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PROMOTING YOUNG GENERATIONS TO STEM FIELDS THROUGH THE BOY SCOUT MERIT BADGE UNIVERSITY IN EAST TENNESSEE

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ABSTRACT

The Sequoyah Council of the Boy Scouts of America (BSA) hosted its annual Merit Badge University at East Tennessee State University (ETSU) in Johnson City, Tennessee on January 25, 2014. Volunteers are students and faculty members from ETSU Surveying and Mapping Science (SAMS) program and local licensed surveyors from the States of Tennessee and Virginia. Seven Scouts registered for a Surveying merit badge to experience what Surveying was about. The annual Merit Badge University event allowed area Scouts to participate and receive their Surveying Badges as well as receive exposure to surveying field at an early age. The Merit Badge University offers the Scouts an opportunity to obtain a Surveying merit badge which requires a full day of commitment. The Scouts had an opportunity to experience some of surveying activities such as field work for traverse and leveling, 3D viewing with a pocket stereoscope, Global Navigation Satellite Systems (GNSS) demonstration, deed search, and drafting. Questionnaires from all participants revealed that they enjoyed most of activities and gained valuable experience about Surveying at the end of the event.

Keywords: Merit Badge University, Science Technology, Engineering, and Mathematics (STEM), Scouts, surveying merit badge

1. INTRODUCTOIN

The 2012 U.S. Census Bureau data reports that Tennessee's Congressional District 1, the East Tennessee region, has the lowest graduation rates for both high school or higher education (82.1%) and those with a bachelor's or higher degree holders (17.9%) among 9 Congressional Districts in the State of Tennessee [1]. The Author believes that education has been one of the key elements in providing a better environment to grow because it provides information, meaningful talents, self-empowerment, personal desires and growth. Several articles emphasize the importance of education especially Science, Technology, Engineering, and Mathematics (STEM) for the future [2, 3]. It is possible that allowing young scholars to events like the Merit Badge University may attract more interests in STEM at an early age.

On January 25, 2014 the Sequoyah Council of the Boy Scouts of America (BSA) hosted its annual Merit Badge University at East Tennessee State University (ETSU) in Johnson City, Tennessee. The Sequoyah Council serves more than 10,000 youths from 15 counties in the States of Northeast Tennessee and Southwest Virginia. About 200 Scouts gathered for the Merit Badge University and seven Scouts registered for a Surveying merit badge. The Merit Badge University offers the Scouts an opportunity to obtain the badges for prestigious ranks such as Eagle Scout and Eagle Palm. A wide variety of badges were offered in many fields like architecture, geology, fishing, music, surveying, etc. The Surveying merit badge was one of the original 57 merit badges issued by the BSA in 1911 [4]. Obtaining Surveying merit badge requires a full day, whereas other takes half day commitment. Some of the requirements for a Surveying merit badge are knowledge on first aid for cuts, heat and cold reactions, snakebite, and poisonous plants/animals,

performing field work for a five-sided lot and leveling, writing a legal description (metes and bounds), and drafting of the field work on a drawing paper. This event has been organized and supervised by many volunteers who gave lectures and surveyed and supervised the Scouts with their field and office work at ETSU since year of 2007. Volunteers are students and faculty members from ETSU Surveying and Mapping Science (SAMS) program and local licensed surveyors from the Northeast Chapter of the Tennessee Association of Professional Surveyors (TAPS) and the southwest chapter of the Virginia Association of Surveyors (VAS).

MORNING SESSION

The event started with an introduction of the Scouts to a group of volunteers, requirements of the Surveying merit badge, and history of the SAMS at ETSU and general information on surveying. Before the Scouts proceeded to field, they were instructed on how to fill out field book and handle equipment in classroom. Due to the increment weather (wind and snow), an indoor basketball court was reserved for field work in advance. Professional licensed surveyors demonstrated how to set up and operate a total station. Then the scouts divided into subgroups with two or three Scouts per group. At least one licensed surveyor and other available students assisted the Scouts to perform traverse and ensured that all Scouts had opportunities to operate both a total station and a prism pole (Figure 1).

Figure 1. Demonstration of Operating a Total Station by a Professional Licensed Surveyor at ETSU

AFTERNOON SESSION

After all field work performed, the Scout was escorted by volunteers to the Culp Center at ETSU for lunch. Lunchtime afforded the opportunity for the Scouts and volunteers to know each other better. The group of the Scouts and volunteers returned to the classroom for afternoon activities. While they were on lunch, loop closure from the Scouts were calculated by professionals due to the time restriction. The Scouts and volunteers were pleased to find out the errors of their traverse closure was within the allowable tolerance. The first afternoon activity was to introduce the Scout about requirements and processes of becoming a licensed surveyor. They were also informed of the potential hazards of surveying and necessary first aid applications during field work. Theory and procurers of leveling were discussed before the Scouts were instructed to perform leveling (Figure 2). The increment weather forced leveling to be performed on first and second floor inside of Wilson Wallis Hall. They started on an arbitrary control point on first floor through second floor and came back to where they started to close.

