first cell pattern in common (which is not a cell pattern shared with any other Bangla letter). Hence, a placeholder silent letter (the English letter A) was used in the software to represent the dot pattern for this first cell common to "ri" and "khônḍo tô" and the sound file for this letter was mapped to a half second of silence. Thus when writing "ri", the tutor will actually recognize the sequence "A ro." Likewise the sequence "A to" will be recognized when writing "khônḍo tô." Hence, the tutor

consistently checks the prior letter that was written to ensure whether it should call “ri” or “ro” (see Figure 43).

During initial testing phases, many users encountered difficulties when attempting to write “ri” or “khônḍo tô.” After completing a braille cell entry, the user presses a side button, moves to a different cell in the slate portion of the tutor, or waits a couple of seconds to receive an audio confirmation from the tutor. Thus to enter a two cell character, two confirmations are needed. During testing, some users attempted to write the second cell of a two-cell character without confirming the first cell entry. After hearing a short set of instructions, users no longer encountered difficulties but it is possible that the process is not natural for the users.

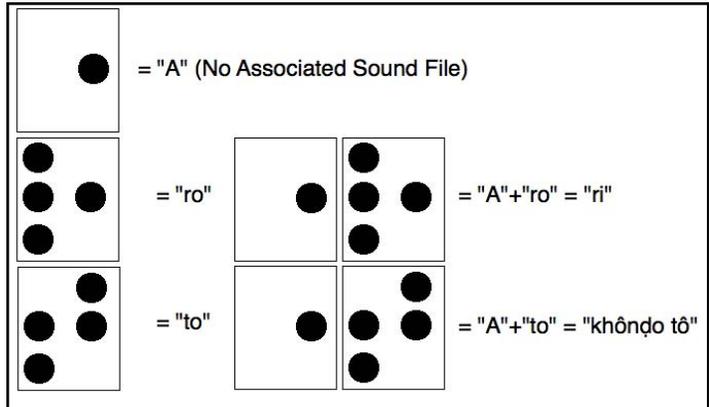


Figure 43 - Mappings in Code for Bangla Braille

#### 7.5.4 Short Form of Vowels

For pronunciation purposes, a vowel followed by a consonant requires the short form of the vowel. To avoid errant pronunciation, the word was first recorded in its entirety. After writing the letters of a word like “C-H-A-I-R” successfully, the tutor would say “CHAIR.” However, during the second iteration of testing with YPSA experts, they proposed that the tutor spell out the characters of the word with the long form of the vowel when the characters were being entered. After successful completion of the word entry, the tutor would spell the word again with the short form of the vowel before pronouncing the whole word. The YPSA suggestion for spelling the word was simpler to implement since it maintained the modular nature of the BWT code. However, pronouncing the entire word could introduce technical issues in the future if memory constraints become critical as the number of sound files that are only used once increases.

#### 7.5.5 The Sentence Structure Problem

Bangla is a subject-object-verb language while the tutor had previously only been translated to languages in which the linguistic structure of a sentence was formatted in the subject-verb-object order. This issue of sentence structure was a fairly simple fix due to the modular nature of the BWT code. All modes of the BWT are initiated via a function by passing language specific information as parameters, such as passing the alphabet and word lists as parameters to the function for initiating the games. To solve the sentence structure problem an additional flag parameter was passed to the mode. This flag signified whether the language was subject-object-verb or subject-verb-object. Anytime a relevant sequence of sound files were to be called, the code runs a check on the sentence structure and calls the sound files in the relevant order.

### **7.5.6 Addressing Cultural Relevance in the Animal Game**

Cultural relevance is important when customizing a tool for a particular audience. For example, many animals in the Animal Game were not common to Bangladesh and many of the common animals that were already recorded sounded unfamiliar to test audiences. In particular, the pig sound caused confusion for many users. As a result, the team with the AUW interns searched for open source and Creative Commons licensed sound files that were more appropriate for Bangladeshi users.<sup>83</sup> Once the files were compiled, the AUW interns made a first pass through the sound files and then the files were further trimmed by YPSA to ensure only relevant sound files were introduced into the game. Additionally, to increase the available number of words, “Animal Game” was expanded into “Sound Game” to include a wider variety of sounds common to Chittagong area of Bangladesh. The final listing of sound files included several animals: cow, tiger, crow, rooster, dog, cat, horse, goat, pigeon, duck, elephant, cuckoo, bee, and fox; a few vehicles: train, rickshaw, and ship; and a few musical instruments: flute, tabla, and harmonium.

### **7.5.7 Addressing Cultural Relevance of the Game Hangman**

Earlier versions of the BWT software included an implementation of a word guessing game called hangman. The game involved picking a random word and asking the user to guess letters in the word, with the aim of revealing the word before making 7 wrong guesses. Investigating the implementation of hangman in Bangla introduced many challenges. Some problematic issues included accented letters and combined letterforms that were difficult to address in a game where the player must guess one letter at a time. Additionally, the fact that Bangla includes 11 vowels and 39 consonants made guessing individual letters less feasible.<sup>84</sup> In testing a simulated Bangla translation, none of the tests ended with a successful game. After testing, AUW interns from Bangladesh proposed an alternative game that they played in school, in which students were given a clue and then tasked to guess a word. This was a simple modification of the Animal Game. Rather than asking for the animal that makes a sound, the tutor asked for the word that corresponded to a given clue. YPSA responded positively and assisted with modifying clues to make them easier to understand for the learners.

## **7.6 Monitoring and Evaluation for YPSA Projects**

### **7.6.1 Iterative Testing for the BWT**

Four iterative testing sessions were conducted with stakeholders and potential users for the BWT. The initial iterative testing session was held with Mr. Bhattacharya to discuss correctness of the initial Bangla language used for the tutor’s audio instructions and correctness of the Bangla braille mapping. Updates were made to the tutor based on Mr. Bhattacharya’s feedback and the second iterative testing session was held with issue experts from YPSA and its partners to test language updates and mode enhancements. The experts were able to identify instructional changes that would benefit younger users that do not understand more complex words used to provide audio instructions for certain modes, and how best to modify the content for modes such as “Animal Game” and “Learn Numbers.”

A week after the expert testing session, a session was scheduled with young learners at the Chittagong Government School for the Blind. Modifications based on the feedback from the initial testing sessions with experts allowed the team to focus this session on feedback from early learners.

### **7.6.2 Iterative Testing Data Analysis**

Data analysis for the iterative testing sessions for the BWT included text mining, transformation of qualitative data into ordinal data, multiperson observation review, and proportional analysis. These techniques were used over multiple testing sessions and led to a set of conclusions regarding user interactions with the BWT.

The key findings from our iterative testing phase indicated that the instructions for the tutor should be further refined by using informative but simple explanations that could be understood by adult learners as well as Class 1 students. The instructions in Bangla could be introduced to the software and would provide adequate context for learners. The team also observed that it took at least two interactions with the tutor for students to understand the instructions for each mode of the tutor. Because students generally did not master the tutor the first time they used it, this was an important observation to inform any training or introductory sessions conducted in the future. A final key outcome was that some of the sounds in the sound game needed further revision, either in audio quality, or in the particular recording, as some of the participants were still not able to identify particular sounds. This testing indicated that further research into open source sounds or recording some sounds might be necessary.

## 8 Dissemination

Strategic information dissemination is key to the success and sustainability of the iSTEP internship. The primary objective for dissemination in iSTEP 2010 was to ensure that the outcomes of the internship were documented and convincingly conveyed through appropriate channels to relevant audiences. Central to this objective was a media plan that ensured the results and experiences of our iSTEP 2010 team were effectively and efficiently conveyed to target audiences. AUW interns were also critical to creating the media plan and they also coordinated with local media organizations and translated media documentation from English to Bangla and back.

### 8.1 Approach

Prior to the internship, students from the iSTEP mini course prepared a media plan to engage members of relevant audiences through the use of traditional and new media channels. The team consolidated separate versions of the media plans to form a comprehensive and detailed media plan that defined the major marketing objectives of the iSTEP 2010 internship, identified key audiences, and described utilization of different media channels. The plan ensured that the projects received coverage throughout the entire cycle of the internship – pre-internship, during the internship, and post-internship, allowing the team to tell a complete story of its work to interested parties.

In communicating the iSTEP 2010 story, several audiences are targeted. In doing so, the larger objective was not only to spread awareness and inform the audiences about iSTEP and TechBridgeWorld’s initiatives, but to increase consciousness of the ICTD field. The messaging and communication strategies utilized traditional news sources and social media channels, and were adjusted according to stages of the internship to heighten effectiveness.

#### 8.1.1 Communication Objectives

The key objectives of the dissemination activities were to:

- Generate interest and increase awareness for the iSTEP internship program and TechBridgeWorld in the Carnegie Mellon community, as well as national (United States and Qatar) and international communities.
- Promote and disseminate the outcomes of the iSTEP 2010 internship to appropriate audiences.
- Encourage funding from sponsors for future iSTEP internships.

#### 8.1.2 Target Audiences

Given these objectives, the media plan sought to inform the following primary audiences:

- Current Carnegie Mellon students at both the Pittsburgh and Doha campuses
- Carnegie Mellon administrators, faculty, and staff at both the Pittsburgh and Doha campuses
- Carnegie Mellon alumni
- Current TechBridgeWorld partners

- Potential partners for future iSTEP internships
- Current TechBridgeWorld sponsors
- Potential sponsors for future iSTEP internships
- Media

As a result of targeting the above primary audiences, the team anticipated the following secondary audiences would come to learn about iSTEP and TechBridgeWorld:

- Researchers in the field of ICTD
- General audience
- iSTEP interns’ families and friends

## 8.2 Social Media Channels

Given the ubiquity of the internet and the growing popularity of social media, the team created a website where people can learn more about the internship, team, and projects. The website (Figure 44) primarily served as the destination point for detailed information about the team’s work and personal experiences, while also serving as a hub to redirect viewers to other social media channels including Facebook (<http://www.facebook.com/pages/iSTEP-TechBridgeWorld/123818270976051>), Twitter ([http://twitter.com/iSTEP\\_TBW](http://twitter.com/iSTEP_TBW)), YouTube (<http://www.youtube.com/user/iSTEPtbw>) and Flickr (<http://www.flickr.com/photos/49908379@N03/>).

The image shows a screenshot of the iSTEP 2010 website. The header features the iSTEP 2010 logo and navigation links for Blog, About, Team, Projects, Contact, and Acknowledgements. A red arrow points to a 'Social Media Outlets' box containing links for Facebook, Twitter, Flickr, and YouTube. The main content area displays a blog post titled 'Day 70: My Last Blog' by Jon, dated July 29, 2010. The post discusses the author's final day of the internship, mentioning the completion of hiring paperwork, final report sections, and the creation of presentation slides for TechBridgeWorld. It also mentions the author's role in regulating web browser usage and testing the English Literacy Tools site. The sidebar includes a Twitter feed for @iSTEP\_TBW and a list of sponsors and partners, including Yahoo! Research, Carnegie Mellon, and Asian University for Women.

Figure 44 - iSTEP 2010 website

### 8.2.1 Blog

Each iSTEP intern had an account on WordPress.com (<http://istep2010.techbridgeworld.org>) which was integrated into the iSTEP homepage (Figure 45). According to a pre-planned rotational schedule, the team wrote daily blog entries on work-related topics and personal experiences.

The team blogged daily, collectively posting 73 blog entries during the internship, with each entry highlighting key learning points of the day. The purpose of maintaining the blog was to share insights on the work and daily life with readers. The blog allowed the team to connect with people at a personal level whether the perspective came from the lab in Pittsburgh or from the field in Bangladesh. The blog entries received a total of 49 comments over the duration of the internship, mostly from friends, family, advisors, advocates and sponsors. The entries also received multiple Facebook “Likes.”



Figure 45 - iSTEP 2010 blog integrated into website's homepage

### 8.2.2 Facebook

The team also launched a Facebook page, which built on the existing member base formed during iSTEP's inaugural year in 2009 (Figure 46). This Facebook page allowed the team to stay in touch with past members of the 2009 Facebook page, connect with new people, and update friends and followers about the work.



Figure 46 - iSTEP 2010 Facebook page

At the end of the iSTEP internship, the Facebook page had 261 fans, ranging from Carnegie Mellon faculty, deans and students, to friends and family of the iSTEP team. From the data collected, it was evident that the highest number of interactions received per post was when pictures, videos and exciting news updates – such as publications in the local Bangladeshi newspaper – were posted on our wall. Additionally, the top five countries viewing our page were from the United States (33.46%), Bangladesh (29.74%), Qatar (9.29%), United Kingdom (4.09%) and Sri Lanka (2.60%).

### 8.2.3 Twitter

The team utilized Twitter as a fast and focused way of sharing information and connecting with people who share similar interests. The team also utilized “tweets” as a news aggregator to quickly and succinctly communicate to the team’s followers<sup>85</sup>. The team tweeted relevant updates including project updates, and links (in shortened form) to photos, blog entries, and relevant news related to the work being done in Chittagong. The Twitter page, which was created by the iSTEP 2009 intern team, was redesigned to fit in with the iSTEP 2010 website look and feel (Figure 47).



Figure 47 - iSTEP 2010 Twitter page

At the conclusion of the internship, the iSTEP Twitter page had received a total of 79 followers.

### 8.2.4 YouTube

The team also used YouTube as another way to feature its experiences in Chittagong. Using a camcorder, several members of the iSTEP 2010 and AUW teams were interviewed for project and personal updates. The team also recorded a variety of activities such as site visits free time activities (Figure 48).



Figure 48 - YouTube video of Anthony dancing to a Bollywood song during an informal event

## 8.2.5 Flickr

Photos taken throughout the internship were uploaded to Flickr. These photos showed interactions with local communities, discussions with community partners, and free time activities. The iSTEP 2010 website featured a photolog which referenced images from the Flickr page (Figure 49).

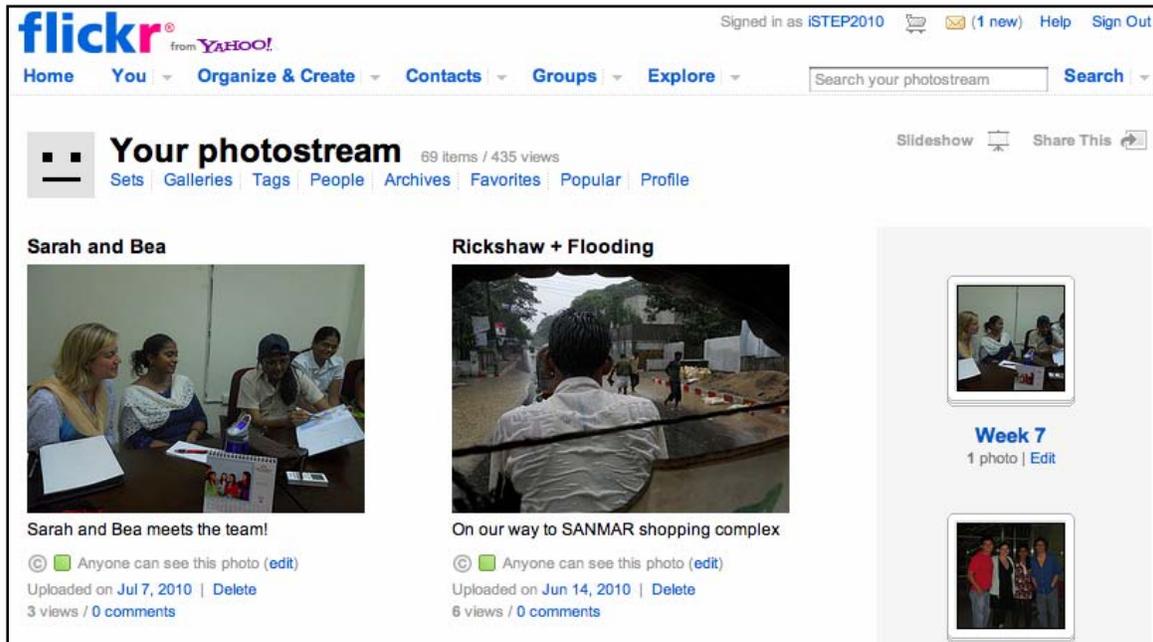


Figure 49 - iSTEP 2010 Flickr page

## 8.3 Traditional Media Channels

Apart from updating the iSTEP 2010 website and various social media channels, the team sent bi-weekly e-mail updates on work progress as well as team experiences to friends and family, and to various faculty and staff members in both Pittsburgh and Doha campuses. A total of six email updates were sent out and positive feedback was received from our advisors. One example was a response from one of our documentation advisors, Chris Labash: “You guys are doing great! Love the updates in the blog!”

### 8.3.1 Newspapers

The team worked closely with Bangladeshi newspaper agencies and successfully published three articles in Bangla and two in English. Two of the newspapers were the leading national Bangla (*Prothom Alo*) and English (*The Daily Star*) newspapers. A story about the iSTEP 2010 internship was also published prior to the launch of the internship in the Gulf Times, Qatar's top-selling English daily newspaper.



Figure 50 - iSTEP published in local Chittagong newspaper Purbokon



Figure 52 - iSTEP published in local Chittagong newspaper Azadi



Figure 51 - iSTEP published on the Gulf Times website

### 8.3.2 Website

The team received coverage through Carnegie Mellon University and Carnegie Mellon University in Qatar's front pages. Specifically, Jonathan Muller's Yahoo! Fellowship award was featured on Carnegie Mellon's front page (Figure 53) and a link to our website was posted on Carnegie Mellon University in Qatar's homepage (Figure 54). The team's work was also covered on the TechBridgeWorld website as well the School of Computer Science's website.

