Developing Web-based Tutorial Modules to Support Training for Group-based Mentoring

Sharon Locke[1], Georgia Bracey[1] and Stephen Marlette[2]
[1]*Center for STEM Research, Education, and Outreach, Southern Illinois University Edwardsville, PO Box 2224, Edwardsville, Illinois, U.S.A.*
[2]*Department of Curriculum & Instruction, Southern Illinois University Edwardsville, Edwardsville, Illinois, U.S.A.*

Keywords: Mentoring, Blended Learning, Web-based Learning, Self-Efficacy, STEM, Robotics.

Abstract: This paper describes the development and implementation of a series of interactive online modules that serve as the core component of a mentor training program for middle school teachers in the Botball® Educational Robotics Program. Botball is an international team-based robotics competition for secondary students. Over the course of a season, students work together to design, build, and program a robot that will meet a particular challenge. Teachers play a critical role in this process as team mentors, but there is currently no mentor training available that is easily accessible to teachers in a variety of geographic locations. To meet this need, and as part of a larger research study, three STEM educators at a US Midwestern university created five Web-based modules designed to introduce users to the fundamentals of group mentoring. These research-based tutorials provide on-demand distance training that is engaging and reflective. We will discuss formative evaluation of the training gleaned from responses to open-ended survey questions given to the initial group of 33 teachers who piloted the modules as well as from interactive webinars offered throughout the training.

1 INTRODUCTION

Mentoring plays a critical role in youth STEM (science, technology, engineering, and mathematics) activities. The relationship between student and mentor has been shown to have an impact on the success of the activity as well as the attitudes, interests, and learning of the participants. Moreover, students with positive perceptions regarding their mentor's effectiveness tend to have increased positive perceptions towards STEM careers (Weinberg et al., 2007). It is clear that adults who are effective mentors are more likely to produce positive outcomes from their students. Unfortunately, most adults do not have specific training in the practice of mentoring, and there are few training programs available that are easily accessible to those who may live miles away from the nearest university or training center.

As part of a university study examining components of effective mentor training for after-school robotics programs, five Web-based tutorials were developed as one piece of a larger training program. The larger program consisted of interactive webinars, a daylong face-to-face meeting, and the Web-based modules. As study participants moved through the program, they had opportunities to engage in activities with university faculty and staff to reinforce and reflect on the content presented in the modules. While many of these activities focused on mentoring in the context of Botball, the modules were designed to be tutorials that could stand on their own and be useful in any group-mentoring situation.

2 THEORETICAL FRAMEWORK

Two principles guided the content development of the Web-based modules. First, general best practices in mentoring--taken from theory and from empirical evidence--formed the basis of two of the five modules. These modules focused on team-building theory (Tuckman, 1965) plus practical issues such as formation of team members' roles, goal-setting, and creating cohesion. The content for a second pair of modules was developed around the theory of self-efficacy and its four components: mastery

Locke S., Bracey G. and Marlette S..
Developing Web-based Tutorial Modules to Support Training for Group-based Mentoring.
DOI: 10.5220/0004847901920196
In *Proceedings of the 6th International Conference on Computer Supported Education* (CSEDU-2014), pages 192-196
ISBN: 978-989-758-021-5

experience, vicarious experience, social persuasion, and physiological reaction (Bandura, 1977, 1997).

Pedagogy for the modules took a constructivist approach. Constructivism states that learners "learn actively and construct new knowledge based on their prior knowledge" (Huang, 2002). With this in mind, the modules were designed to be interactive and to encourage the learners to connect the content to their own experience and understanding. Thoughtful, open-response questions throughout the modules provided opportunity to interact with and reflect on the content.

3 MODULE DESIGN

The purpose of the Web-based modules was to present concepts of mentoring best practices and mentoring for self-efficacy in a self-paced format. The modules served as an introduction to mentoring that was later reinforced through a face-to-face workshop and webinars. Since mentors would complete the modules individually, the design incorporated engaging elements such as video clips and reflective questions that supplemented a narrative text. Summative questions at the end of the module checked participants' understanding of the content.

The team selected the Moodle development platform because it has an intuitive interface and is free to use. An outside consultant familiar with Moodle transferred the content into Moodle and developed the navigation features. The project team provided feedback on the graphic design and reviewed the online version of the module for accuracy.

3.1 Multimedia Presentation

The module narrative integrated images and videos to enhance interest and provide opportunities for participants to apply their knowledge (Figure 1). Video clips and images were selected from freely available content on the Internet and imported into the module platform. Reflective questions were embedded throughout the module.