Figure 2. Scouts Performing Leveling Exercise at Wilson Wallis Hall

The Scouts were also taught about basic theory and applications of Real-Time Kinematic (RTK) Global Navigation Satellite Systems (GNSS) in the

classroom. Typically the use of RTK GNSS has been demonstrated to the Scout to show how traverse work done by the Scouts earlier could have been done in a more efficient manner. Due to the increment weather once again, demonstration of GNSS applications could not be performed outside. Instead, they watched a video clip related to GNSS on YouTube and had an opportunity to appreciate a GNSS receiver with a digital data collector indoor. Scouts practiced pocket stereoscopes for 3D viewing of aerial photographs. All of the Scouts showed interest and enthusiasm when they viewed objects such as buildings, trees in 3D based on two overlapped aerial photographs (Figure 3).

Figure 3. Scouts with Pocket Stereoscopes for 3D viewing

The Scouts were then taken to the computer lab. While a faculty member helped calculating closures from level loops, the Scouts were educated about lecture on deed records and metes and bounds description were given (Figure 4). They had opportunities to find their parents' or neighbors' deed documents from the State of Tennessee real estate assessment website.

Figure 4. Scouts Searching for Their Parents' Property Deed on the Internet

The errors of their leveling loop closure were also within the allowable tolerance so satisfactory results were achieved. The last activity for the event was hand-drafting of the field traverses on the drafting table (Figure 5). After they finished their drawings, they were taken to the Culp Center with their own drawing to take home.

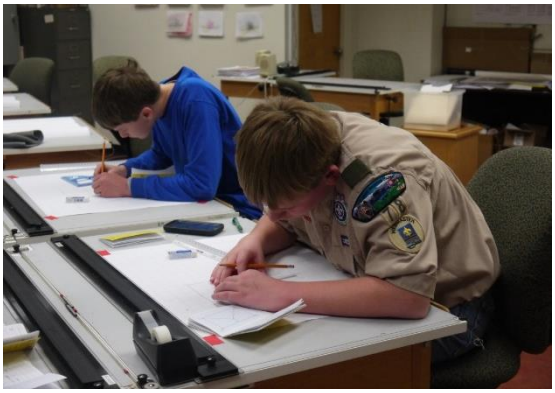

Figure 5. Scouts Drafting Their Traverse on the Drawing Table

2. METHODS AND MATERIALS

To get more standardized feedback from participants, seven questionnaires were given to each Scout and answered at the end of the event in the classroom and all seven questionnaires were collected and analyzed to evaluate the effectiveness of the event.

3. RESULTS

Response rates to the questionnaire from each Scout were summarized in Table 1.

Table1. Scouts Response Rates from Each Grade

Grade	Number of respondents	Percentage of respondents
7	2	29
8	1	14
9	1	14
10	2	29
11	1	14

Seventy one percent of Scouts heard about the Surveying merit badge event from acquaintances (family, relatives, friends, classmates, etc.). This indicates that recommendation from parents is very important for them to recognize the STEM education at early stage of their lives. The others heard it from multimedia such as email (29%).

Travel time Scouts took to participate the event varied; one Scout took less than 30 minutes, three Scouts took between 30 minutes and one hour, and three Scouts took between one hour and one and a half hour.

Regarding their goals for the event, all Scouts desired to simply have fun, 86% Scouts were interested in learning more about Surveying and 43% Scouts wanted to get a badge (multiple responses allowed). It is interesting to note that no Scouts participated in the event because of parental pressure. However, only 4% Scouts were not sure about their goals for the event indicating that most of participated Scouts knew what the event was about.

Based on the scale of 1 (not interested at all) ~10 (extremely interesting) in rating all activities in the event, 3D viewing was the most interesting activity (8.2 with 2.5 Standard Deviation (SD)) followed by licensing with first aid (6.4 with 1.5 SD), leveling (6.0 with 2.6 SD), traverse field work (5.6 with 2.5 SD), GNSS demonstration (4.8 with 2.2 SD), deed search (4.4 with 2.5 SD) and drafting (3.8 with 1.9 SD) (Figure 6).

4. CONCLUSIONS

Based on all feedback from the event discovered that the Surveying merit badge event was successful with great positive responses. There were tremendous supports from surveying students and professional licensed surveyors so that the event allowed young Scouts to experience surveying applications. Numerous positive feedback received from participants revealed that events were memorable, fun, and successful. The increment weather limited some of demonstrations such as GNSS applications.

