EEGRC Poster: Improving Pre-service Elementary Teachers’ Nature of Engineering Views with the Use of EV3 Robotics

Mr. Erdogan Kaya, University of Nevada, Las Vegas

Erdogan Kaya is a PhD student in science education at University of Nevada, Las Vegas. He is working as a graduate assistant and teaching science methods courses. Prior to beginning the PhD program, he received his MS degree in computer science and engineering. He coached robotics teams and was awarded several grants that promote Science, Technology, Engineering, and Mathematics (STEM). He has been volunteering in many education outreach programs including Science Fair and Robotics programs such as First Robotics competitions. Over the past four years, he published several journal papers and presented at national and international conferences. Areas of research interest include science and technology education, STEM, and robotics in science education.

Mrs. Anna Danielle Newley, Sonoran Schools

Anna Newley received a B.A. degree in Elementary Education from Arizona State University. She was an employee with the Tempe Elementary School District as a kindergarten, and second grade teacher, and instructional assistant until 2012. From 2012 to the current, she has been employed with the Sonoran Schools District. Presently, at Sonoran Science Academy-Phoenix, she is a fifth grade teacher. She is the contact for several grants awarded to the school. Mrs. Newley coaches the exploratory robotics club for grades 5-8, the Elementary Science Olympiad team, and the competitive high school robotics team, FTC. She contributed to international published papers, national proceedings, and is the process of writing several children’s books. This summer she will present a workshop on robotics for elementary school students.

Dr. Hasan Deniz, University of Nevada, Las Vegas

Hasan Deniz is an Associate Professor of Science Education at University of Nevada Las Vegas. He teaches undergraduate, masters, and doctoral level courses in science education program at University of Nevada Las Vegas. His research agenda includes epistemological beliefs in science and evolution education. He is recently engaged in professional development activities supported by several grants targeting to increase elementary teachers’ knowledge and skills to integrate science, language arts, and engineering education within the context of Next Generation Science Standards.

Miss Ezgi Yesilyurt, University of Nevada, Las Vegas

Ezgi Yesilyurt is a PhD student in curriculum and instruction/science education at University of Nevada, Las Vegas. She is working as a graduate assistant and teaching science methods courses. She received her MS degree and BS degree in elementary science education. She participated European Union Projects in which she conducted series of professional development programs for in-service science teachers. Areas of research interest are engineering education, inquiry learning and evolution education.
We propose that with the help of EV3 robots, PSTs, with no experience in engineering, can easily attain the skills and confidence needed to integrate engineering into elementary science classes. Teachers have influence over the perception of their students; and although they have a powerful potential to sway students towards STEM careers, there is only some emphasis in engineering in middle and high school. Conversely, at the elementary level, engineering education is generally underestimated and neglected for the sake of other subjects. Additionally, there is extensive research about educational robotics in engineering education. However, there is scarcely any attention in elementary school settings. For these reasons, we need more trained and well-equipped elementary educators that can teach engineering to their students. The purpose of this study is two-fold. Our primary purpose is descriptive to document our engineering unit organized around educational robotics and our secondary purpose is to examine changes in PSTs’ NOE views after experiencing the engineering unit. We specifically examined to what extent the 3-week engineering unit organized around educational robotics improved PSTs’ NOE views.

DATA COLLECTION

Data collected through an open-ended pre- and post-questionnaire designed to assess participants’ NOE views. We modified the Views of Nature of Science Version-C (VNOS-C) questionnaire to assess NOE views and we called this modified instrument the Views of Nature of Engineering (VNOS) questionnaire. Engineering notebooks, reflective essays, and instructor and PSTs observations were obtained as additional data sources. We then assigned codes to them, partially informed, and fully informed to the qualitative information independently, and then discussed discrepant results. Discrepant results were re-considered by referring back to the data more closely until consensus was achieved. We based our analysis on the descriptions of NOE aspects presented on the NOE poster (Figure 3). If a participant’s response captured the meaning of the NOE aspect without any discrepancy we labeled this response as fully informed. If a participant’s response captured the meaning of the NOE aspect with some discrepancy we labeled this response as partially informed. Finally, if a participant’s response included conceptions opposite to the description of the NOE aspect we labeled this response as uninformed.

CONCLUSION

We provided an account of how we introduced engineering design process into our elementary science teaching methods course, which was designed for PSTs. This research can be beneficial to science teacher educators who are planning to integrate engineering design into their elementary and/or secondary science teaching methods courses in an NGSS era. We explicitly introduced NOE aspects to PSTs and asked them to reflect upon their engineering design experiences from the perspective of NOE aspects. As a result of our pre- and post assessment of our participants’ NOE views we found that they improved their NOE views. However, it should be kept in mind that we only had 11 PSTs in our study and we used a modified version of an open-ended NOES questionnaire to assess our participants’ NOE views. Future studies should consider including more participants and using a more robust NOE questionnaire.

Preparing PSTs to teach engineering design in elementary classrooms can be a first step in the right direction to start developing engineering literacy among elementary students. This increased awareness about engineering literacy can trigger elementary students’ interest in STEM careers and it can allow students to make more informed decisions about their career selections.