Using Video Diaries to Explore Perceptions of Engineering: A Comparison of Engineers and Educators

Dr. Rebekah J Hammack, Montana State University

Rebekah Hammack is an Assistant Professor of K-8 Science Education at Montana State University. Prior to joining the faculty at MSU, she served as an Albert Einstein Distinguished Educator Fellow in the Division of Research on Learning in Formal and Informal Settings at the National Science Foundation. She holds a BS in Animal Science from The Ohio State University, a MS in Animal Science from Oklahoma State University, and a PhD in Science Education from Oklahoma State University. She spent 12 years teaching secondary science and engineering in Oklahoma, and is a 2014 recipient of the Presidential Award for Excellence in Mathematics and Science Teaching.

Dr. Nick Lux Lux, Montana State University

Dr. Nicholas Lux has is an Associate Professor of Curriculum and Instruction in MSU's Department of Education. His teaching and research interests are in the area of educational technology. He has worked in the fields of K-12 and higher education for 18 years, and currently teaches in the Montana State University Teacher Education Program. He has experience in educational technology theory and practice in K-12 contexts and teacher education, with a focus on STEM teaching and learning, technology integration, online course design and delivery, program evaluation, and assessment. Dr. Lux's current research agenda is STEM teaching and learning in K-12 contexts, technology integration in teacher preparation and K-12 contexts, educational gaming design and integration, and new technologies for teaching and learning.

Dr. Paul Gannon, Montana State University - Bozeman

Associate Professor, Chemical Engineering Associate Director, Montana Engineering Education Research Center

Dr. Brock J. LaMeres P.E., Montana State University - Bozeman

Dr. Brock J. LaMeres is a Professor in the Department of Electrical & Computer Engineering at Montana State University (MSU) and the Director of the Montana Engineering Education Research Center (MEERC). LaMeres is also the Boeing Professor at MSU where he is responsible for initiatives to improve the professional skills of engineering graduates. LaMeres teaches and conducts research in the area of computer engineering. LaMeres is currently studying the effectiveness of online delivery of engineering content with emphasis on how the material can be modified to provide a personalized learning experience. LaMeres is also researching strategies to improve student engagement and how they can be used to improve diversity within engineering. LaMeres received his Ph.D. from the University of Colorado, Boulder. He has published over 90 manuscripts and 5 textbooks in the area of digital systems and engineering education. LaMeres has also been granted 13 US patents in the area of digital signal propagation. LaMeres is a member of ASEE, a Senior Member of IEEE, and a registered Professional Engineer in the States of Montana and Colorado. Prior to joining the MSU faculty, LaMeres worked as an R&D engineer for Agilent Technologies in Colorado Springs, CO where he designed electronic test equipment.

Using Video Diaries to Explore Perceptions of Engineering: A Comparison of Engineers and Educators

Introduction

This paper presents an overview of the first nine months of work conducted as part of the recently funded National Science Foundation Research in the Formation of Engineers project, "Research: Looks Like Me": Leveraging Funds of Identity to Enhance Engineering Career Pursuits in Rural/Reservation Communities. The overall goal of the project is to foster partnerships among tribal and community colleges and the surrounding rural and tribal school districts. These partnerships will result in increased awareness and preparedness of rural and indigenous youth to pursue engineering and engineering related careers. We are currently assembling professional learning communities (PLCs) consisting of pre and in-service elementary teachers, instructors from partner tribal and community colleges, and faculty from a large land grant university. The PLCs will work together throughout the project with the goal of supporting teachers in the design and implementation of placed-based engineering activities to increase 3rd – 5th grade students' awareness of, interest in, and preparedness to pursue engineering related careers. We will use photo novellas and video diaries as a means for students and their families to document their views about learning, knowledge, and engineering. The photo novellas and video diaries, along with classroom observation data, will be analyzed to identify students' funds of identity and current perceptions of engineering. This information will then be used by PLC members to develop place-based engineering-focused interventions for the students that connect to the programming and research happening at the tribal and community colleges.

The citizens of rural communities and tribal reservations have a great wealth of local funds of knowledge (FoK). Children internalize these family and community FoK and resources in order to make meaning and define themselves, creating funds of identity (FoI) that "act as a lens through which we view and absorb new information and new identities" [1]. To create impactful engineering-focused interventions, we will position children's FoI at the center of our work. This project will explore the connections between FoI and engineering identity development and the mediating factors that inform this relationship. We will expand upon Moll and colleagues' FoK work [2-3] and engage with teachers to identify methods that can be used to identify elementary students' funds of identity and current perceptions of engineering. This information can then be utilized by PLC members to develop place-based engineering-focused interventions for students.