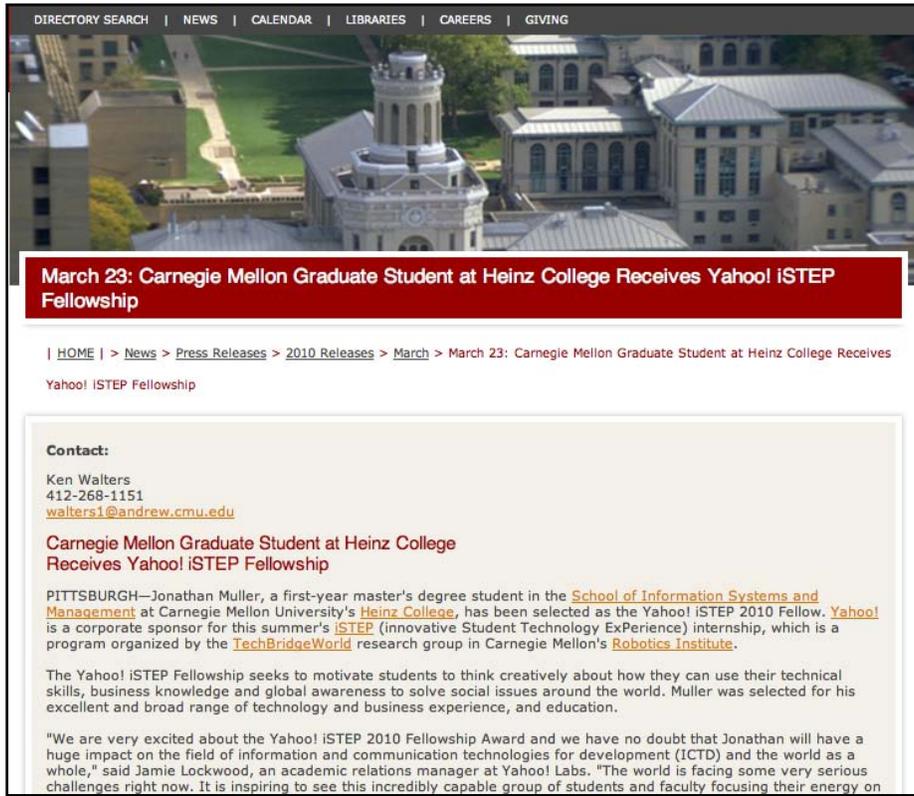


Figure 53 - Jonathan Muller Yahoo! Fellowship award featured on CMU's front page



Figure 54 - iSTEP featured on Carnegie Mellon University Qatar's homepage

### 8.3.3 Radio

The Qatar Foundation generously supports iSTEP and the team was interviewed three times by the Qatar Foundation Radio (<http://www.qfradio.org.qa/#education-tab>). These interviews took place before the team traveled to Chittagong, and twice during the first few weeks on the ground. Qatar Foundation’s radio station covered iSTEP stories periodically by interviewing members of the field team about work and personal experiences.

### 8.3.4 Presentations

The team delivered three different presentations to groups of different audiences during the course of the internship. An initial PowerPoint presentation was delivered to the Access Academy teachers as an introduction to the summer work; another was to solicit support from the student body; and the final presentation was to AUW’s senior management which covered the key learning points and experiences (Figure 57).

### 8.3.5 Popular Mediums

Facebook seemed to be the most popular medium for checking updates and driving viewers to the iSTEP website. Most followers were students from the Carnegie Mellon’s Pittsburgh and Doha campuses, indicating that we have successfully increased awareness of the program in the Carnegie Mellon community. Additionally, a community of followers in Chittagong was generated that was comprised of AUW students and staff. 63% of the Facebook fans are female, of which 39% are between the ages of 18 and 24 years old according to the key insights displayed in the chart below (Figure 55):

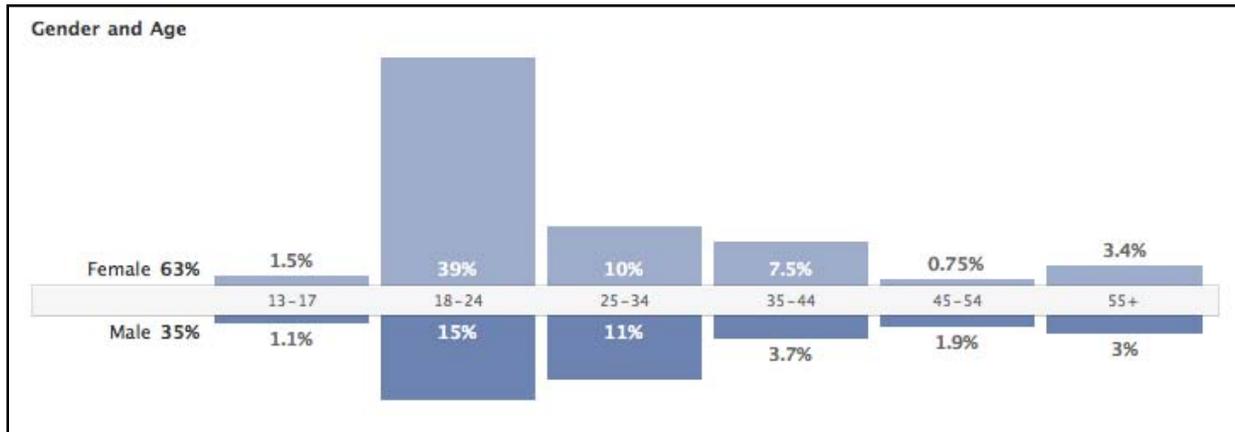


Figure 55 - Facebook analytics on Gender and Age

This outcome could be attributed to the population of female students from AUW. This community is one the team had not anticipated reaching.

## 8.4 Conclusions

Through the media plan, the team effectively reached all identified media outlets and updated content periodically through the respective media channels. The team built upon iSTEP 2009's efforts and ultimately created media outreach that was both extensive and comprehensive. Furthermore, the team coordinated effectively to ensure that real-time information was broadcasted in the most accessible and engaging manner. For example, the integration of Wordpress.com onto the website along with the daily blog updates helped the team communicate progress with audiences throughout the internship.

### 8.4.1 Improvements

The team recognizes that a number of improvements could be made that would significantly increase the reach and interactivity of media channels. The following are highly recommended considerations for future work:



Figure 56 - AUW and iSTEP intern

#### Social Media

- Set key milestones to be achieved over time for realistic and ideal progress metrics.
- Develop a schedule and track progress periodically using analytical tools (such as WebTrends or TwitterAnalyzer) for monitoring and effectiveness.
- Develop monitoring and evaluation plan for mid-point of internship to reevaluate effectiveness of the dissemination plan. This would allow for re-strategizing if necessary.

#### Traditional Media

- Conduct background research on local news agencies and plan an outreach strategy that includes a detailed fact sheet for cultural liaisons.
- Introduce background of projects while delivering presentations to give comprehensive overview of related work.
- Persuade audience that the work accomplished throughout the iSTEP internship is relevant to their community.
- Produce attention-grabbing openings for each project when presenting in front of a live audience.

The overall dissemination efforts extended beyond the target audience and the team was able to successfully engage the Bangladeshi media. As a result, YPSA received multiple phone calls from government representatives and private institutions from across the country expressing their interest in learning more about the BWT. Not only has the media coverage disseminated iSTEP's general mission, but it has also helped the community partners realize other opportunities for partnership and growth.

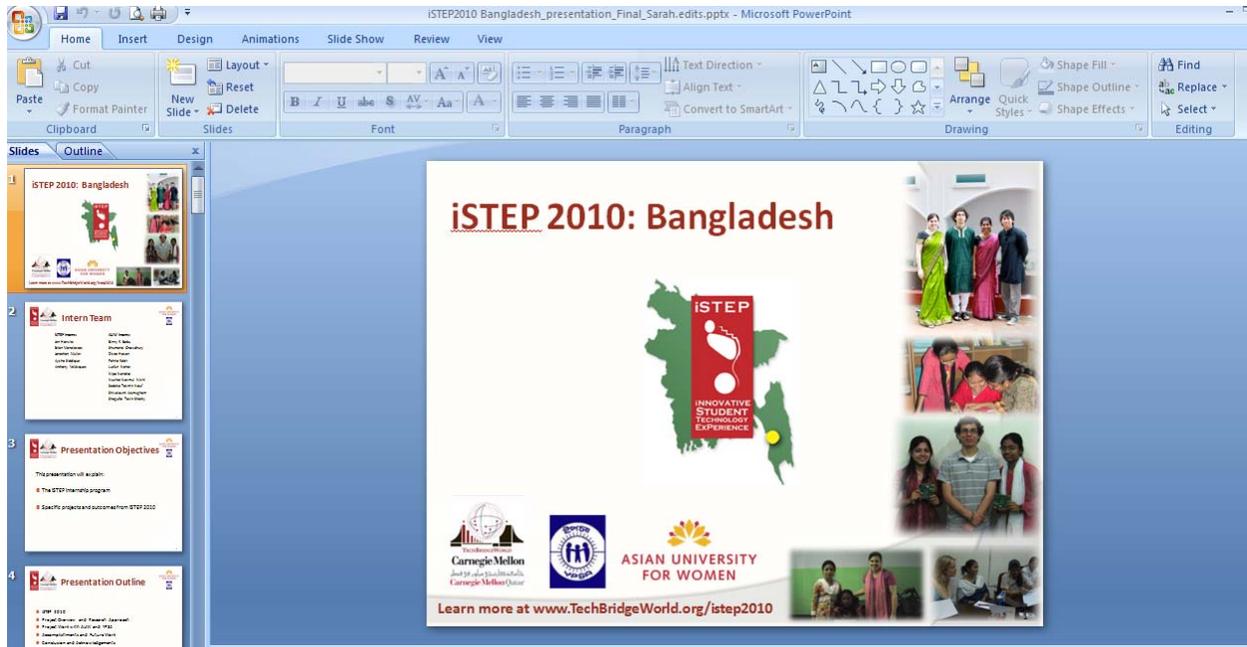


Figure 57 - PowerPoint presentation deck for presentation to AUW stakeholders

## 9 Team Experiences

### 9.1 Overall Team Experience

The 10-week iSTEP internship was an opportunity for professional growth and character building. The team had a chance to apply and utilize their skills to identify and interpret challenges unique to the communities being served. The team worked together with the partners to collaboratively develop technology solutions and had the opportunity to positively impact two communities in Bangladesh. Anthony reflects, “I can’t imagine another experience I could compare to my experience watching a student at the Government School for the Blind look up at Shumana, one of the AUW interns I worked with, and repeat everything she heard from the Braille Writing Tutor through one of the biggest smiles I’ve ever seen.” The team was able to form personal relationships with the partners and within the team, despite being separated by time and distance. “One of the things I am most proud of is the relationships I developed with the rest of the field-based team,” explains Jon, who was stationed in Pittsburgh for the duration of the internship.



Figure 58 - Sitakundo rural area

Furthermore, the team was given the flexibility to conduct analysis and innovatively develop solutions according to their understanding of what would best address the specific needs of each community. This was a unique experience in working as a team, balancing the work based on each person’s strengths and weaknesses to conduct field research and deliver outcomes according to the recommendations.



Figure 59 - Jen and Anthony with students at the Chittagong Government School for the Blind

Not only were professional relationships developed with the AUW interns, but life-long friendships were developed that extended past the borders of the work relationship. The interns were pivotal in helping the team interact with the local community. As the interns helped the team to acclimate to the surroundings, the team was exposed to the many facets of Chittagonian life, tradition and customs which in turn gave the advantage of being more aware of general surroundings. Not only did their understanding of the local community provide the team with the advantage of effectively and efficiently understanding the community’s needs and challenges, it also gave a better perspective when it came to dealing with daily activities. Often, foreigners are charged higher prices for goods or services – from rickshaw and CNG rides to buying a drink at a local supermarket. Thanks to the AUW interns, the team was able to make honest observations about the surroundings. The AUW interns also provided insights of the “ins” and “outs” of the local setting. The team certainly benefitted from their knowledge and familiarity of Chittagong.

The team had the opportunity to explore different restaurants around the city, to ride rickshaws and CNGs, shop at malls, and visit a few local sites at a nearby town (Sitakundo). The team spent the majority of their free time hanging out with the AUW interns and connected with them over Bollywood movies, outings and even visits to some of their homes. In Pittsburgh, Jon supported the field interns with research and technology development. He was able to learn about Bangladesh through the eyes of his colleagues and explain the project to Carnegie Mellon students, staff, and faculty during his free time.

## 9.2 iSTEP Individual Team Experience

### Jen Horwitz

“When I applied for the iSTEP 2010 internship, I was looking for an experience that would be hands-on, provide an opportunity to learn about a new location and new communities, and that would help me to develop a stronger understanding of international development work. At its close, this internship has been all these things and more, and I am very thankful that I had the opportunity to be a member of the team.



Figure 60 - Jen meeting with Zishrat, Binny and Fahria

Over the course of ten weeks, so many things have happened. Our first few days in Bangladesh were challenging for me - adjusting to the climate, the chaotic traffic (that I now appreciate), and the complexity of the social fabric – the fact that next to modern high-rises you had a shanty town, followed by a shopping complex. I was excited when we started our work as I enjoy juggling lots of tasks and working quickly. However, this internship was also a lesson in balancing urgency with the time it takes to actually accomplish work on the ground. In the past, many of my jobs have included working with community partners on a variety of issues. In contrast, it is a very different experience when you need to establish a relationship, collaborate to develop technology, and deliver a needs-based technology solution within ten weeks.

I have come to love the country and the culture in Chittagong and while I still struggle with the dichotomy that you see every time you walk down the street, I know that so many people are working so hard to help their communities develop in sustainable and responsible ways. As I prepare to leave Bangladesh, some of the most impactful things that I take away from this experience are the stories of the AUW interns, the Access Academy students and teachers, the staff from YPSA, the students at the Government School for the Blind, and my fellow team members. For me, these personal stories put not only our projects, but also my future aspirations, into perspective. This experience has reaffirmed my desire to pursue a future career in international development policy and I hope to be able to come back and visit the region again in the not too distant future.”

## Brian Manalastas

“When I received the congratulatory email from TechBridgeWorld, I remember thinking to myself what a huge achievement and honor it was to be selected for such a competitive internship. I applied the year before, when I was a sophomore but was declined a seat on the team. I didn’t understand then but now I understand why. Field research is challenging. It’s really tough being in the field and to prepare extensively for something you can’t even begin to comprehend. But it’s important to understand and accept that there will always be unaccounted variables in your preparation process, no matter how thorough your planning has been. I was fortunate to be a part of a team of extremely talented people that worked together to accomplish a common goal: to make a difference in communities in Chittagong. This goal unified us and helped us to overcome diverse cultural backgrounds and extreme personality types. I realized how much I depended on my teammates for work, for recreation and most importantly, for survival.



Figure 61 – Brian participating in an interview with students

iSTEP has taught me so many things. One lesson was to expect the unexpected and to react strategically and leverage my resources when those unexpected challenges arose. Furthermore, I learned the importance of producing high quality work; being flexible when working in a team; organizing, leading and turning things in a timely manner; and acting and reacting in a culturally appropriate manner. On the other hand, I learned that being passionate about your work and considerate to the people and communities you are interacting with goes a long way. Most importantly, I learned that to be successful, you have to be willing – willing to work the extra hours; willing to build life-long, true and honest relationships; willing to have heart-felt conversations with people from the driver to the highest ranked person in our partner organization; and willing to become more than what you thought you could be.



Figure 61 - Brian, Lutfun and Anthony during a meeting

Despite the challenges, field research is really rewarding. At times, it becomes difficult to understand how you are creating meaningful impact. But it’s important to look at what’s in front of you and appreciate and cherish the work you are doing. After all, the solution has a tendency to be right there in front of you. It’s really up to you to look in the right places, listen carefully, and make your judgment.”

## Jonathan Muller

“‘Work well independently and as a part of a team.’ How many job descriptions are adorned with these requirements? If I was to summarize my iSTEP internship position, these are the most important requirements for the Technical Floater role. This summer, I improved my skills in these areas and developed real-world technology solutions while pursuing research.

When I came to Carnegie Mellon University for graduate studies, I didn't feel like my experience would be complete without participating in some type of research. However, I was not interested in esoteric research that would only sit on a shelf. I wanted to do something that would affect real people. Given my experience in education, technology, and international development, the iSTEP internship seemed like the perfect opportunity to do research and build something that would impact people's lives.



Figure 62 - Jon with the BWT

After our first mini preparation course, I felt ready for the independent study and internship that followed. I had also developed work relationships with and an understanding of the work styles of the rest of the team. When it was announced that I was chosen as the Yahoo! iSTEP 2010 Fellow, this upped the ante and served as a motivator for me as I entered the summer internship.

During the first half of the summer, I was getting up-to-speed with relevant technologies and conducting a literature review while my teammates in Bangladesh conducted needs assessments. I spent hours searching for relevant scholarly papers and combing through English literacy textbooks at the CMU and Pittsburgh libraries. This up-front independent preparation helped later-on during the development and report writing phases later in the internship.

One of the things I am most proud of is the relationships I developed with the rest of the field-based team. Because I was the Pittsburgh-based team member that had the most daily contact with folks in Chittagong, I was often able to read between the lines of Skype and email exchanges and help smooth the communications process. The importance of teamwork was most apparent during the hectic technology development stage. We all had to be attentive to detail, responsive, and accommodating to our fellow teammates. Though I was separated by time differences and an information deficit, I pushed myself to fill in the blanks and move outside of my comfort areas. I have no doubt that I will find myself working on a virtual team again in the future, and the iSTEP experience has served as invaluable training for my future efforts.”

### Aysha Siddique

“I had about 10 days after my graduation before flying out to Chittagong. I had not thought about what to expect from iSTEP, but I clearly remember being worried that I wasn't prepared, both emotionally and for the work that awaited. I felt drained and exhausted and seriously doubted if I would do a good job. But in the first week of being in Chittagong, I felt energized and recharged. I was reminded of why I applied to iSTEP – to be involved with Asian University for Women (AUW). That first week, I enjoyed learning about AUW and the opportunities it offered to girls like me from



Figure 63 - Aysha working with an AUW student

all over Southeast Asia. I found my motivation to work from the fact that I was contributing, in whatever little way, to something bigger that would have an impact on the socio-economic state of the region.

With time, I had little doubt about the work I would do – but I had other concerns. I had concerns about my interpersonal skills and interacting with people in all levels of power. I also had concerns about whether our projects would be successful. Would people use it? Is it actually what they need? I was also experiencing several things for the first time like keeping dry in a flooding room, battling giant cockroaches and spiders, hand washing clothes, getting used to dorm life, and eating cafeteria food day in and day out. Overall, there were many high and low moments of I’m-so-glad-I’m-here and get-me-out-of-here interleaved in quick succession.

Given these concerns and challenges, I started doubting my being cut out for the field of information and communication technologies and development (ICTD). It was unnerving because I believed this to be true for almost three years. But it was very rewarding to interact with young women and hear their experiences and viewpoints on things they really care about. There were some girls that were experiencing the same educational and cultural challenges that I have experienced and am still experiencing, and I realized that I am in a unique position to help them out.