After a concept was introduced using narrative or a video clip, participants responded to a prompt in an open form field (Figure 2). The reflective questions asked participants to draw on their own previous experiences in mentoring and often required application of new concepts presented in the module.

At the end of each module participants also completed a set of summative questions that served as a review of the material (Figure 3).

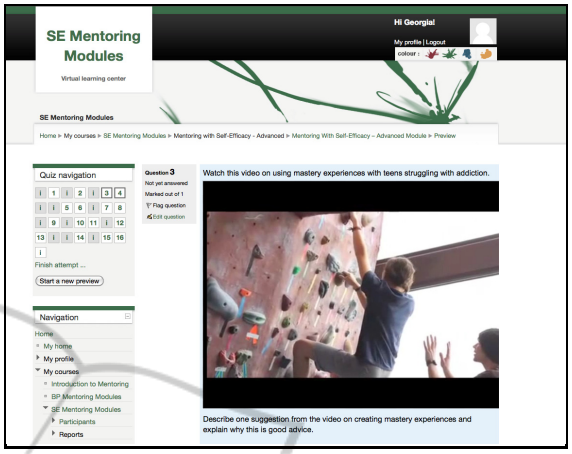

Figure 1: Module video interface.

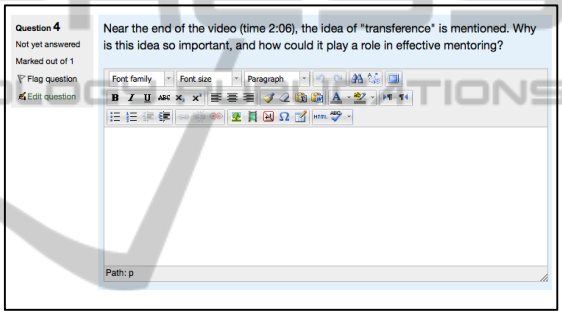

Figure 2: Example of reflective question.

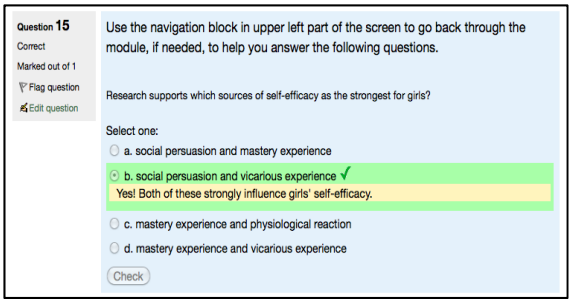

Figure 3: Example of summative question.

4 DATA COLLECTION

The modules include embedded reflective questions for participants to complete as they progress through the mentor training. The purpose of the questions is to help mentors identify and recall previous experiences with mentoring and reflect on the relevance of that prior experience to the new context. Researchers were able to access participants' answers in a database and use the

information to determine participants' prior mentoring experience, views on mentoring, and degree of engagement with the module content.

The open-ended answers provided detailed information about participants' previous mentoring experience and opinions about the mentoring process. In some cases participants were able to make meaningful connections between the module content and their own personal experiences, as shown in this response:

> *Adolescents love social interaction. The students in my class love anything that is hands-on where they can work with peers and socially interact. In a group mentoring program students must work together as a team. They get the chance to socially interact and make decisions together. They are forced to listen to each other's ideas and work together.*

The responses also served as a basis for preparing the webinar presentations, with example responses anonymously shown during the webinar. Participants were invited to explain their response in more detail if it appeared during the webinar and they were comfortable revealing their identity.

Multiple-choice questions at the end of each module are designed to reinforce the content and serve as a check for understanding; for example, the following question occurs at the end of the basic self-efficacy module: *Which one of the sources of self-efficacy is operating when a parent points out the positive and negative aspects of a child's work?* Participants receive feedback if they choose an incorrect answer and can go back to change their answer. After a participant finishes all the questions, the module is recorded as "Completed" in the system.

Participant responses to the embedded assessments in the modules also serve as data for the research study. Qualitative textual analysis of the open-ended responses can reveal themes for participants' views about mentoring that may influence how they respond to training. For example, many participants used mentoring examples from their own classroom teaching and some considered themselves to be experienced mentors. Participants who identify themselves as "experts" before the training may be less engaged with the ideas presented in the modules.