Research Design

The research goals during this portion of the study were to a) develop and refine a photo novella prompt that can be used to collect data on individual's funds of knowledge related to engineering, and b) identify differences in the ways engineering and education professionals and students view engineering in their communities.

Our FoI work relies heavily on the photo novella projects. There is a rich history of using photography in qualitative research [4] and photo novella methods have been used frequently in

the public health and nursing fields [5-6] and with studies of immigrant youth [7-8]. However, photo novella has not been widely applied in elementary schools or when studying engineering identity formation of rural and indigenous youth. In preparing the photo novella and video diary prompts for use with participating children and their families, the research team piloted the data collection and analysis process with members of the local university community.

First, two engineering faculty and two education faculty were provided with digital cameras and the prompt presented in Table 1. After participating faculty completed the prompt, the research team coded the data and used the findings to refine the prompt for use in the second round of pilot testing. During the second round of pilot testing, 15 engineering undergraduate students and 36 education undergraduate students completed the prompt in Table 1. The new data set was coded by the research team and used to further refine the prompt for use with participating elementary teachers. The focus of this poster presentation will be to detail the data collection, data analysis, and initial findings of the pilot.

Table 1. Photo novella prompts used for pilot study

Pilot Prompt – Round 1
Go into your community (the area around your home) and look for examples of what you think engineering is. Use the provided camera to take 5 pictures that you think represent engineering in your community. For each picture that you take, upload it to Adobe Spark. Then, annotate the picture by writing a sentence to describe the picture. Finally, create a voice over describing why you chose the picture –be sure to talk about why the pictures represent engineering.
Pilot Prompt – Round 2
Go into your community (the area around your home) and look for examples of what you think engineering is. Use the provided camera to take 5 pictures that you think represent engineering in your community. Next, record a short video (less than 1 minute) of an example you consider to be engineering in your community. During the video please record your own voice describing the example and why you chose it.   For each picture that you take, upload it to Adobe Spark. Then, annotate the picture by writing a sentence to describe the picture and why you chose it. Finally, add the video to Adobe Spark project.

Preliminary Findings

Data collection is currently underway and findings will be shared at the poster presentation.

Preliminary Conclusions and Implications

Exploring the relationship between FoI and engineering identity development with elementary students from rural and tribal communities will provide valuable information about the development of engineering identity in young children and advance knowledge pertaining to how to address the unique needs and assets of these underrepresented students. Further, the findings from this project have the potential to advance knowledge relative to the use of photo novella projects as a means to identify FoI in both child and adult populations.

Acknowledgements

References

[1]   Esteban-Guitart, M. & Moll, L. C. (2014). Funds of identity: A new concept based on funds of knowledge approach. *Culture & Psychology, 20*(1), 31-48.

[2]   Moll, L. C., Amanti, C., Neff, D., & Gonzalez, N. (1992). Funds of knowledge for teaching: Using a qualitative approach to connect homes and classrooms. Theory Into Practice, 31(2), 132-141.

[3]   González, N., Moll, L., & Amanti, C. (Eds). (2005). Funds of knowledge: Theorizing practices in households, communities and classrooms. Mahwah, NJ: Erlbaum.

[4]   Collier, J., & Collier, M. (1986). *Visual anthropology: Photography as a research method.* Albuquerque, NM: University of New Mexico Press.

[5]   Burke, D. & Evans, J. (2011). Embracing the creative: The role of photo novella in qualitative nursing research. *International Journal of Qualitative Methods, 10*(2), 164-177.

[6]   Hurworth, R., Clark, E., Martin, J. & Thomsen, S. (2005). The use of photo-interviewing: Three examples from health evaluation and research. *Evaluation Journal of Australasia, 4*(1-2), 52-62.

[7]   Esteban-Guitart, M. (2016). *Funds of Identity: Connecting meaningful learning experiences in and out of school.* New York, NY: Cambridge University Press.

[8]   Berman, H., Ford-Gilboe, M., Moutrey, B. & Cekic, S. (2001). Portraits of pain and promise: A photographic study of Bosnian youth. *Canadian Journal of Nursing Research, 32*(4) 21-41.