Electrical Application with Makey Makey: Enhancing Agricultural Mechanics in SBAE

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Introduction

In school-based agricultural education (SBAE), agricultural mechanics and engineering is an important content area in the overall curriculum, often taught through an entire course or as a unit of instruction within other courses. Specially, within the power, structure and technical systems career pathway, electricity and its applications are a vital curricular sub-component (The National Council for Agricultural Education, 2015). Electricity education exposes students to various careers and yields tangible learning opportunities through content application.

When teaching any subject matter, students are able to connect to the material through "conceptual bridges" of their own experiences (Korganci, Miron, Dafinei, & Antohe, 2015, p. 2464). An easy way to create those "bridges" when teaching electricity could be through the connection of daily usage and electricity consumption. Electricity consumption is changing because of the evolution of technology—according to EIA, 5.9% of residential household consumption is credited to televisions, computers and related technology (U.S. Energy Information Administration, 2018). Related technology could include smart phones and gaming consoles, items high school students are likely to engage with in their everyday lives.

Establishing this conceptual bridge can cultivate a felt need for students to understand how the transfer of electricity works in common hand-held devices, such as smart phones. Beginning with an explanation of the flow of currents and simple circuitry, students can create their own understanding for the ways they consume electricity. Additionally, the use of analogies can aid in student learning abstract concepts within the science of electricity (Korganci et al., 2015). To facilitate this learning process, I introduce the Makey Makey, a unique application for teaching electrical circuits within SBAE.

How It Works

Makey Makey is an external keyboard output that is used to complete simple circuitry and basic computer programming projects. This device pulls from a lap top or external battery USB connection as a primary power source. Makey Makey utilizes alligator clips and conductive materials to complete circuits that in turn respond as if you are pushing a key on a keyboard. The different receptors on the board are designed to interact in multiple ways to complete a circuit (Deck & Moyer, 2018). This feature allows students to interact with the device in more than one "textbook" way. Additionally, Makey Makey encourages experimentation with conductivity as a primary learning tool (Deck & Moyer, 2018). This enables students to create buttons out of abnormal items, like fruits and vegetables, Play Doh, or tin foil; further engaging them with their daily experiences, and solidifying their comprehension of electrical circuits.

Makey Makey in the classroom not only encourages interaction with electricity and circuitry, it also encourages soft-skill development and teaching through multiple student-centered methods. Makey Makey can enable problem-, project-, inquiry-, and team- based learning. At the independent level, it allows students the opportunity for problem-solving and deductive analysis in a case where a circuit gets broken or a material isn't conductive enough to

complete the circuit. When used in a groups or pairs, students can build collaboration and communication skills through the projects they create.

Results and Implications

In my experiences with Makey Makey, student engagement reaches higher potentials, and their motivation is maintained more consistently. Korganci, et al. (2015) credits that inquiry-based instruction and the use of analogies help students to understand abstract lessons, such as electrical circuits. Makey Makey doesn't necessarily create a specific analogy for instruction; rather, it poses limitless opportunity for inquiry. Students can inquire into the subject by testing various items and their effectiveness for completing a circuit. For example, some fruits may be more conductive than others depending on their hydration. Due to this variation, students may approach instances where their buttons are only engaging half of the time because of the weak circuit. Here, students are not only faced with a moment of inquiry, but also problem-solving. They must explore how to make their button work one hundred percent of the time through a stronger flow of current by completing the circuit with a more conductive, less resistant material. Having these experiences with electricity through Makey Makey gives students a hands-on application, while learning the material and making physical connections to their daily lives.

Plans and Advice

My current position is as an instructional assistant for lab-based vocational instruction at a local middle and high school. As support staff, I have helped teachers guide their students through implementing Makey Makey and observed its use in action. Moving forward with Makey Makey, my plans include developing lessons to expand use of the item into more inventive applications. The Educator's Guide (Deck & Moyer, 2018) includes an outline of educational standards that this integration can achieve—standards referenced include Common Core State Standards (CCSS) and Next Generation Science Standards (NGSS). This alone can provide support and strengthen the case for the use of Makey Makey to administrators.

Currently, the things that I have seen using the Makey Makey kit are straightforward options utilizing the online compatible software. However, with more experimentation I would like to see students create circuits and buttons for their own creations, rather than pre-designed ones. Thus far, this has been a great way to create circuits and talk about conductivity, allowing students to make connections through games they might interact with at home. In the context of agriculture education, this can be applied as a content application or even as an interest approach, connecting agriculture mechanics and specifically electricity to other content areas.

Costs and Resources

A classroom STEM kit containing 12 keyboards, color-coded alligator clips and extra wires, is approximately $700. However, the creators of Makey Makey offer educator discounts when purchased directly from their website. In addition to the low cost of an individual unit at about $45, the Makey Makey website provides additional educator resources including sample lesson plans, discussion boards, and how-to workshops to facilitate a smooth use of the product in a formal educational setting.

References

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