When I look back now, the challenges don’t stand out as much. The interactions do. The people do. And I’m glad that was the case, because it’s the people and the interactions that matter most. I have enjoyed learning about the Access Academy teachers who have left behind a comfortable life to come teach here and do so with a sense of purpose that is admirable. I have enjoyed working in a very diverse group – with people of different ethnicities, nationalities, ages, religions, work fields and skills. They have provided me with experiences and stories that I’ll remember years to come. I’m glad for all the team interactions, new friendships, cultural exchanges, and the kind words that were exchanged over the last 10 weeks. Moreover, I’m glad that despite the challenges, I still see this field as something I’m passionate about and want to do further work in. All of my previous ICTD experiences weren’t quite as challenging or “real-world”-ish, and I’m glad this one was. It challenged me, made me think and re-evaluate my stance on whether or not I am cut out for this field. I think I am :).”

### **Anthony Velázquez**

“Things look different from the field. It sounds trivial but I still can’t believe just how much I underestimated the difference between my role last year and being on the field this year. From being able to go home everyday to being able to easily replace items that get lost or broken, being on the home-side gives you a lot of benefits to make the experience a little less stressful.

However, being in the field, and actually talking to the users who interact with the projects is an unbelievable experience. Not many internships allow their participants to see how people interact



**Figure 64 - Anthony working with YPSA and AUW Participants**

with their work on the same level as iSTEP. I can't imagine another experience I could compare to my experience watching a student at the Government School for the Blind look up at Shumana, one of the AUW interns I worked with, and repeat everything she heard from the BWT through one of the biggest smiles I've ever seen. I can't imagine working anywhere where groups of people call me "Dada," or elder brother. And I can't imagine working at a job where people routinely ask me to dance and I quickly star to blossom into a big YouTube hit. But the biggest take away from the past 10 weeks, is that nowhere else will I have an opportunity to take feedback to heart like this. It completely changes the purpose of the work, to really know whom you're developing for and to really understand why your work is valuable.

And so I leave my second and last year of the iSTEP internship and enter the next stage of my life knowing that I have enjoyed a career experience on professional and personal levels that few others will have the opportunity to experience. The past 10 weeks and the people I've met will stay with me for the rest of my life. I just hope that our work will continue. However, after working with TechBridgeWorld, AUW, and YPSA, I know how passionate and dedicated they are about the work and I firmly believe that these projects will continue to improve long after we leave."

### 9.3 AUW Individual Team Experience

#### Binny K. Babu, Needs Assessment Team

"My time spent over the summer would not have been as productive if I had not been involved with the iSTEP internship. Before working with the iSTEP team, I had little exposure to real world issues developing communities face. The iSTEP experience gave me the opportunity to reach-out to some of the local communities in Bangladesh and really understand some of the daily challenges they encounter. The moment I came in contact with members from Young Power in Social Action (YPSA), I could empathize with them. I began to experience the real world conditions in an area far away from my native community, many of which, I could never have imagined before. I am proud of the progress I have made in developing my Bangla language skills.

I am happy that I chose iSTEP as my summer internship. The iSTEP internship has motivated me to be actively involved with developing communities."

#### Shumana Chowdhury, BWT Team

"This summer, our BWT team made changes to the existing tutor according to the needs assessment process and I in particular have contributed to the project in developing a Bangla version of the tutor. Without the team, we wouldn't have been able to successfully develop an initial Bangla version of the tutor and through the iSTEP experience, I realized the importance of team work. Anthony brought his technical expertise about the tutor while Lutfun and I brought our knowledge and understanding of our local communities.

Being able to be a part of this unique team has really helped me become a better team-player and has



Figure 65 - Shumana and Vashkar during demonstration

given me the chance to learn about the importance of having strong team dynamics. With dedication, willingness, and a healthy mentality; we were able to successfully modify the tutor to meet our partner's needs.

Working with the iSTEP team as well as the communities at home has been an eye-opening experience and has definitely confirmed my ambitions to continue to pursue a degree in ICT.”

#### **Zishrat Hasan, Needs Assessment Team**

“When I started working with the iSTEP team, the only knowledge I had was the basics of conducting ICTD field research. Everything I learned was entirely new to me, and I prepared myself for a 10 week long learning session. During this internship, not only did I get to learn about the project, but also got the chance to meet people from diverse communities with different real life experiences, which is a remarkable experience for me. Being a part of the needs assessment team gave me the opportunity to observe closely how the iSTEP field research was carried out and how the technical, documentation and needs assessment teams came together. The most important lesson I have learned is how to quantify qualitative information and perform assumptions based on our collected results.

Apart from the work experience, my overall personal experience from participating in the iSTEP internship is noteworthy. The iSTEP interns are not only cooperative, but also very friendly. I came to learn about some non-academic and real life experience such as American and Japanese cultures from Jennifer and Aysha, Kanji characters from Brian, and playing card games from Anthony. Overall, it was an incredible experience to work with people from different cultures and backgrounds throughout the summer.”

#### **Fahria Kabir, Needs Assessment Team**

“The iSTEP program is my first internship experience and it was a very exciting and enjoyable experience. I worked enthusiastically with two other AUW interns, Zishrat and Binny as part of the needs assessment team and learned about the importance of teamwork. I learned how it is crucial to consider your teammates' opinions and to listen carefully about their needs and concerns when striving to reach a common goal. More importantly, I realized that it is important to extend yourself past your own team and be resourceful. I gave my best efforts in assisting the different sections of the teams to facilitate the completion of both projects.

This internship program has personally helped me build my confidence and pushed me to apply the lessons learned in class. Learning is insignificant without practical application, and iSTEP has given me the opportunity to apply the knowledge acquired throughout my education.”



**Figure 66 - Fahria explaining IRB forms to YPSA stakeholders**



**Figure 67 - Lutfun and Anthony during a meeting**

### Lutfun Nahar, BWT Team

“I believe I am extremely fortunate to be a part of the iSTEP internship, and especially to be involved with the BWT project. I learned a lot from Anthony, our technical lead, from basic programming to understanding how the tutor functions. More importantly, I am happy that I gained the chance to interact with the blind community in Chittagong who have been courageous in overcoming many of the problems they face in Bangladeshi society. Throughout the iSTEP internship, I closely observed children from the blind community who were ambitious and determined to receive an education, but struggled to learn braille. Their dedication has been inspirational to me and I am glad I was able to experience this with the iSTEP team. I believe the tutor the iSTEP team brought with them to Bangladesh will serve the blind community well.

The most important lesson I’ve learned from this internship through my interactions with the iSTEP team is that you have to believe in yourself and in your community for a technology solution to work. This internship has helped me identify my responsibilities to my society and I am looking forward to contributing further to the work the iSTEP team has accomplished.”

### Nipa Nandita, Documentation Team



Figure 68 - Documentation Team

“Before being selected to participate in the iSTEP internship, I had little understanding of the ICTD field and how technology can be used as a solution to help solve certain challenges people face in our communities in Chittagong. I chose to be a part of the Documentation team as I am interested in photography and media. At times, I felt that the documentation role was unclear to me but I thoroughly enjoyed going to all the newspaper offices to promote the publication of media articles written about the internship in both Bangla and English. It was fun to watch

the journalist’s interesting faces and questions about the projects. I would like to thank my other group members especially Nouf and Shathy for the Bangla typing which was the most challenging task in the translation process. It took more than two hours for me to write only one paragraph in Bengali! However, it was truly rewarding when I read our articles published in Bangladesh’s most popular newspapers!

Not only did this 10 week internship teach me about documentation, taking video and photos, writing articles, and research, but it also gave me the chance to learn about individual groups of people, visit different sites around the Chittagong region, as well as overcome challenges. Overall, my most exciting moment goes back to when I saw the demonstration of the BWT in Bangla and using the English literacy practice tool in our IT labs. I thank the entire iSTEP team for a wonderful experience. I would be very happy to work with this team in the future if I get another chance.”

### **Nuzhat Nazmul Nishi, ELT Team**

“Being a member of the English Literacy Tools (ELT) team has given me the privilege to learn many technical processes that are entirely foreign to me from Aysha, the ELT Technical Lead. I have acquired basic software development language skills from JavaScript, to HTML, and MySQL. Additionally, Aysha has taught the team how to create databases using Microsoft Access. One of the most important lessons I have learned through this internship is the importance of thorough planning before building and implementing any specific software amongst other basic technical skills. The success of a technology solution depends on how well you have assessed and understood a community’s needs through the needs assessment process, and we were successful in coming up with a tool that would assist Access Academy students in improving their English skills.



**Figure 69 – Nishi playing guitar during free time**

With my background and ambitions to pursue a degree in Politics, Philosophy and Economics, the iSTEP experience has encouraged me to think creatively about how I can combine my major with my new understanding of how technologies can be utilized to promote development in my country in a feasible way.”

### **Sadeka Tasmin Nouf, Documentation Team**

“Of the different available summer internships at our university, the first that caught my attention was the iSTEP internship. After reading the description about the two projects the iSTEP team would be working on, I started thinking about being a part of the team. It became my dream and was my first preference for the summer internship. Naturally, when I came to know that I was selected for the iSTEP program, I was very excited and after 10 weeks of working with the iSTEP team, I can confidently say that my excitement was not in vain.



**Figure 70 - Nouf interviewing a student**

Working with the iSTEP team was really a wonderful experience. Though we are from different cultures, we experienced very little cultural conflicts within our team. I admired working in the friendly environment the team created which made my work much easier to do. Working in the documentation team, I got the chance to learn how to approach different groups of people while promoting the internship. We had to visit many places, meet media people and read and write persuasively in order to publish our articles. Though the main responsibility of my team was documenting the overall team experience, I learned a lot about public relations and a bit about public policy too. It was never boring to work with the group and the learning process was easy and fun.

It would be hard for me to forget this summer as I have learned many new lessons about working on research technology projects. This includes understanding the necessity of the needs assessment process and considering sustainability of projects. Most importantly, I have met four wonderful

friends from Carnegie Mellon University who have helped us in this learning process with a lot of patience and love.”

#### **Shivalaxmi Arumugham, ELT Team**

“Teamwork is essential for projects that require multidisciplinary skill sets to solve real world problems. All five members of the iSTEP team have different educational backgrounds and are experts in their own fields, yet they are capable of working with each other efficiently. Working with the iSTEP team gave me insights into the individual perspectives they have on the challenges of the projects.

The iSTEP and AUW interns have really made the effort to teach me the overall process of field research. The week-long tutorial on field research and ICTD by Dr. Yonina Cooper was especially useful before the team’s arrival and I appreciate the time Aysha took to explain her experience from the previous projects she was involved in. Additionally, Aysha has also taught me how to design basic databases using Microsoft Access and its application in various fields.

This internship has brought both Carnegie Mellon and Asian University for Women students together and helped me to understand the different technologies that Carnegie Mellon has built. It challenged me to think of improving the learning environment at AUW with technology based solutions and it has made me closely consider the existing social problems around Chittagong which I have not noticed before. I do hope I will be able to be involved in another research-oriented internship in the future.”

#### **Shagufta Tazin Shathy, Documentation Team**

“One of the key components of the iSTEP internship is teamwork. From this internship, I realized how crucial it is to have a positive attitude in your work in order to achieve the vision the team has set to reach. Positivity and confidence are necessary qualities to have in field work, especially since there is a lot of uncertainty no matter how thorough your plans are. With motivational support from my teammates, I really overcame challenges I encountered throughout the internship – challenges that were specific to the purpose of my role.



**Figure 71 - Shathy interviewing a student**

My personal take away from this internship is that having objectives and a final destination defined will help you overcome all the obstacles that you face.”

## 10 Conclusion

Overall, the iSTEP 2010 team was successful in establishing a positive and solid relationship with both community partners in Bangladesh. Furthermore, the partners are looking forward to a long-term relationship with TechBridgeWorld to further develop both projects. Mr. Vashkar from YPSA states, “We [YPSA] would like to work together with TechBridgeWorld to further develop a successful device, and to promote this technology in the rural parts of Bangladesh as well as all over the country.” Additionally, YPSA is interested in exploring other disability issues that extend past the BWT project with TechBridgeWorld. Vashkar states, “We want to have a long term partnership with Carnegie Mellon University to tackle challenges that are not only limited to the visually-impaired community, but other disability issues that are related to ICT for development.”



Figure 72 - Anthony observing a student interacting with the BWT



Figure 73 - Aysha demonstrating the ELT to Access Academy teacher, Diana Davies

Although the English Literacy Tool has not been officially deployed at the Access Academy, both the teachers and students have expressed how helpful it was to have a multi-functional web-based tool that facilitates both teaching and learning processes. In particular, most of the Access Academy teachers found the team and the overall purpose of the internship to be helpful in exploring alternative ways to facilitate students’ learning more effectively. Access Academy teacher John Jordan states, “One benefit of having the iSTEP interns come here and work on this program is that their different perspectives help us teachers think of other ways we can improve students’ interactions with teachers in the classroom.” Mr. Jordan further states, “It is nice to have an outside group of people come in and work with us to find a way to use other tools that help us understand how we can better educate our students.”

The bonds with AUW and YPSA illustrate the success of the team’s collaborations. The combination of the partners’ knowledge of the local setting and commitment to participation and technical expertise accounts for the success of the projects. Moreover, the team received constructive feedback from the partners stating that the technology solutions developed are useful and that the overall project outcomes have the potential to positively impact both communities. Furthermore, the results drawn from the information dissemination efforts indicate an increase in followers and supporters of the work. Facebook alone generated 290 followers by the end of the internship and continues to grow. Based on the team’s dissemination



Figure 74 - Lutfun & Shumana

efforts, they are confident that they have successfully promoted their work and generally raised awareness of the ICTD field among audiences who may have not taken notice previously.

The team looks forward to transferring ownership of the work produced during their time in Bangladesh to the community partners and to TechBridgeWorld for longer-term development and also look forward to seeing how these projects continue to develop in the future. Based on the outcomes observed during the time in Bangladesh, the team hopes that their work will continue to positively impact the communities served during iSTEP 2010.

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# 11 Appendices

## 11.1 English Literacy Tool Interview Questions

### English Literacy Game Interview Questions for Students (Time approx 30 min)

---

#### **Introductions:**

Introductions will be conducted in conversational style and will include exchange of names, project overview, letting the participant know that we will be taking notes (if applicable), reviewing the research participation agreement (if applicable)

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#### **Personal information:**

Intros: names, how the day has been, are you excited to be a part of iSTEP, etc (purpose, consent, notes, etc)

(Consent Form)

Where is everyone from?

Do you know what you want to do after you graduate? Would you tell me about it?

Why did you apply to Access Academy?

What have been your favorite classes? (Ask for explanation if necessary)

What classes have been challenging? (Write Down Answer on paper provided)

#### **English Literacy Coursework Experience:**

Since our project will be designing tools for new Access Academy students, it would be very helpful for us to learn more about your experiences during Access Academy....

What do you like about learning English at Access Academy?

What is challenging about learning English at Access Academy? (Write Down Answer on paper provided)

Vocabulary

Grammar

Listening

Presentation

Writing

Reading

Why are these areas challenging? (Write Down Answer on paper)

How do you try to practice these areas?

Go to teacher office hours

Study with friends

Study alone

Do homework whenever it is assigned

Look up information on the internet

Play other educational games like bookworm, grains of rice, etc

Other

What types of assignments did you like doing for any of your classes?

What types of assignments did you like doing for your English classes?

What types of assignments do you not like?

**Computer Use:**

Do you need to use a computer to complete any of these assignments?

If yes, what types of assignments most frequently require you to use a computer?

How many a times per week did you use a computer to complete your assignments for your English classes?

How many times a week did you use computers to complete your assignments for all of your classes (Access Academy)?

Do you like working on a computer?

Why/Why not?

If do not like – what might help you to want to use a computer more?

Aside from school work, what else do you enjoy doing on the computer?

If not mentioned, do you play any games on the computer?

If yes, which ones?

How many hours per week do you use a computer outside of classwork?

Do you use a computer more often or a cell phone more often?

Why?

If you were creating a program for you and your classmates to improve your English skills, would you make it so it can be used on a computer or a cell phone?

Why?

What would you design the game to look like?

What information would you include?

**Additional Ideas for tool content:**

These are great ideas. What else do you enjoy doing at school such as clubs or other school sponsored activities?

Are there any things that you like to do, like shopping, watching TV outside of school activities?

If yes, prompt interviewee for types of activities and explanations if necessary.

Do you play any games on your cell phone?

What types of games do you like to play?

**Closing:**

Is there any other information that you would like to share with us today?

Thank the participant for their time. Interviewer should then provide information on follow up communications, reiterate how interviewee can contact the iSTEP team with questions, and information on any other closing procedures.

## **English Literacy Game Interview Questions for Teachers (Time 45-60 min)**

---

### **Introductions:**

Introductions will be conducted in conversational style and will include exchange of names, project overview, letting the participant know that we will be taking notes (if applicable), reviewing the research participation agreement (if applicable)

---

### **Teacher & Class Information:**

We'd like to begin by learning more about your role at AUW and the classes you teach.

May we ask how you came to be involved with AUW?

What types of work does your job include (possible prompts: what courses you teach, do you advise any of the student clubs, etc)?

For your English literacy course(s) - what do you like about teaching these courses?

What challenges do you face in teaching English literacy (possible prompts - limited supplies, wide range of student needs, etc)?

What is the English skill level of an average student before completing the program? (Frame this question based on the rating scale that the school uses)

What is the English skill level of an average student in your group after completing the program?

On a scale of 1-5, how motivated are your students, on average, to perform as best as possible?

What parts of the curriculum do you think students enjoy learning?

What parts of the curriculum do you think are challenging for students to learn?

What types of teaching methods do you use in your English literacy class(es) (possible prompts – group projects, independent classwork/homework, collages, research, etc)?

### **Connection to the rest of Access Academy Curriculum & AUW Student Body:**

Are there any skills such as leadership or community service that all of the Access Academy classes try to incorporate?

What other subjects do you think your students enjoy learning?

What other subjects do you think are challenging for your students to learn?

What other activities or clubs are popular among the students at AUW?

(Interviewer should prompt for more info on any activities mentioned if necessary)

(Talk a bit more about the game concept) Given the vision for the project, what types of content do you think should be prioritized to include in the game?

What ideas do you have for what the game could look like (themes)?

**Technology:**

It would also be helpful for us to know more about how you and your students use computers or other technology in the classroom and to complete assignments...

How comfortable do you feel with using technology to help you teach your class(es)?

Very comfortable      Somewhat (a little bit) comfortable      Not comfortable

How many times per week do you use a computer to complete your work related to your English literacy class(es)?

Do you use any other types of technology to teach this/these class(es)?

What kinds?

On average, how comfortable do you believe your students are with using technology to complete their assignments?

Very comfortable      Somewhat (a little bit) comfortable      Not comfortable

On average, how many times per week do your students use a computer to complete assignments for your (English literacy) class(es)?

How many times per week do you think your students use a computer to complete any of their work for their courses?