ACKNOWLEGMENTS

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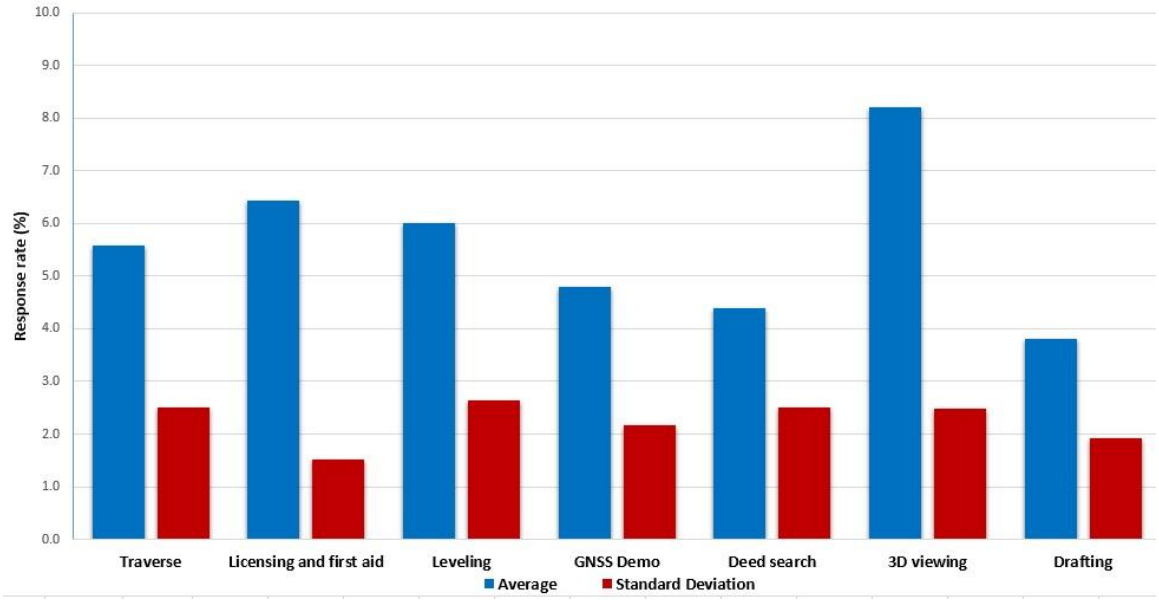

Figure 6. Rating each activity in the event at 1 (no interest) ~10 (most interested) scale

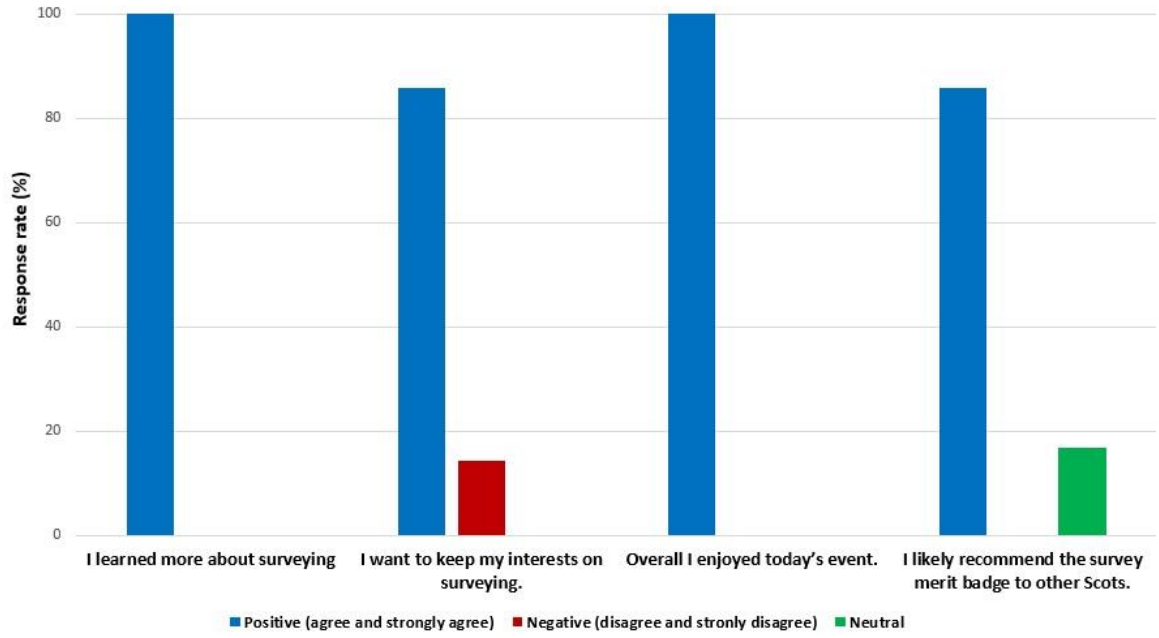

Figure 7. Overall feedback from Scouts participated in the event