5 MODULE IMPLEMENTATION

The research project required that thirty-three middle-school teachers complete the online modules. Every teacher received a webinar introduction to the modules from the three STEM educators, and then completed the modules on their own time. The introductory presentation described the goals of the mentor training, provided the web link and login instructions for the Moodle site, and demonstrated how to navigate through the site to complete the assignment. Participants had ten days to complete their assigned modules. Technical assistance was available via email or phone.

The timing of the mentor training was planned so that mentors were adequately prepared to use the mentoring strategies to support their teams during the competition season. Mentors also participate in a Botball technical workshop seven weeks prior to the final Botball tournament. The following timeline illustrates the format, content, and delivery of mentor training:

6 weeks prior to Botball technical workshop (January): Mentors participated in a one-hour webinar that introduced the project goals, schedule, Moodle platform, and online modules.

5 weeks prior to Botball technical workshop: On their own, mentors completed online tutorials on mentoring best practices and/or self-efficacy. Available modules include an introductory module on theories, models, and benefits of mentoring; two best practices modules (basic and advanced) on research-based best practices in mentoring; and two self-efficacy modules (basic and advanced) on mentoring for self-efficacy.

4.5 weeks prior to Botball technical workshop: Mentors attended a one-hour webinar that reviewed the content presented in the online modules.

3 weeks prior to Botball technical workshop: Mentors participated in 8 hours of on-site training at their location. The workshop provided time for small-group activities and discussion and reflection on potential mentoring scenarios. The face-to-face workshop closely followed the content of the online modules.

Botball technical workshop (February): Mentors received the two-day Botball technical training, including practice with the robotics kits, design challenge, scoring, and rules and begin the mentoring process.

6 weeks prior to Botball tournament: Mentors participated in a two-hour webinar that reviewed and reinforced the key principles of mentoring (best practices and/or self-efficacy) and addressed mentor questions.

3 weeks prior to Botball tournament: Mentors participated in a two-hour webinar that addressed mentor questions or problems as related to best

practices and/or self-efficacy and reminded mentors of goals for implementation.

Week 7 of competition season (April): Botball tournament

6 MODULE EVALUATION

The developers had multiple avenues for evaluating the quality and impact of the online modules. The embedded questions provided insights into the level of engagement of the participant, e.g. through the length and quality of responses to open-ended questions. In addition, three webinars were conducted after the mentors had completed the modules. The second webinar provided a review and discussion of the module content, giving mentors a chance to ask questions and the STEM educators an opportunity to clarify concepts. The third and fourth webinars prompted mentors to reflect on how well they were able to apply the mentoring strategies presented in the modules during their robotics team meetings. All webinars were recorded, enabling researchers to transcribe and review the conversations and determine how well the module content was being transferred into practice. Lastly, a survey with open-ended questions about the mentor training was administered after the Botball robotics season had ended.

Data analysis for the preliminary evaluation focused on participants' responses to three open-ended survey questions: 1) What aspects of the mentor training did you find to be least helpful? 2) Did you encounter barriers or challenges to implementing the mentoring strategies? If so, please explain, and 3) Would you want to be a Botball mentor again? Please explain. Four members of the research team used open and analytical coding to look for emerging themes in the response text. Forty percent of respondents indicated that all of the training was useful, while less frequent themes included not enough time to complete all activities, repetition of the content across the three modes of delivery (online modules, webinars, face-to-face workshop), and duplication with content previously learned. Ninety percent of respondents indicated that they would want to be a Botball mentor again.

7 DISCUSSION

Evaluation findings revealed that there were no major concerns about the module content and format. Responding to the question "What aspects of the mentor training did you find to be least helpful?" forty percent of the participants responded that all of the training was useful:

> *I thought it was all useful. The training and modules had great information.*

A few participants characterized the mentor training overall as "repetitive," suggesting that delivering the same content in the modules, the face-to-face meeting, and the webinars may have been unnecessary for some participants:

> *The mentor training was useful, but often repetitive. More free-form discussion between the mentors would have been helpful.*

In contrast, one participant acknowledged the value in repeating content:

> *I had had experience with mentoring before, but the topics really solidified it and helped it become second nature. Although at times repetitive, it was all useful.*

Taken as a group, the responses did not identify one aspect of the blended learning environment as being more helpful than another. While some participants found it beneficial to interact with other mentors during the webinars, a small number did not. The face-to-face workshop was mentioned by only one participant in the open-ended response; this individual did not think the workshop was important. However, evaluation surveys administered to participants immediately following the face-to-face workshops were overwhelmingly positive.