**Closing:**

Is there any other information that you would like to share with us today?

We plan on meeting with (insert overview of people here) as well. Is there anyone you would recommend we meet with to help us with this project?

Thank the participant for their time. Interviewer should then provide information on follow up communications, reiterate how interviewee can contact the iSTEP team with questions, and information on any other closing procedures.

## 11.2 Braille Writing Tutor Interview Questions

### Braille Writing Tutor Interview Questions Students

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#### Introductions:

Introductions will be conducted in conversational style and will include names, letting the participant know that we will be taking notes (if applicable), reviewing the research participation agreement (if applicable)

---

#### Young Students:

1. What do you like about learning to write braille?
2. What is hard about learning to write braille?
3. What can you write in braille?
  - a. Letters?
  - b. Words?
  - c. Numbers?
  - d. Sentences?
4. What other subjects do you like learning?
5. What games do you like to play with your friends?
6. What are your favorite animals?
  - a. Optional: What sounds do they make (asked after each animal is called out)?
7. What other things do you like to do at school?

#### Students 10+

1. What do you like about learning to write braille?
2. What is hard about learning to write braille?
3. What can you write in braille?
  - a. Letters?
  - b. Words?
  - c. Numbers?
  - d. Sentences?
  - e. Compositions?

4. What types of practice exercises do you enjoy doing to help you practice writing braille?
5. Which do you like better – writing braille or reading braille?
  - a. Why?
6. What other subjects do you enjoy learning?
7. What other subjects are challenging?
8. What other things do you like to do at school?

## **Braille Writing Tutor Interview Questions for Teachers (Time 45-60 min)**

---

### **Introductions:**

Introductions will be conducted in conversational style and will include exchange of names, project overview, letting the participant know that we will be taking notes (if applicable), reviewing the research participation agreement (if applicable)

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### **Teacher & Class Information:**

How long have you been teaching this/these courses?

What do you like about teaching braille writing?

What challenges do you face in teaching braille writing?

What types of teaching resources (books, slates & styluses, etc) do you have available to help you teach?

Do you think students most often struggle with learning to write braille or learning to read braille?

What types of practice exercises do you most often assign to help the students practice writing braille?

How does the information students learn in your class connect to their other coursework (any shared topics, do you team teach)?

What other subjects do you think your students enjoy learning?

What other subjects do you think are challenging for your students to learn?

### **Technology:** (Ask if not apparent)

As we mentioned, the BWT uses a computer for power and for audio - do you have access to a computer in your classroom?

### **Closing:**

Is there any other information that you would like to share with us today?

We plan on meeting with (insert overview of people here) as well. Is there anyone you would recommend we meet with to help us with this project?

Thank the participant for their time. Interviewer should then provide information on follow up communications, reiterate how interviewee can contact the iSTEP team with questions, and information on any other closing procedures.

## **Braille Writing Tutor Interview Questions for Staff (Time 45-60 min)**

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### **Introductions:**

Introductions will be conducted in conversational style and will include exchange of names, project overview, letting the participant know that we will be taking notes (if applicable), reviewing the research participation agreement (if applicable)

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### **For interview with staff from Chittagong Center:**

Would you tell us more about your programs and projects?

- For school programs: what schools do you work with?
- What are you doing with these students?
- How are you working with the students?
  - o Do these schools have computer(s)
  - o Do they have electricity on a regular basis?
  - o Do they have protection from water/sun for computer-like equipment?

Are you interested in expanding your programs/projects with the schools or are you interested in expanding your programs/projects at the Chittagong center?

What are you expecting from us?

What types of technology do you need most to help you do your work?

In what ways can we help you?

Do you have other visually impaired instructors?

- Can we meet with them to see if they would be willing to participate in the study?

Ask about setting up focus groups with relevant students

What is the average age of students?

- At center
- Outside of center

### **What information we need to collect:**

- Types of computers and how many they have?
- What other types of technology they are using?
- All of the organization's projects/programs
  - o Schedule
- How many people do they service who are visually impaired?
  - o At the Chittagong center
  - o At the other center
- How many people do they service total?

- At the Chittagong center
  - At the other center
- Types of students who use the center
- Types of students who they work with outside the center
- Do they have a copy of the Bangla braille alphabet (either on computer, a handout, etc)
- Copies of curriculum/or types of classes they provide for students
  - At center
  - Outside center

Do we have the ability to install software on the computers OR do the computers have enough space to install more programs OR storage capacity?

Do you have to log into each computer or are they open OR does each user have an individual?

## **BWT Mixed Focus Group June 3, 2010**

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### **Introductions:**

Introductions will be conducted in conversational style and will include exchange of names, project overview, letting the participant know that we will be taking notes (if applicable), reviewing the research participation agreement (if applicable)

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### **Questions for Advanced Learners**

#### **Background Questions**

1. When did you first learn to write braille?
2. Did you learn through a school or through a workshop/training program?
  - a. What did you like about the program?
  - b. What do you think were the greatest challenges for the program?
3. Has your education/did your education include learning in a sighted class?
  - a. What are/were the benefits/challenges?
4. How long did it take you to learn to write:
  - a. The alphabet
  - b. Primary level vocabulary words
  - c. Secondary level vocabulary words
5. How did you learn how to write combined letters and symbols with a slate and stylus?
  - a. Did you learn these at the same time as other letters
6. What was challenging for you in learning to write braille?
7. Are there any activities or exercises that your instructors used in your program that were very helpful for you?

#### **Tech Questions**

8. Do you use a computer or slate/stylus more often now?
9. Which method do you prefer – writing using slate/stylus or computer?
10. What other types of technology do you use to help you communicate?

#### **Expert feedback**

1. How many grade levels are at Government Schools for the Blind?
2. What content is taught in each school?

- a. What other content would you like to be able to cover?
  - b. What are the challenges that prevent you from teaching these subjects?
3. What subjects are easier to teach?
4. What subjects are more difficult to teach?
5. What's the method for teaching the alphabet?
  - a. For primary level vocab?
  - b. For secondary/advanced vocab?
6. How do you teach students to write combined letters in words?
7. What types of games or activities do you use to help students learn?
8. What is the cost of materials printed in braille?
9. What is the procedure for printing braille resources?
10. What types of preparations are needed to help visually-impaired students integrate into sighted classrooms?
11. How is education for visually-impaired individuals integrated at higher levels of learning?

**Both:**

1. Are the characters for numbers the same for Bangla braille as they are for English braille?
  - a. If no, are any of the characters more than one cell
2. How do you teach/learn math?
3. Do you think the ability to solve math problems would be a useful addition to the tutor?
  - a. If yes, what types of problems would you like to be able to solve using the tutor?
4. The BWT has a game like Shabdaved, should the game say the number of letters or the number of braille cells that you need to fill to complete the word?
5. Do you have suggestions for games that we could included on the BWT to help students enjoy learning braille characters or words?

## 11.3 English Literacy Tool User Manual

# English Literacy Tools User Manual

Designed for:

**The Asian University for Women Access Academy**



By:

**The iSTEP 2010 Interns**



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### 11.3.1 Introduction

The English Literacy Tools is a web application developed by interns from Carnegie Mellon and TechBridgeWorld's innovative Student Technology ExPerience (iSTEP) program in the summer of 2010. In partnership with Asian University for Women's (AUW) Access Academy, the iSTEP interns worked with AUW students, teachers, and administration to develop a tool to assist with English literacy skills.

The web based software was developed to be administered by AUW's teachers and administration. After the conclusion of development, AUW will have the ability to manage the questions database and the administration of users.

To assist in sustainability, the iSTEP interns have created this manual to serve as a reference guide for future users of the application. This manual will guide the various types of users through the common functionality as well as specific usage scenarios based on the user type.

Four distinct user types have been identified within the application: administrator, teachers, teacher's assistants, and students.

Finally, this manual provides documentation about known software issues: including bugs and potential future features.

### 11.3.2 Before you start

Please read this section before attempting to use the English Literacy Tools (ELT). The information provided will ensure that you have a more complete user experience and will also explain the conditions of use.

#### 11.3.2.1 Software Requirements

The English Literacy Tools are a web-based tool and therefore, no specific software must be downloaded to run it. However, the English Literacy Tools will work best using the Mozilla Firefox browser on a Windows system with the latest version of the Flash player and Java and Javascript enabled. While other browsers and operating systems can be used, the iSTEP team recommends Firefox.

Download the latest version of Firefox here: <http://www.mozilla.com/firefox/>

#### 11.3.2.2 IRB

The English Literacy Tools is part of a research project overseen by Carnegie Mellon University's Institutional Review Board. The board approves, monitors, and reviews research projects that rely on data obtained from human subjects. Users of the software will be asked to give their voluntary consent to participate in the research study when registering for the software. First time users who are entered into the system will receive an email once their email address and user names have been added by an administrator. This email will activate

their account, help them create a password, and provide a copy of the the IRB consent form which they previous consented to.

### 11.3.2.3 Logging In

Users of the English Literacy tools should open their web browser and visit [http://server1.tbw.ri.cmu.edu/elt2010/svn\\_repo/live/](http://server1.tbw.ri.cmu.edu/elt2010/svn_repo/live/) and enter their user ID and password. If you are a teacher or an administrator, please contact the Asian University for Women administration to receive your login information. Administrators can create logins for teachers and students. Because different types of users will have access to different components, this manual explains the features available to each user.

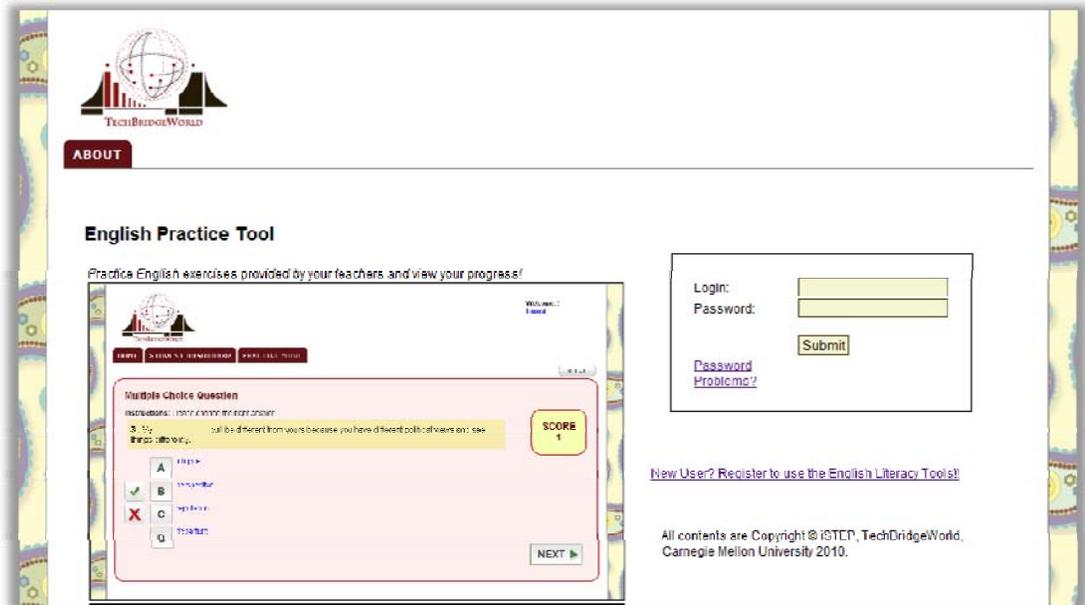


Figure 1: Log in page

### 11.3.3 Administrators

#### 11.3.3.1 Features

Administrators are top-level users who are able to give access, remove, and edit new users (administrators, teachers, teacher’s assistants, and students). Administrators have access to the control panel which manages users. This section outlines the unique features that administrators are able to access.

#### 11.3.3.2 Administering Users

After logging in, administrators will be taken to the control panel.

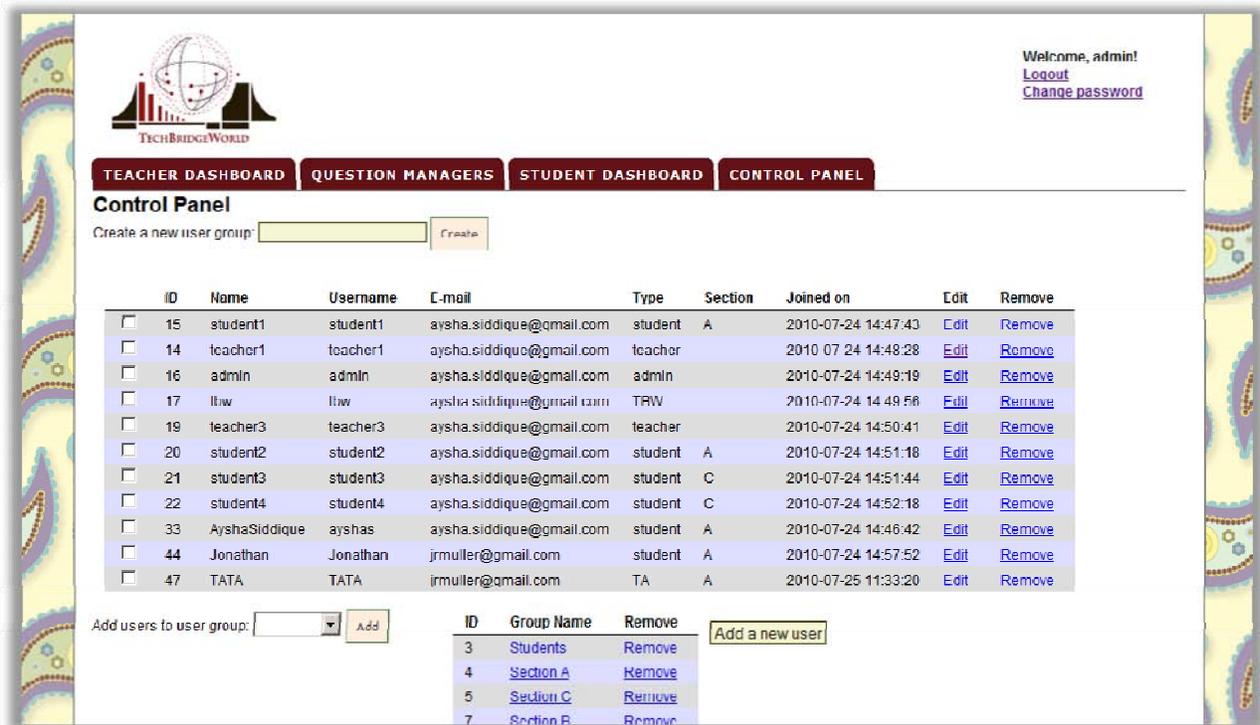


Figure 2: Administrator's Control Panel

Each row of the user table shows details of the users in the database. By clicking “Edit”, the administrator can edit a user’s details.

Type	Section	Joined on	Edit	Remove
student	A	2010-07-24 14:47:43	<a href="#">Edit</a>	<a href="#">Remove</a>
teacher		2010-07-24 14:48:28	<a href="#">Edit</a>	<a href="#">Remove</a>
admin		2010-07-24 14:49:19	<a href="#">Edit</a>	<a href="#">Remove</a>

Figure 3: Editing a User's Details

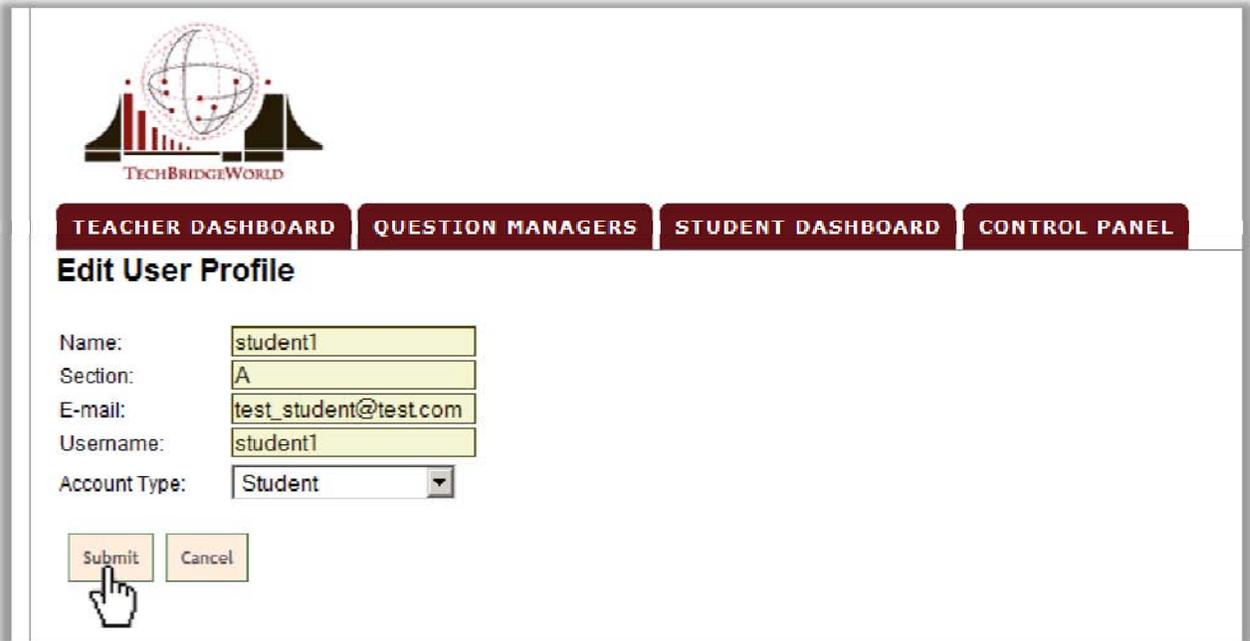


Figure 4: Click Submit to Save User Details

Clicking “Remove” deletes the user from the database. A confirmation box will appear asking if you are sure.

Joined on	Edit	Remove
2010-07-24 14:47:43	<a href="#">Edit</a>	<a href="#">Remove</a>
2010-07-24 14:48:28	<a href="#">Edit</a>	<a href="#">Remove</a>
2010-07-24 14:49:19	<a href="#">Edit</a>	<a href="#">Remove</a>

Figure 5: Removing a User

By typing a user group name into the “Create a new user group” text box, the administrator can create a new user group.

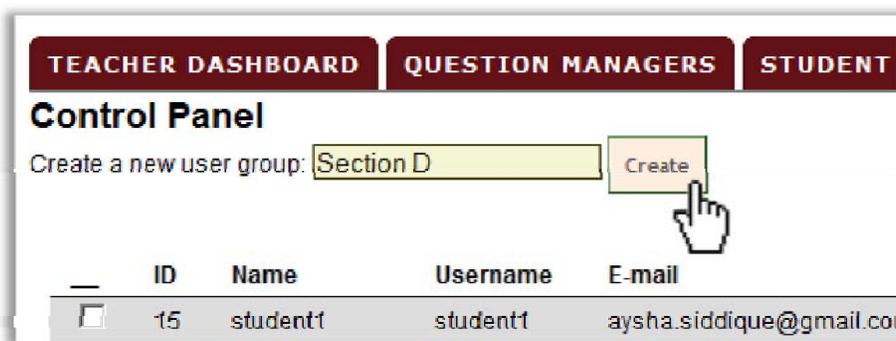


Figure 6: Creating a new user group

User groups are used by teachers to assign specific questions to specific students (All Students or Section A, for example). Once a new user group has been created, the administrator can click the check boxes next to student IDs and add users to specific user groups. *Note that if a user is not added to any group, they will not have access to any questions.*

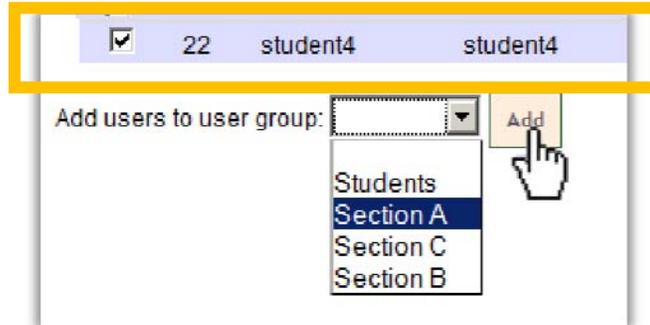


Figure 7: Adding users to a group

To find out which students are in which groups, the administrator can click on the group name under the **Group Name** heading. The students in the group will show up in a list to the right and from this list, users can be removed from groups.

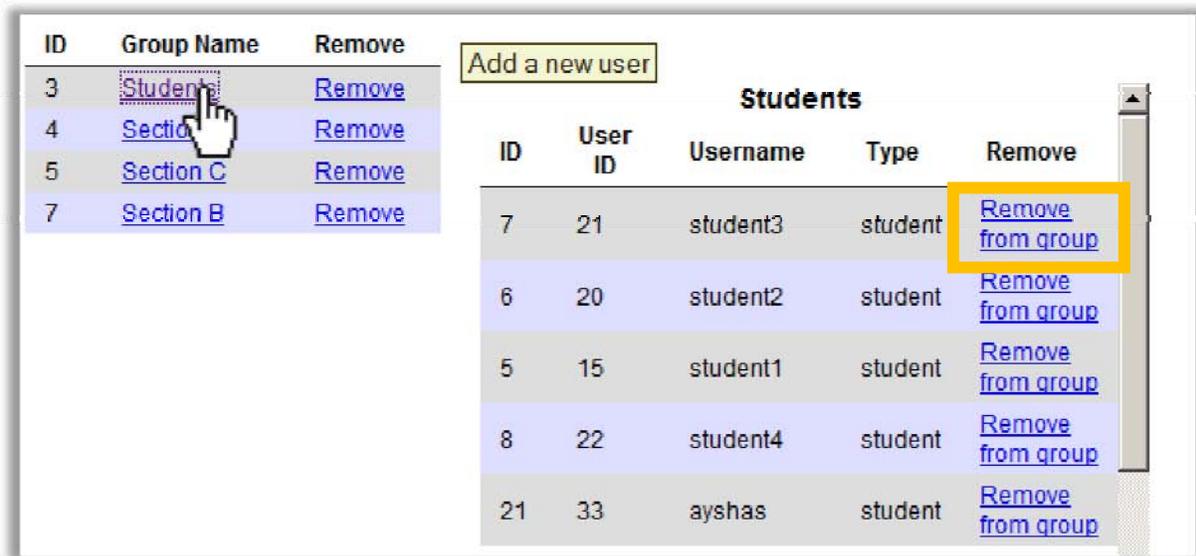


Figure 8: Removing users from a group

Finally, an administrator can create new user accounts. After clicking **Add a new user**, the administrator will fill in the necessary details and select a user type.

The image shows a web form for adding a new user. At the top, a button labeled "Add a new user" is highlighted with a yellow border. Below it, the form contains several fields: "Name:" with the value "myNewStudent", "User name:" with "Jane", "Email:" with "jane@auw.edu", and "Section:" with "A". The "User type:" field is a dropdown menu currently showing "Student", with a list of options expanded below it: "Student" (highlighted in blue), "Teacher", "Administrator", "Teacher's Assistant", and "TechBrideWorld". A "submit" button is located below the "User type:" field, with a mouse cursor pointing at it.

**Students** can only answer questions, while **Teachers** can create questions and monitor student progress, **Administrators** can create users, and **Teacher's Assistants** can only create questions. The **TechBridgeWorld** user account allows for researchers to access data necessary for monitoring and evaluation.

**Caution:** Create new teacher, teacher's assistant, and administrator accounts with care as they can be abused by untrained users.

## 11.3.4 Teachers

### 11.3.4.1 Features

The English Literacy Tools was designed to be easy to use, flexible, and capable of meeting teachers' needs. As a result, there are many features available, including the ability to create customized questions of several different types. Teachers can also monitor student or student group performance overall or in specific learning areas.

### 11.3.4.2 Teacher Dashboard

Once a teacher logs into the tool, they are provided with an overview of all student progress over time. This data is represented in tabular and graphical format.

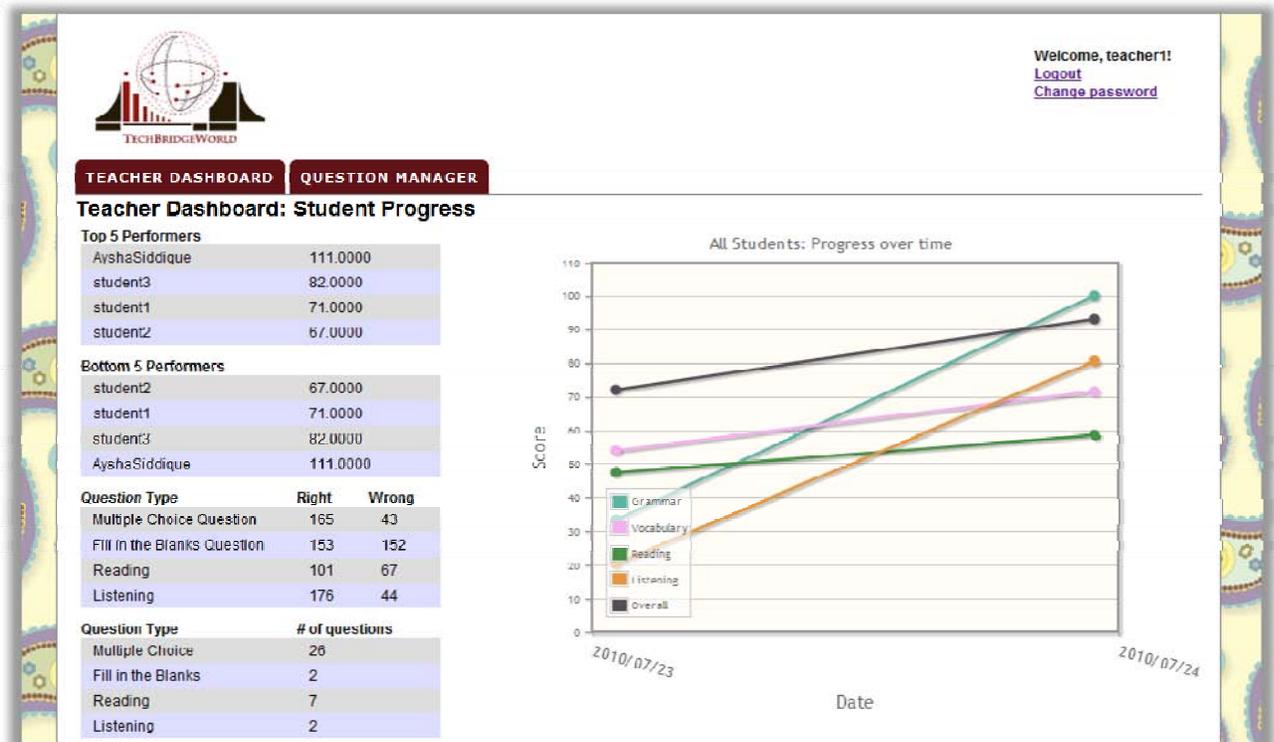


Figure 9: Teacher's Dashboard Showing Student Progress

The tables show the top five and bottom five performers as well as the total number of right and wrong questions answered and the number of question types available in the database. To the right of the tables is a graphical representation of student performance in four question categories (Grammar, Vocabulary, Reading, and Listening), as well as an overall indicator averaging all categories.

Teachers can also view a particular student's progress by searching for their name or view the collective progress of a group of users.

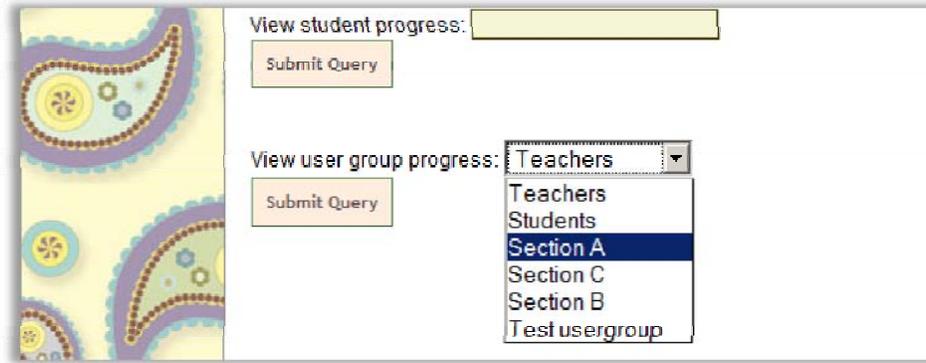


Figure 10: Viewing student or group progress

#### 11.3.4.3 Question Manager

After logging in, teachers can access the Question Manager at any time by clicking on the “Question Manager” tab. The Question Manager is a question authoring tool for teachers and teacher’s assistants. Once at the Teacher Dashboard, teachers can **Search & View Questions** or **Create and Edit Questions**. The default tab is Search & View Questions, and the first question in the database is shown. Teachers can advance to other questions by clicking next or the numbers in the list below.



After clicking on the Question Manager tab, a teacher can search & view or create & edit questions.

The screenshot displays the 'Question Manager' interface. At the top left is the 'TehBhedaWorld' logo. On the top right, it says 'Welcome, teacher!' with links for 'Logout' and 'Change password'. Below the logo are two tabs: 'TEACHER DASHBOARD' and 'QUESTION MANAGER'. The 'QUESTION MANAGER' tab is active, showing two buttons: 'Search & View Questions' (highlighted in yellow) and 'Create & Edit Questions'. Below these are several filter dropdowns: 'Question Type', 'Difficulty Level', 'Primary Category', 'Sub Category', and 'Date Added', followed by a 'Filter Questions' button. The interface shows '37 Results' and a pagination control with buttons for 'previous', '1', '2', '3', '4', '5', '6', '7', '8', '9', '...', '36', '37', and 'next'. The main content area displays a 'Multiple Choice # 62' question. The question text is: 'My \_\_\_\_\_ will be different from yours because you have different political views and see things differently.' The answer is 'perspective'. The options are: 'intrigue', 'perspective', 'regulation', and 'departure'. To the right of the question are several management options: 'Difficulty Level: 1', 'Record time taken for question? No', 'Countdown timer for question? No', 'Public/Private Question: Public', 'Available for practice: Yes', and 'Specifications: Section A'. There are also three action buttons: 'Edit', 'Student View', and 'Remove'.

Figure 11: Question Manager

#### 11.3.4.3.1 Search and View Questions

Teachers can filter questions based on **Question Type** (Multiple Choice, Fill in the Blank, Listening, or Reading), **Difficulty Level** (Easy, Medium, or Hard), **Primary Category** (Grammar, Vocabulary, Reading, or Listening), **Sub Category** (Verbs, Prepositions, Modifiers or other user entered sub category), and **Date** (that the question was added to the database). Once the user has selected the desired drop down options, they click filter questions and the result of the operation will be populated in the numbered list below.

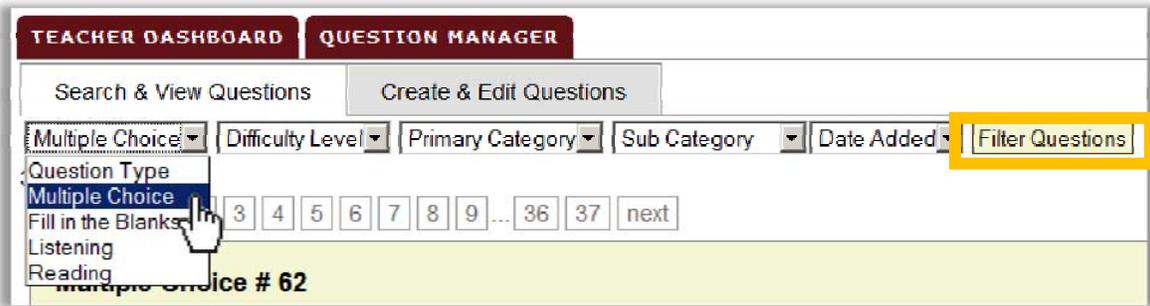


Figure 12: Filtering Questions

The details of the question including the associated metadata are displayed (instructions, questions, correct answers, etc.) and updated as the user scrolls through the questions. From here, a user can **Edit** a question, preview the question in the **Student View**, make a **Copy** of the current question to create a new question based on an existing question, or **Remove** a question (from the database entirely).

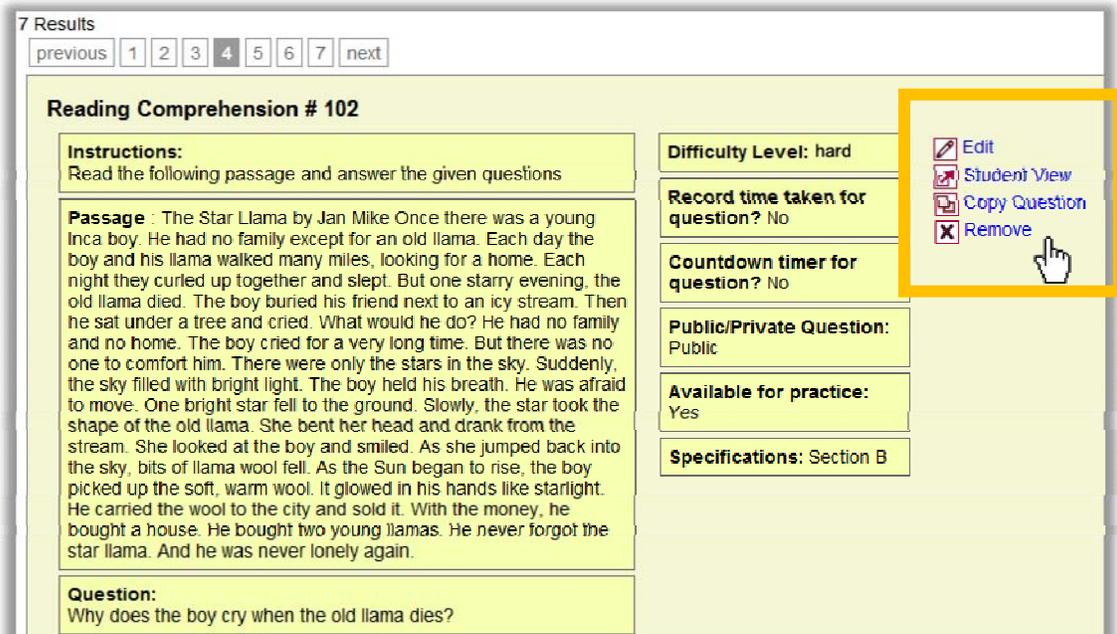


Figure 13: Edit, View Student View, Copy Question, or Remove Question

Clicking **Edit** will take the user to the **Create & Edit Questions** tab and populate the current question data into a data input form, which can be changed and saved.

### 11.3.4.3.2 Creating Questions (Common Fields)

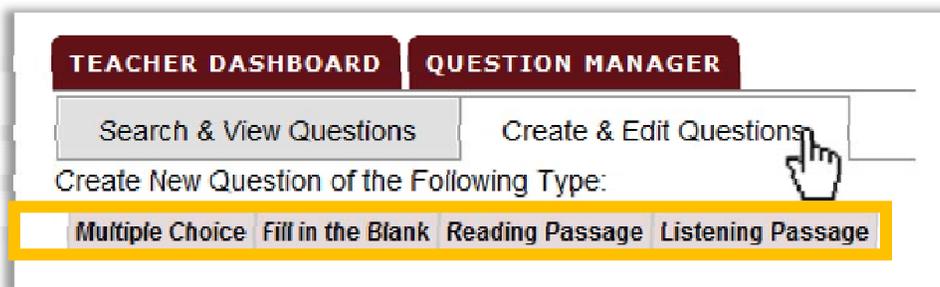


Figure 14: Creating New Questions

To create new questions, teachers must click on the **Create & Edit** tab and then click on one of the four question types (Multiple Choice, Fill in the Blank, Reading, or Listening). All four questions share some similar data attributes. Teachers must **Choose** which **Main Category** of question they are creating (Grammar, Vocabulary, Listening, or Reading).



Figure 15: Selecting a Category

Optionally, teachers can also **Choose** or enter **new** subcategories. All questions require that teachers enter a set of **Instructions**.



Figure 16: Selecting or Creating a Sub Category

Other common question data include an **Explanation** of the answer and the **Explanation URL** as well as **difficulty level**. Difficulty level is assigned as **Easy**, **Medium**, or **Hard**. Question difficulty and the measurement of difficulty are determined by the teacher. Questions can be made **available** for practice or **disabled** and can be made available to all students or to certain student groups. Finally, questions can be made **public** (public questions can be viewed by all teachers) or kept private to the author (private questions can only be viewed by the teacher who created the question). After making these selections, a teacher then clicks **Submit** to save the question.

Explanation: (optional)

Explanation Url: (optional)

Choose the difficulty level: Easy

Make question available for practice?: Yes:  No:

Make question available for user groups: Students

Make question public to all teachers?: Yes:  No:

Submit

Figure 17: Final Selections and Submission

The next sections will discuss the distinct data entry that is required for each question type.

#### 11.3.4.3.3 Creating Multiple Choice Questions

Beyond the common data required for each question type, there is also specific data required for the multiple choice question types. Each question requires **Question** text and at least two possible **Answers**. The teacher must also **Check** the radio button next to one of the answer choices to indicate which is the correct answer.