These preliminary data suggest that the mentors viewed the blended learning environment as a positive experience. Many participants considered the web-based learning through modules or webinars to be effective for them. The mentors were comfortable with the online module format and offered meaningful responses to the embedded open-ended questions. The webinars enabled mentors to form a community of learners, where successful strategies were shared and struggling mentors could ask questions.

There is an extensive literature on learners' experiences in a blended environment (e.g., Bluic et al., 2007). Ausburn (2004) found that adult learners in a blended environment value options, personalization, self direction, variety, and a learning community. In a study of a university accounting course, Cottrell & Robinson (2003) found that students preferred blended learning to the traditional format and classroom time was reduced. Our study used a blended format for adult mentor

training in order to reduce the amount of face-to-face time required. Also, because half of the participants were located on the West Coast of the U.S., and all participants were from different schools, web-based learning was the only practical solution for delivering the content and facilitating ongoing dialogue between the trainers and the participants.

The evaluation to date has uncovered participants' perceptions of the value of different components of the training, but further study is needed to determine possible areas for improvement of the module content and pedagogy. The researchers are planning a focus group to further probe participants' opinions about the value of the modules and to solicit feedback on the design. The feedback will inform revision and refinement of the modules before a public version is made available.

The online module development described in this paper was a part of a larger research study to determine the best approach to mentoring in STEM. The study uses an experimental design to determine if one of three mentoring approaches is more effective in improving STEM-related outcomes for middle school students: mentoring for best practice, mentoring for self-efficacy, or mentoring using a combination of best practices and self-efficacy. The online modules are one component of the intervention being tested, which is fully outlined in Section 5 of this paper. Quantitative analysis of pre/post surveys of mentors and students in the three treatment groups and the control group is in progress and will be reported in a future paper.

8 CONCLUSIONS

The modules described in this paper were designed for a research project focusing on middle school teachers' mentoring skills for student robotics teams. The modules use a research-based approach to train mentors in the theory and practice of group mentoring. The first module is an introduction to group mentoring. Two of the modules focus on best practices in mentoring, including Tuckman's theory of group development. Two additional modules focus on the importance of self-efficacy for student outcomes. They describe the four sources of self-efficacy identified in the research literature and mentoring strategies that support students' self-efficacy. The module content is not specific to grade level or robotics, and instead has broad application for any situation where group mentoring is taking place. This new resource could serve as a valuable tool in other types of academic competitions such as Olympiads.

ACKNOWLEDGEMENTS

The authors wish to acknowledge project team members Profs. Gary Mayer, Susan Thomas, Jerry Weinberg, and Maja Matarić, Mr. Brad White, and Mr. Ross Mead, who provided review comments on early versions of the modules. Ms. Deb Greaney created the interface design in Moodle. Ms. Molly Brooks, Leann Henderson, and Rosemary Morr assisted with coding of open-ended responses. This material is based upon work supported by the U.S. National Science Foundation under Grant No. 1139400. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

REFERENCES

Ausburn, L. J., 2004. Course design elements most valued by adult learners in a blended online learning environment: An American perspective. *Educational Media International*, 41(4), pp.327-337.

Bandura, A., 1977. Self-efficacy: Toward a unifying theory of behavioural change. *Psychological Review*, 84(2), pp.191-215.

Bandura, A., 1997. *Self-Efficacy: The Exercise of Control*. Freeman. New York.

Bluic, A.-M., Goodyear, P. and Ellis, R. A., 2007. Research focus and Methodological choices in Studies into students' experiences of blended learning in higher education. *Internet and Higher Education*, 10, pp.231-244.

Cottrell, D. M. and Robinson, R. A., 2003. Blended learning in an accounting course. *The Quarterly Review of Distance Education,* 4(3), pp.261-269.

Huang, H., 2002. Toward constructivism for adult learners in online learning environments. *British Journal of Educational Technology,* 33(1), pp.27-37.

Tuckman, B. W., 1965. Developmental sequence in small groups. *Psychological Bulletin*, 63, pp.384-399.

Weinberg, J. B, Pettibone, J. C., Thomas, S. L., Stephen, M. L. and Stein, C., `2007. The impact of robot projects on girls' attitudes toward science and engineering. *Robotics Science and Systems (RSS) Workshop on Research in Robots for Education*, Georgia Institute of Technology, Atlanta, June 30, 2007. Available at http://www.roboteducation.org/rss-2007/,