Instructions:

Question:

Answer:   Check if correct

Answer:   Check if correct

Add Another Answer Remove Last Answer

Figure 18: Adding additional answers to a multiple choice question

If more than two possible answer choices are required, a teacher can add additional answer inputs by clicking **Add Another Answer**. Later, they can also click **Remove Last Answer** to limit the number of answer choices.

**Instructions:**  
 What is the parallel structure of this sentence?

**Question:**  
**She received a cake and a party on her birthday.**

Answer: adjective  Check if correct  
 Answer: adverb  Check if correct  
 Answer: noun  Check if correct  
 Answer: gerund  Check if correct  
 Answer: infinitive  Check if correct  
 Answer: verb  Check if correct

Add Another Answer Remove Last Answer

Figure 19: Multiple Choice Questions

Once all necessary data has been entered, the user can then click on **Submit** and they will be taken to a new multiple choice question form with a link to the last question added to the database.

Create New Question of the Following Type:

Multiple Choice Fill in the Blank Reading Passage Listening Passage

Question added!  
[View Question](#)

**Create New Multiple Choice Question**

Figure 20: Question Successfully Added

#### 11.3.4.3.4 Creating Fill in the Blank Questions

Fill in the blank questions are created by clicking **Create & Edit Questions** in the **Question Manager** and then clicking on the **Fill in the Blanks** button.

**TEACHER DASHBOARD** **QUESTION MANAGER**

Search & View Questions Create & Edit Questions

Create New Question of the Following Type:

Multiple Choice **Fill in the Blank** Reading Passage Listening Passage

Figure 21: Creating Fill in the Blank Questions

The user will enter common question data and then build a fill in the blank question by typing a sentence and then clicking, **Insert New Blank**.

Type your sentence and click the button below to enter "fill in the blank" placeholders.

**Insert New Blank**

My teacher told us to arrive

Once the user clicks **Insert New Blank**, a placeholder for a blank will be entered into the text box.

Type your sentence and click the button below to enter "fill in the blank" placeholders.

**Insert New Blank**

My teacher told us to arrive \_1\_

At this point, a user can finish the sentence and enter text into the box labeled **blank: \_1\_**.

Type your sentence and click the button below to enter "fill in the blank" placeholders.

**Insert New Blank**

My teacher told us to arrive \_1\_ class early on Monday.

**Blank: \_1\_**

to   Check if correct

[Add another answer](#)

If the teacher puts only one answer into the **Blank**, the blank will be displayed to the student as an input text box, and the student must type in the correct answer. In this case, the teacher must click on the **Check if correct** radio button next to the single answer option for the blank.

Type your sentence and click the button below to enter "fill in the blank" placeholders.

**Insert New Blank**

My teacher told us to arrive \_1\_ class early on Monday.

**Blank: \_1\_**

to   Check if correct

[Add another answer](#)

Explanation: (optional)

If a teacher wants the blank to be displayed to the student as a drop-down menu with multiple answer choices, they must click **Add another answer** and type in another answer choice. Teachers can add up to seven answer choices.

Type your sentence and click the button below to enter "fill in the blank" placeholders.

Insert New Blank

My teacher told us to arrive \_1\_ class early on Monday.

Blank: \_1\_

to  Check if correct

from  Check if correct

[Add another answer](#)

To add more blanks, a teacher simply needs to continue typing and click the **Insert New Blank** when they want the blank to appear in the text. The process for adding new options to the next blank is the same and again, the correct answer must be checked. Teachers can add up to 6 blanks to a passage.

Type your sentence and click the button below to enter "fill in the blank" placeholders.

Insert New Blank

My teacher told us to arrive \_1\_ class early on Monday. I told her that we will be \_2\_ time.

Blank: \_1\_

to  Check if correct

from  Check if correct

[Add another answer](#)

Blank: \_2\_ | [Remove Blank](#)

through  Check if correct

over  Check if correct

on  Check if correct

[Add another answer](#)

If a teacher decides to remove a blank, they can click **Remove Blank**.

Type your sentence and click the button below to enter "fill in the blank" placeholders.

Insert New Blank

My teacher told us to arrive \_1\_ class early on Monday. I told her that we will be \_2\_ time.

Blank: \_1\_

to  Check if correct

from  Check if correct

[Add another answer](#)

Blank: **2\_ | Remove Blank**

through  Check if correct

over  Check if correct

on  Check if correct

[Add another answer](#)

Type your sentence and click the button below to enter "fill in the blank" placeholders.

Insert New Blank

My teacher told us to arrive \_1\_ class early on Monday. I told her that we will be time.

Blank: \_1\_

to  Check if correct

from  Check if correct

[Add another answer](#)

The teacher must also remove the surrounding text so that the passage makes sense. Note that every "fill in the blank" question must have at least one blank.

Type your sentence and click the button below to enter "fill in the blank" placeholders.

**Insert New Blank**

My teacher told us to arrive \_1\_ class early on Monday.

**Blank: \_1\_**

to  Check if correct

from  Check if correct

[Add another answer](#)

After completing all common data fields, the teacher can then click **Submit** and save the question. Finally they can click **View Question** to verify their work.

**11.3.4.3.5 Creating Reading Passage Questions**

Reading questions allow teachers to type or copy and paste reading passages for students who can then answer up to three multiple choice questions based on the passage. The common question inputs are very similar to other question types, however teachers must provide a reading passage for students to read and comprehend.

Reading passage questions are created by clicking **Create & Edit Questions** in the **Question Manager** and then clicking on the **Reading Passage** button.

**TEACHER DASHBOARD**    **QUESTION MANAGER**

Search & View Questions    Create & Edit Questions

Create New Question of the Following Type:

Multiple Choice    Fill in the Blank    **Reading Passage**    Listening Passage

After entering common question data, such as categories and instructions, users then type or copy and paste a passage into the "Passage" text box.

**Passage:**

Type or copy and paste a passage for reading.

**Question and Answers:**

Question: \_\_\_\_\_

Answer: \_\_\_\_\_  Check if correct

Answer: \_\_\_\_\_  Check if correct

Answer: \_\_\_\_\_  Check if correct

After creating the reading passage, teachers can enter up to three questions based on the passage (at least one question must be entered). For each question the teacher must provide at least two answer choices (optionally, up to four answer choices can be provided per question). Additionally the teacher must click on the "Check if correct" radio button next to the correct answer choice for each question entered.

Figure 22: One of Three Reading Passage Question and Answers

After entering this data and other required common question data, the teacher can click **Submit** and view the new question.

#### 11.3.4.3.6 Creating Listening Passage Questions

Listening questions allow teachers to create or select listening passages and then create up to three multiple choice questions associated with the listening passage. The common question inputs are very similar to other question types, but listening questions are distinct in that they allow teachers to record voice passages or select YouTube videos for listening.

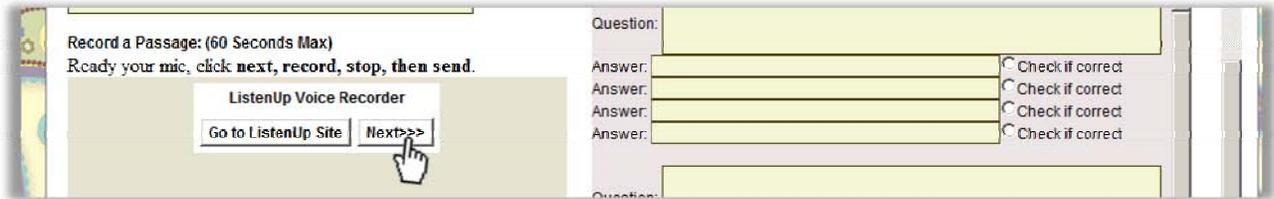
Listening passage questions are created by clicking **Create & Edit Questions** in the **Question Manager** and then clicking on the **Listening Passage** button.

After filling in common required fields, the user must decide whether they will record an audio passage or select a YouTube video.

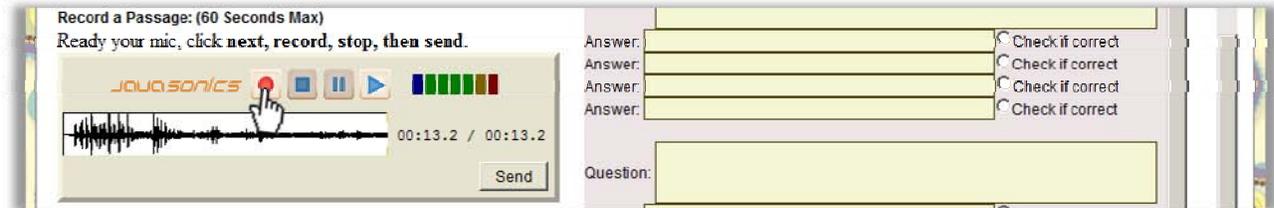
#### Recording an Audio Passage

To record an audio passage, a user must have a microphone. On-board laptop microphones will record a great deal of hiss and machine noise, therefore it is advised that either a handheld microphone or microphone headset are used to record the listening passage. Passages can only be up to 60 seconds in length, therefore it is advised that users write down and practice saying their listening passage before recording. Note that recording and saving several unused listening passages will take up unnecessary server space.

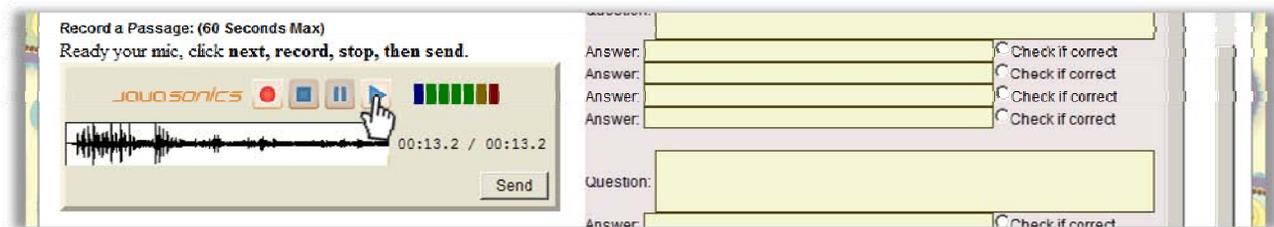
**NOTE:** Users may have to enable Java and/or provide authorization to launch the Java applet, which is required to record audio.



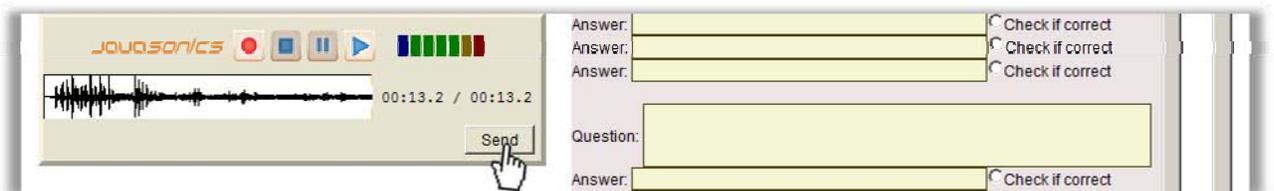
After clicking **Next**, the page will display a *Javasonics* audio recorder. Users can then ready their microphone and click the **record icon**.



While recording, users should notice a wave form scrolling and time lapsing, indicating that a recording is in progress. When finished recording, the user can click the **stop icon** and preview their recording by clicking the **play icon**.



If the user is not satisfied with their recording, they can click record again. If they are satisfied, they can click the **Send button**.



After clicking the send button, the user is given one more chance to preview the audio file by clicking **Play Recorded Message**. If they are happy with their recording, they can click Use this Listening Passage and the **Audio File URL** will populate. If they are not happy with it, they can click **or record another** and rerecord a passage.

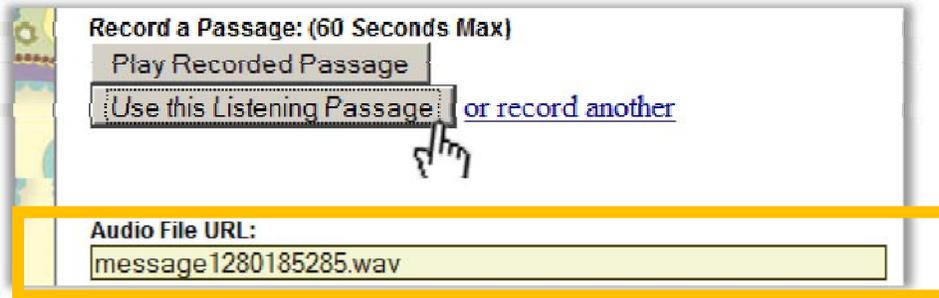
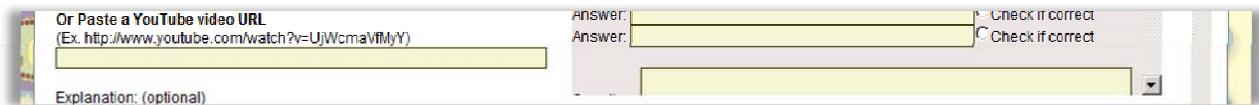


Figure 23: Using the Listening Passage You've Recorded

The user can then move on to filling in the other required data, including multiple choice questions associated with the listening passage.

### Selecting a YouTube Video

Teachers can select a YouTube video for listening comprehension instead of recording a passage. By scrolling past the audio recorder and Audio File URL, teachers will see a location to paste a YouTube video URL.



Teachers can go to YouTube.com and search for video that can be used for listening comprehension. Once they have selected a video, they can copy the URL of the video from the browser address bar.



Figure 24: Required Youtube URL Format

The URL must be formatted as “**http://www.youtube.com/watch?v=#####**” or the application will not allow for submission of the entry.

After recording a listening passage or selecting and inputting a YouTube clip, users can then create questions based on the passage. At least one question must be entered, and at least two answer choices must be provided for each question. Additionally the correct answer must be specified for each question by click on the “Check if correct” radio button next to the correct answer choice.

**Question and Answers:**

Question:

Answer:   Check if correct

Answer:   Check if correct

Answer:   Check if correct

Answer:   Check if correct

**Figure 25: Listening Questions and Answers**

After entering this data and other required common question data, the teacher can click **Submit** and view the new question.

### 11.3.4.3.7 Editing Questions

After a user has created a question of any type, it can be edited by clicking **Edit**.

**TEACHER DASHBOARD QUESTION MANAGER**

Search & View Questions | Create & Edit Questions

Create New Question of the Following Type:

Multiple Choice | Fill in the Blank | Reading Passage | Listening Passage

Multiple Choice # 228

Instructions: What is the parallel structure of this sentence?

Question: She received a cake and a party on her birthday.

Answer: noun

Options:

- adjective
- adverb
- noun
- gerund
- infinitive

Difficulty Level: 1

Record time taken for question? No

Countdown timer for question? No

Public/Private Question: Public

Available for practice: Yes

Specifications: Students

**Edit** | Copy Question | Remove

**Figure 26: Editing Questions**

After clicking **Edit**, users will be taken back to the create questions form, but it will be populated with the current data. Users can then change inputs and click **Submit** to save the question.

**TEACHER DASHBOARD** **QUESTION MANAGER**

Search & View Questions | Create & Edit Questions

Create New Question of the Following Type:

**Multiple Choice** | Fill in the Blank | Reading Passage | Listening Passage

**Multiple Choice**

Choose the main category: Grammar

Choose the sub category: None | Or enter a new one:

**Instructions:**  
What is the parrallel structure of this sentence?

**Question:**  
She recieved a cake and a party on her birthday

Answer: adjective  Check if correct  
 Answer: adverb  Check if correct  
 Answer: noun  Check if correct  
 Answer: gerund  Check if correct  
 Answer: infinitive  Check if correct  
 Answer: verb  Check if correct

Add Another Answer | Remove Last Answer

Explanation: (optional)

Explanation Uri: (optional)

Choose the difficulty level: 1

Make question available for practice?: Yes  No

Make question available for user groups: Students

Make question public to all teachers?: Yes  No

Submit | Cancel

Figure 27: Editing and Submitting and Question

#### 11.3.4.3.8 Copying Questions

In the **Search and View Questions** pane of the **Question Manager**, there is a **Copy Question** button. With this feature, questions can be used as templates to create new questions. The copy function allows users to duplicate a question, change its contents and save it to the database.

**Multiple Choice # 228**

**Instructions:**  
What is the parallel structure of this sentence?

**Question:**  
She recieved a cake and a party on her birthday

**Difficulty Level:** 1

**Record time taken for question?** No

Edit  
 Student View  
**Copy Question**  
 Remove

Figure 28: Copying Questions

When a user clicks on **Copy Question**, an exact duplicate of the question is loaded into the question edit form. However, when this form is submitted, the question will be saved as a new question. The teacher must change the question significantly or they will be

presented with an error message alerting them to the fact that they have tried to create a duplicate question.

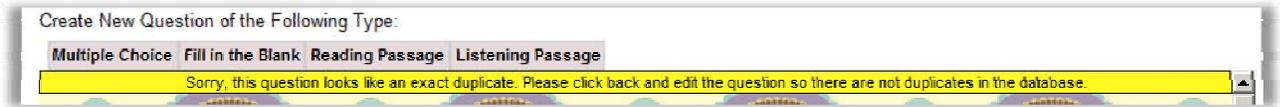


Figure 29: Duplicate Question Alert

### 11.3.5 Teacher's Assistants

Teacher's Assistants are able to access the Question Manager but are not allowed to access the Teachers Dashboard to see student data.

## 11.3.6 Student

### 11.3.6.1 Student Dashboard

The student interface provides individual performance metrics for different question categories in tabular and graphical format. **Choosing Practice Mode** displays questions to students.

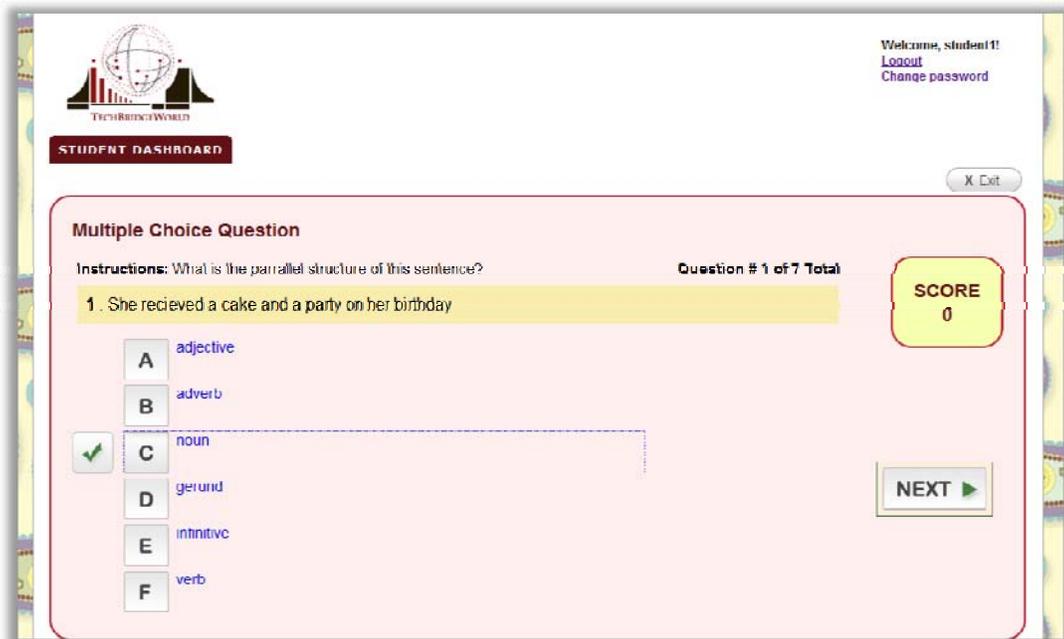


Figure 30: Student Dashboard

### 11.3.6.2 Question Types

Students can practice questions from the major categories (Grammar, Vocabulary, Reading, and Listening) or choose to answer questions of all types.

#### Multiple Choice Questions



The screenshot displays a 'Multiple Choice Question' interface. At the top left is the 'TECHBRIDGEWORLD' logo. At the top right, it says 'Welcome, student!' with links for 'Logout' and 'Change password'. Below the logo is a 'STUDENT DASHBOARD' button. In the top right corner of the question area, there is an 'X Exit' button. The question text is: 'Instructions: What is the parallel structure of this sentence? Question # 1 of 7 Total'. The question itself is: '1. She recieved a cake and a party on her birthday'. To the right of the question is a yellow box labeled 'SCORE 0'. Below the question are six options: A adjective, B adverb, C noun (selected with a green checkmark), D gerund, E infinitive, and F verb. At the bottom right is a 'NEXT' button with a right-pointing arrow.

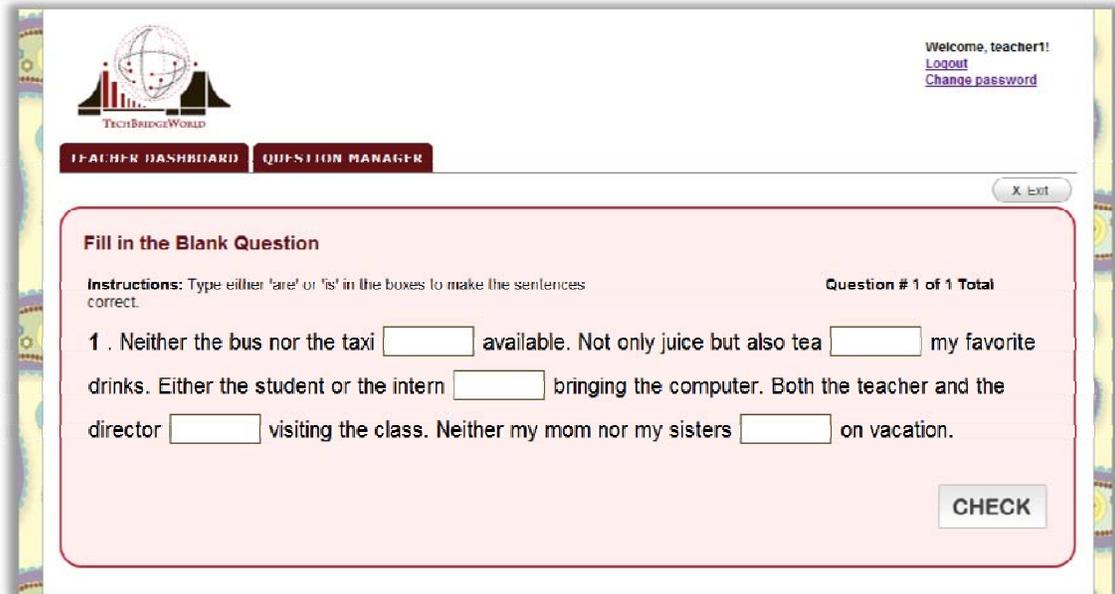
## Listening Questions (Audio Passage)

The screenshot shows a student dashboard for a listening question. At the top left is the 'TchBridgWorld' logo. At the top right, it says 'Welcome, student1!' with links for 'Logout' and 'Change password'. Below the logo is a 'STUDENT DASHBOARD' tab. A 'X Exit' button is in the top right corner of the question area. The main heading is 'Listening Passage Question'. Below it, it says 'Question #1 of 3 for this listening passage.' and 'Instructions: Read the poem by Emily Dickinson and answer the questions.' To the right, it says 'Question # 2 of 7 Total' and 'SCORE 1' in a yellow box. A 'PLAY' button with a red triangle icon is on the left. Below it, the question is '2. Who is Emily Dickinson writing to?'. There are four radio button options: A 'The world', B 'The news', C 'Nature', and D 'Her hands'. A green checkmark is next to option A. To the right of the options is an 'Explanation' box: 'Explanation: Visit the link to read the poem. For more info go to: http://www.infoplease.com/6llr/dickinson/1/'. A 'NEXT' button with a green arrow is at the bottom right.

## Listening Questions (YouTube Video)

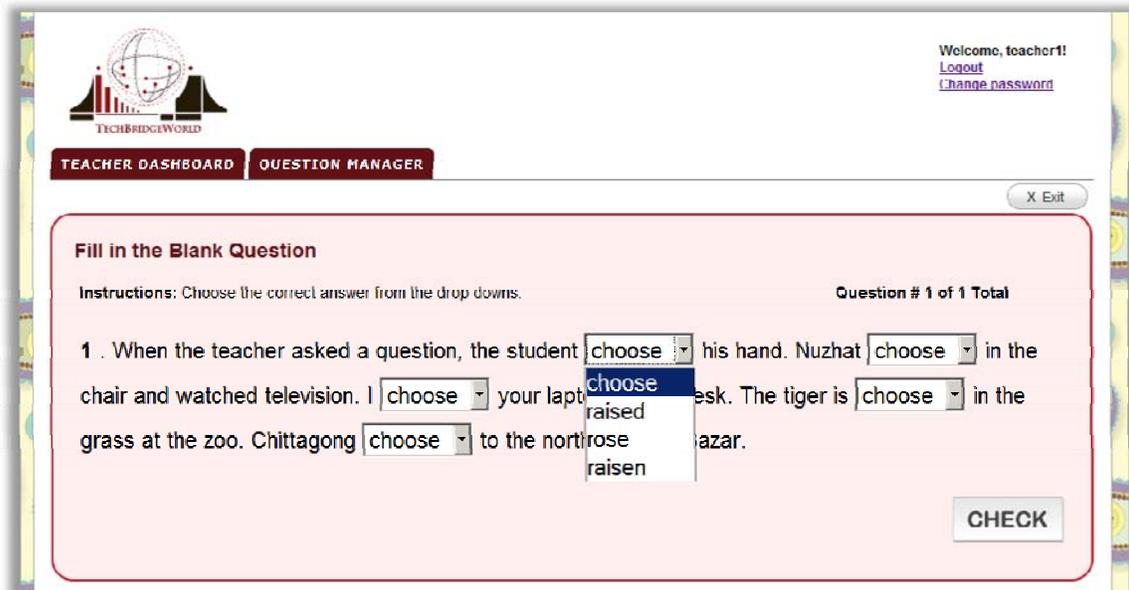
The screenshot shows a teacher dashboard for a listening question. At the top left is the 'TchBridgWorld' logo. At the top right, it says 'Welcome, teacher1!' with links for 'Logout' and 'Change password'. Below the logo are 'TEACHER DASHBOARD' and 'QUESTION MANAGER' tabs. A 'X Exit' button is in the top right corner of the question area. The main heading is 'Listening Passage Question'. Below it, it says 'Question #1 of 2 for this listening passage.' and 'Instructions: Watch Eric Mead's TED video and answer the following questions.' To the right, it says 'Question # 1 of 1 Total'. A YouTube video player is embedded in the center, showing a man (Eric Mead) speaking. Below the video, the question is '1. What is the best definition for the word placebo?'. There are two radio button options: A 'a take pill' and B 'a therapy'.

## Fill in the Blank (Text Inputs)



The screenshot shows a web application interface. At the top left is the logo for 'TECHBRIDGEWORLD' featuring a globe and a bar chart. At the top right, it says 'Welcome, teacher!' with links for 'Logout' and 'Change password'. Below the logo are two buttons: 'TEACHER DASHBOARD' and 'QUESTION MANAGER'. A small 'X Exit' button is in the top right corner of the question area. The main content area is titled 'Fill in the Blank Question' and 'Question # 1 of 1 Total'. The instructions are: 'Type either 'are' or 'is' in the boxes to make the sentences correct.' The question text is: '1. Neither the bus nor the taxi [ ] available. Not only juice but also tea [ ] my favorite drinks. Either the student or the intern [ ] bringing the computer. Both the teacher and the director [ ] visiting the class. Neither my mom nor my sisters [ ] on vacation.' A 'CHECK' button is at the bottom right.

## Fill in the Blank Question (Drop Downs)



The screenshot shows a web application interface similar to the first one. It has the same logo, navigation buttons, and user information. The main content area is titled 'Fill in the Blank Question' and 'Question # 1 of 1 Total'. The instructions are: 'Choose the correct answer from the drop downs.' The question text is: '1. When the teacher asked a question, the student [choose] his hand. Nuzhat [choose] in the chair and watched television. I [choose] your laptop [choose] desk. The tiger is [choose] in the grass at the zoo. Chittagong [choose] to the north [choose] bazar.' A 'CHECK' button is at the bottom right. A dropdown menu is open over the second 'choose' dropdown, showing options: 'raised', 'rose', and 'raisen'.

## Reading Passage



Welcome, teacher!

[Logout](#)

[Change password](#)

TEACHER DASHBOARD

QUESTION MANAGER

X Exit

### Reading Passage Question

Question #1 of 3 for this reading passage.

**Instructions:** Read the following passage and answer the given questions

Question # 1 of 1 Total

*The Star Llama by Jan Mike* Once there was a young Inca boy. He had no family except for an old llama. Each day the boy and his llama walked many miles, looking for a home. Each night they curled up together and slept. But one starry evening, the old llama died. The boy buried his friend next to an icy stream. Then he sat under a tree and cried. What would he do? He had no family and no home. The boy cried for a very long time. But there was no one to comfort him. There were only the stars in the sky. Suddenly, the sky filled with bright light. The boy held his breath. He was afraid to move. One bright star fell to the ground. Slowly, the star took the shape of the old llama. She bent her head and drank from the stream. She looked at the boy and smiled. As she jumped back into the sky, bits of llama wool fell. As the Sun began to rise, the boy picked up the soft, warm wool. It glowed in his hands like starlight. He carried the wool to the city and sold it. With the money, he bought a house. He bought two young llamas. He never forgot the star llama. And he was never lonely again.

1.

- A because he is afraid of the dark
- B because he is always sad
- C because the old llama is his only family

### 11.3.7 Known Issues and Limitations

The following is a list of known issues and limitations of the current English Literacy Tools system. If you would like to report new problems or request additional features, please send email to [help@techbridgeworld.org](mailto:help@techbridgeworld.org).

- The English Literacy Tools system has not been tested in all web browsers. If you use a browser other than Mozilla Firefox (under windows) you may encounter rendering issues when viewing some sections of the system.
- Duplicating “fill in the blank” questions is currently not supported (The “Copy Question” link is disabled when viewing “fill in the blank” questions).
- The java applet used for recording audio (used for listening questions) can run slowly on some computers resulting in very poor quality audio files.
- The Apple Quicktime plugin is required to play the audio files for listening questions. This plugin may need to be installed manually by downloading the installer from: <http://www.apple.com/quicktime/download/>
- Copy/pasting text from a Microsoft Word document can lead to errors because characters in the Word document may not render well in the English Literacy Tools system (can cause problems with the way questions are displayed).
- When a user group is deleted, any questions that were previously assigned to that user group will still be available to all users who were in the user group before it was deleted.

### 11.3.8 Credits and Contact Information

This manual has been developed for the version of the English Literacy Tools project that was developed in collaboration with the Asian University for Women as part of TechBridgeWorld's iSTEP 2010 internship.

The development of English Literacy Tools project has involved the work of many people. All of this work was coordinated through Carnegie Mellon University's TechBridgeWorld research group and Carnegie Mellon University in Qatar's Qri8 robotics lab.

We recognize the following individuals for their contributions to the work addressed in this manual:

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Ermine Teves  
Anthony Velázquez

The following organizations have been involved with TechBridgeWorld's field testing activities related to the work addressed in this manual:

Asian University for Women, Bangladesh

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Please note that this prototype version is intended solely for non-commercial use. If you plan to adapt this project or any of its components for commercial use please contact TechBridgeWorld staff at [info@techbridgeworld.org](mailto:info@techbridgeworld.org). Please also feel free to send direct inquiries about the English Literacy Tools project to TechBridgeWorld at any time.

## 11.4 Braille Writing Tutor User Manual

# Automatic Braille Writing Tutor User Manual

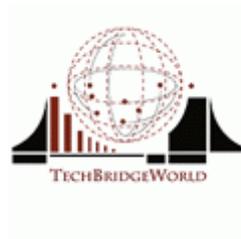
Designed for:

**Young Power in Social Action (YPSA)**



By:

**The iSTEP 2010 Interns**



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### 11.4.1 Introduction and Terminology

This document will serve as a guide for using the Automated Braille Writing Tutor (BWT) device. The BWT is a square shaped electronic device with 8 small legs, 8 buttons (6 buttons form a large braille cell and one button on either side of the large braille cell), and 32 braille cells. It should come with one mini USB cable and one stylus with a metal tip.

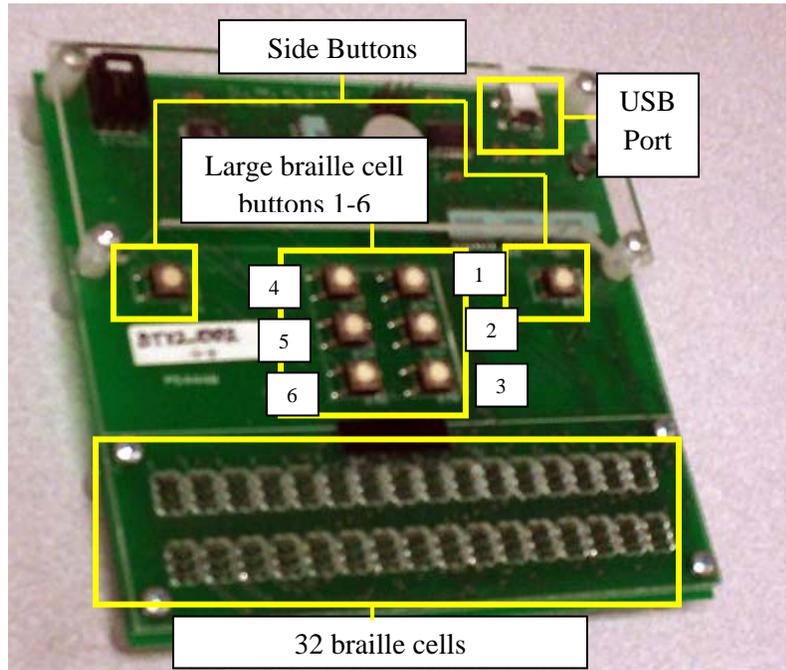


Figure 31: Automatic Braille Writing Tutor

### 11.4.2 Getting Started

The program used to start the BWT is called **btbt.exe**. The buttons are square extrusions with small circles on top of them. The cells are located at the bottom of the BWT and should have two rows of 16 cells each, which are shaped like the cells in an A4 frame. Each cell has 6 holes in it, spaced the same way as a braille cell. The mini USB cable plugs into the back of the BWT, and then into an available USB slot on a computer which has the proper drivers installed, as well as the **btbt.exe**, **btbt\_noinstructions.exe**, and **musicmaker.exe** files.

### 11.4.3 Connecting the Device

The BWT device connects to the computer's USB port. The USB port is found on the back panel of the computer. The smaller end of the provided USB cable connects to the port on the device. The other end of the cable must be connected to the USB port on the computer.

*If you are starting the BWT program for the first time, please read the instructions below:*

The BWT works only on a Windows machine. Your Windows system may require a driver to use the BWT. In many cases, plugging the BWT into your USB port will cause the operating system to download the appropriate driver if your computer is connected to the Internet. If this is not the case for you, run the provided driver installer program distributed with the software:

#### Driver Installer (CDM 2.02.04).exe

The driver supports Windows Vista, XP, 2000, and Windows Server 2003. Alternately, you may download the driver from the company that makes the BWT's USB interface chip: <http://www.ftdichip.com/Drivers/VCP.htm>.

Be sure to select a driver that supports the "FT232R" chip. Once the appropriate driver is ready, the BWT is a "plug-and-play" USB device. No additional steps are required beyond plugging the BWT into your USB port and running the BWT program.

Before you start the program you must first connect the device to the computer using the USB cable and also connect the headphones (or speaker) to the sound port on the computer's back panel. To start the program, double-click on the "Braille Tutor" (**btbt.exe**) icon on the desktop.

You should now be on the main menu of the BWT software. Test this by pressing button 1 or 4 – the tutor should say the name of a mode aloud. If you do not hear a voice, check to make sure the speakers and sound on your computer are on, and then try again. If this still does not work, please retrace these steps or refer to the "Troubleshooting" section of this manual.

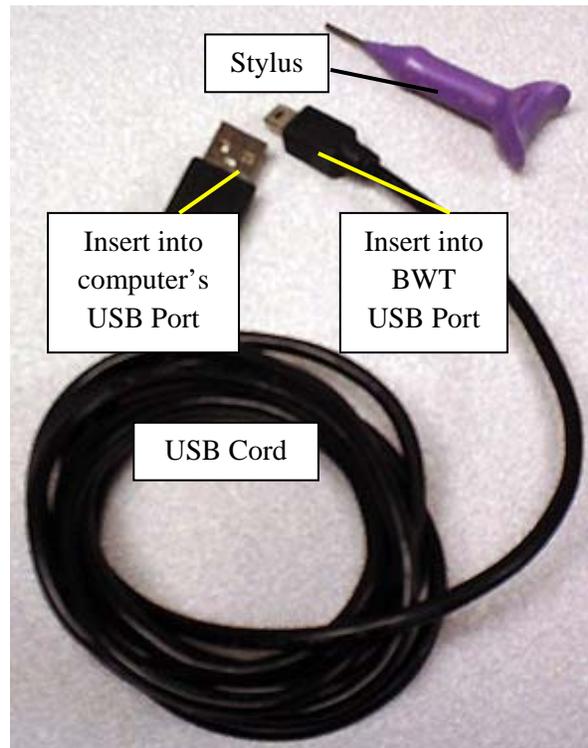


Figure 32: The USB Cord and Stylus

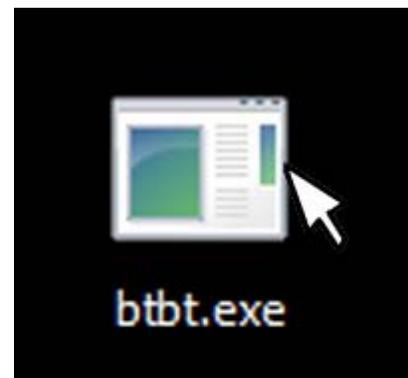


Figure 33: Braille Tutor Icon

#### 11.4.4 Interacting with the Device

There are two ways to interact with the BWT device; the button cell and the slate cells. To use the buttons, simply press down on the button with your fingertip. To use the slate cells, you must insert the stylus into the appropriate dot in the slate cell. The stylus must be inserted all the way down until it makes contact with the board below. The user may choose to use the button cell or the slate cells at any time when interacting with the device. The two side buttons are identical and provide additional functionality such as ending a dot pattern or switching modes. This is explained in more detail in the sections below. In all modes except mode 2 (Letter Practice) the program will say out loud each dot that you enter. For example if you press button 2 in the button cell or if you insert the stylus into dot 2 in any slate cell, the program will say “Two”.

#### 11.4.5 Buttons and Layout

When pressing a button, it should respond with a “click” sound. If you do not hear that sound, try pressing harder, if no “click” sound is made, you may not be pressing a button. Buttons are laid out in the following way:

<b>Side Button</b>	<b>4 1</b>	<b>Side Button</b>
<b>(Button 0)</b>	<b>5 2</b>	<b>(Button 0)</b>
	<b>6 3</b>	

#### 11.4.6 Inserting the Stylus into the Cells

The cells are numbered right to left. The first cell (cell 1) is located in the top row, far right. The last cell (cell 32) is located in the bottom row, far left. A stylus should be provided with the tutor for inserting into the cells.

There is some difference between an A4 frame and the BWT cells. It is important to fully insert the stylus into the holes in the cells. The stylus should be inserted vertically (not at an angle) down into the holes to ensure proper detection of the stylus. The stylus passes through the first board, down onto the second board, and it should feel as though you are pushing a pin through a cylinder onto a depression.

Sometimes users have the stylus pressed directly against the side wall of the frame, and cannot insert the stylus because of this. If the stylus is pressed against the frame, move the tip slightly in from the wall of the frame towards the center of the cell to locate the hole.

#### 11.4.7 Listening to the Instructions

The user should listen to the instructions fully before inserting a stylus or pushing a button. If the BWT is speaking instructions and the user either presses buttons or inserts a stylus before the BWT finishes, it may cause an error.

#### 11.4.8 Selecting a Mode

When you start the BWT software, you start on the menu. By pressing buttons 1 and 4, you scroll through the different modes that are available to you. Pressing button 1 scrolls right and pressing

button 4 scrolls left. As you scroll onto each mode, the tutor says the name of the mode. To select that mode, press the side button. The BWT will then enter that mode.

#### 11.4.9 Exiting a Mode

To exit a mode, hold down the side button, and then press any of the 6 middle buttons. This will exit the mode and the BWT will restart on the main menu. You can do this at any time. The BWT will not store your progress on any mode.

#### 11.4.10 Entering a Single dot

To enter a dot, the user should press any of the 6 middle buttons or insert a stylus into any of the dots within the cells on the bottom of the BWT

#### 11.4.11 Entering a Series of Dots

To enter a series of dots, either press any combination of the 6 middle buttons or insert the stylus into any combination of dots within a single cell on the bottom of the BWT. The user may press a button or insert the stylus into the same dot more than once without causing an error. A user can enter a dot pattern in any order.

#### 11.4.12 Finishing a Dot Pattern

There are three different ways to finish a dot pattern:

1. The user can input a series of dots (using any of the means described by Entering a Series of Dots) and then press either of the side buttons.
2. The user can input a series of dots into a cell using the stylus, and then start inputting another letter into a new cell.
3. The user can input a series of dots, and then wait for 5 seconds.

#### 11.4.13 Language Switching

The languages included on the BWT are Bangla and English. On the main menu, pressing the side buttons will allow a user to scroll through different language modes (English and Bangla). All modes are included in both languages. Other languages are also available (for example, French and Arabic) but are not currently included.

#### 11.4.14 Explanation of Modes

For the purposes of this section, when speaking of recommended skill level, the skill levels are defined in this way.

**Any:** Users of any age or skill level.

**Beginner:** Users who are being introduced to braille and the concept of braille cells for the first time.

**Intermediate:** Users who understand what a braille cell is but are still in the process of learning all of the letters.

**Advanced:** Users who have a good grasp of the letters of the alphabet.

#### 11.4.15 Learning modes

**Free Play:** This mode is meant for users to explore the relationship between dot location and dot number. The BWT says aloud a dot's number when the stylus is inserted into that dot or one of the 6 middle buttons are pressed.

*Interaction:* Buttons 1-6, Empty Braille Cell.

*Recommended Skill Level:* Any.

**Learn Dots:** This mode is meant to practice the relationship between the dot location and the dot number. The BWT instructs the user to find a specific dot. It will ask the user to locate a dot, and then wait for the user to either insert a stylus into that dot, or push the appropriate button. If the user indicates the correct dot, the tutor will respond with "good!" and ask the next question. If the user indicated the incorrect dot, the tutor will respond with "no" and ask for that dot again. This continues until the user indicates the correct dot.

*Interaction:* Buttons 1-6, Empty Braille Cell.

*Recommended Skill Level:* Beginner.

**Dot Practice:** This mode is meant to get users to practice inputting a series of dots. The BWT asks for a series of dots, and then waits for the user to correctly input that series of dots using either the stylus or the buttons. For example, the BWT will say "please press 1, 2" and wait for the user to press 1 and 2. These can be input in any order (for example, 1 then 2 or 2 then 1 both are correct answers). If the user inputs the correct answer, the tutor will respond with "good!" and ask a different series of dots. If the user inputs the incorrect answer, the tutor will respond with "no" and wait for the correct answer.

As the user answers correctly, the series of dots the tutor asks for will become increasingly longer (for example, first it will ask for 1 dot, then a 2 dot sequence, then a 3 dot sequence). As the user answers incorrectly, the series of dots the tutor asks for will become shorter.

Because most letters are represented by more than a single dot, this mode gets users to input a series of dots to build up to representing letters as a series of dots. The dot sequences that a user is asked to input actually represent the alphabets (but the user is not aware of this). That is, the user is not randomly pressing dot sequences but implicitly also learning the letters.

*Interaction:* Buttons 1-6, Empty Braille Cell.

*Recommended Skill Level:* Beginner.

**Learn Letters:** This mode is meant to teach the user the mapping between letters and dot sequences. The tutor internally divides the alphabet into subsets, and focuses on teaching the student one subset at a time. The tutor starts by instructing the user how to write a letter. For example, the tutor will say, "to write the letter A, press dot 1." The tutor then waits for the user to correctly input the sequence. If the user inputs a correct answer, the tutor will respond "good" and

move on to the next letter. If the user enters an incorrect answer, the tutor says “no” and repeats the instructions.

The tutor tests a subset of five to six letters at a time. When the tutor has reached the end of the subset it administers a test. The tutor will ask the user to write one of the letters within the subset. For example, the tutor will say, “write the letter A” and then wait for the user to input the correct sequence that represents A. If the user inputs the correct answer, the tutor tests another letter at random until it has tested all of the letters within the subset. If the user inputs an incorrect answer, the tutor asks for the letter again. If the user again inputs an incorrect answer, the tutor will instruct the user of the proper sequence, and then ask the user to enter that sequence. After this has been correctly completed, the tutor will continue with the testing.

Once one subset is finished, the tutor moves on to another subset of letters until it has taught and tested the entire alphabet.

*Interaction:* Buttons 1-6, Empty Braille Cell.

*Recommended Skill Level:* Intermediate.

**Letter Practice:** The goal of this mode is to allow the user to practice writing sequences of letters, which represent words. In this mode the BWT will prompt the user to input a series of letters which compose words in the given language. The tutor will say, “Please write A, T.” The tutor then waits for the user to input the proper characters. After a letter is input into the tutor the tutor will say the name of the letter the user has input.

Once the user inputs the correct series of letters, the tutor will say “good!” and move on to another series of letters. As the user continues to get answers correct the series of letters increases in length. If the user inputs the incorrect answer, the tutor says “no” and waits for the user to input the correct answer. If the user does not input the correct answer after three tries, the tutor instructs the user on the correct sequence of dots which represents the letter it has requested. The sequence of letters decreases in length as the user answers incorrectly.

*Interaction:* Buttons 0-6, Empty Braille Cell.

*Recommended Skill Level:* Intermediate.

**Free Spelling:** In this mode, the user can explore the alphabet. The goal of this mode is to allow users to freely explore the relationship between dot sequences and characters. It is particularly targeted at users who learn better through exploration than instruction. As the user presses a button or inserts the stylus into a dot, the tutor says the number of that dot aloud. The user can input a series of dots, and then employ any of the three methods described above (in the section Entering a Series of Characters) to make the tutor say the name of the corresponding letter aloud. If the user inputs a series of dots which does not have a corresponding letter, no sound is played.

*Interaction:* Buttons 0-6, Empty Braille Cell.

*Recommended Skill Level:* Any.

**Learn Numbers:** The goal of this mode is to teach the user the mapping between numbers and their corresponding dot sequences. This mode behaves similarly to Learn Letters, but instead of teaching the mapping between letters and dot sequences, the tutor instructs on the mapping between numbers and dot sequences. It does this by randomly selecting a number between zero and nine, and stating the name of the number, and then the series of dots which represent that number. It then asks the user to input the dot pattern that indicates a user will enter a number

(3,4,5,6) and then the pattern for that number. If the user inputs the correct answer, the tutor says “good!” and moves on to another number. If the user inputs the incorrect answer the tutor says “no” and instructs the user again on the proper sequence of dots which represents that number.

*Interaction:* Buttons 1-6, Empty Braille Cell.

*Recommended Skill Level:* Intermediate.

**Free Number Practice:** This mode behaves similarly to Free Spelling, but instead of allowing users to explore the relationship between letters and their corresponding dot sequences, it allows users to explore the relationship between numbers and their corresponding dot sequences. It also requires the user to write the number code before every number.

*Interaction:* Buttons 0-6, Empty Braille Cell

*Recommended Skill Level:* Any Game modes

**Hangman** (English Only): The goal of this game is to give the user practice writing individual letters and spelling words. In this game, the computer chooses a word, and the user is supposed to guess what the word is. The tutor will start by saying the word, with dashes where the letters are to obscure the answer (for example, the tutor says, “dash dash dash dash” which means the word is 4 letters and the user has not guessed any letters correctly yet).

The user guesses a letter which they think is in the word by inputting that letter into the BWT. If the letter is in the word, the tutor tells them the word constructed only with letters they have correctly guessed (for example if the word is “b-a-c-k” and the user guessed the letter A, the tutor would say “dash A dash dash”). If the user guesses a letter that is not in the word, they have made one mistake. The tutor will record and inform the user how many mistakes they have made - the user can only make 7 mistakes until the game is over.

*Interaction:* Buttons 0-6, Empty Braille Cell.

*Recommended Skill Level:* Advanced.

**Word Game** (Bangla Only): The goal of this game is to give the user practice writing individual letters and spelling words. In this game, the computer chooses a word and provides a clue about the word. The user has three chances to guess the word before the tutor will tell them the correct answer.

*Interaction:* Buttons 0-6, Empty Braille Cell.

*Recommended Skill Level:* Advanced.

**Animal/Sounds Game:** The goal of this game is to give the user a fun way to practice inputting letters to spell words. This game engages students by asking them to spell the name of an animal or thing when presented with the sound it makes

The tutor asks the user to “write the name of the thing that makes the sound” and then plays a noise. These noises include those of a bee, horse, cat, dog, rickshaw, and a few others. The name (and thus the answer to the command) is dependent upon the language.

To input the name of the thing, follow the instructions described in “Entering a Series of Characters”.

*Interaction:* Buttons 0-6, Empty Braille Cell.

*Recommended Skill Level:* Advanced.

**Music Maker:** Music Maker is a game where the BWT can be used to make music. The goal of this game is to get users to learn how to use the slate and stylus in a fun and interactive way. This game uses all of the 32 braille cells.

Each column represents a single beat. At every beat, there are six different tones, one for each dot in a column. All the tones are silent, until you insert a stylus into the hole to turn it on. Every beat (column) plays sequentially, and when it reaches the last row, the program loops back to the beginning.

The music loops constantly, so the user makes their music by deciding what notes should be on and what should be off. It is an exploratory way to make music, as well as practice inserting the stylus into the cells. The idea is that the user writes words and letters, and the BWT reads it back to them as music.

There is a separate executable to run this game. To start the game, follow the same instructions as “Starting the Program” section, except instead of double clicking on “**btbt.exe**” type “**musicmakergame.exe**”. This will start a separate game. The game starts reading what you write instantly. The more you write, the more complex the melody. If you want to end the game, hold the “Control” key and press the “C” key.

*Interaction:* All Braille Cells.

*Recommended Skill Level:* Any.

**Closing the Program:** The user may choose to stop using the program at any time. The program does not have to be restarted for a new user. The instructor should simply switch to the correct mode for the new user before asking the new user to get started. However, the program should be closed before shutting down the computer. To close the program simply hold down the “Control” key, and press “C” key.

You may now unplug the BWT and safely store it. Please store the BWT in a clean dry place, well away from contaminants such as dirt, dust, or excessive moisture.

### 11.4.16 Troubleshooting

This section provides a checklist of things to do when you encounter a problem while using the BWT device. If none of these suggestions work to fix your problem please contact TechBridgeWorld to get assistance (please see “Credits and Contact Information” section).

**Device is not detected:** If the program fails to detect the device you will hear an error message in the program window. If you hear this error message, check to see that the USB cable is connected to the device and the computer’s USB port. If the cable is already connected, unplug it and then plug it back in again and then restart the program.

**Nothing is happening:** When you finish using a BWT program on your computer, you must unplug your BWT and plug it back in again before you can run another BWT program. The current hardware has an “autodetect” mode that only runs when the BWT is plugged in; once a program cancels “autodetect” mode, the BWT will not return to that mode until it has been unplugged and plugged back in. If nothing is happening, unplug the USB cable from the BWT, plug it back in. Hold the “Control” key and press the “C” key to end the **btbt.exe** program. Then restart the program by double clicking the icon.

**Sound is not working:** If the sound is not working (you cannot hear anything on the headphones or speakers) make sure that the headphones/speakers are plugged in correctly to the sound card ports. Also check that the Windows volume control has not been muted. If all these are checked and the sound is still not working, try turning off the computer and turning it back on or trying a different pair of headphones or different speakers.

**BWT is talking on its own:** The BWT operates at a certain pace. If you enter information too quickly, the sound files will build up and you will not be able to enter information in the correct time. If you are hearing one sound file after another without entering information, pause for a minute and let the BWT catch up to you. However, if you enter information too slowly you may not be able to enter the full character before it tries to recognize the series of dots as a character. Best practice is to listen fully to the instructions, and then respond quickly. Do not try to input characters while the BWT is speaking.

The other possibility is that BWT is registering false input. When using the BWT, make sure it lies flat on a table, and that you are not inadvertently pressing undesired buttons. Also, do not pinch the top and bottom board together near the Braille cells. This will register as input. Users should place the BWT on a table and try not to handle the bottom of the circuit board with their palms or fingers. Touching the BWT in this way can lead to false signals.

**Cannot insert the stylus:** Please refer to the “Inserting the Stylus” section. Inserting the stylus properly can be tricky, but can be mastered with practice. Try moving the tip of the stylus in small circles. Gradually increase the radius of the circle until you find a hole to insert the stylus into. You can also use the frame of the cells to understand what hole you have found.

**Program terminates unexpectedly:** If the program terminates unexpectedly (the program closes or an error message is displayed) you must restart the program. If you get a prompt asking if you want report the error, click the “Don’t Send” button. Before you restart the program you must unplug the device and then plug it back in again. Once that is done you can restart the program by double clicking on the “Braille Tutor” icon on the desktop.

### 11.4.17 Credits and Contact Information

This manual has been developed for the version of the BWT that was tested and modified for Young Power in Social Action in Bangladesh in collaboration with the Asian University for Women as part of TechBridgeWorld's iSTEP 2010 internship.

The development of BWT hardware and software, as well as this and other versions of the BWT manual, have involved the work of many people. All of this work was coordinated through Carnegie Mellon University's TechBridgeWorld research group and Carnegie Mellon University in Qatar's Qri8 robotics lab. We recognize the following individuals for their contributions to the work addressed in this manual:

Sarah Belousov	M. Freddie Dias	Jonathan Muller
Vashkar Bhattacharjee	Imran Fanaswala	Lutfun Nahar
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Uhuru Mchanganyiko Primary School, Tanzania

University Computing Centre Limited, Tanzania

Young Power in Social Action, Bangladesh

The first and second versions of the BWT are in the process of being released under an Open Source license.

The sound files for the Animal Sound Game are from [www.freesound.org](http://www.freesound.org) under a Creative Commons Sampling Plus 1.0 License available at <http://creativecommons.org/licenses/sampling+/1.0/>. The initial files were created by: acclivity (cow, cuckoo, horse, rooster), HardPCM (tiger), eartrumpet (bee), vixuxx (crow), NoiseCollector (cat, dog), dobroide (duck, pigeon), kerri (flute), reinsamba (goat), milo (ship), RHumphries (tabla), sazman (train)

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Please note that this demo version is intended solely for non-commercial use. If you plan to adapt this tutor or any of its components for commercial use please contact TechBridgeWorld staff at [info@techbridgeworld.org](mailto:info@techbridgeworld.org). Please also feel free to send direct inquiries about the BWT (included in this package) to TechBridgeWorld at any time.

