

How Agricultural Education Teachers Utilize Artificial Intelligence to Improve Student Learning

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Introduction

The integration of artificial intelligence (AI) into educational environments presents opportunities for personalized learning and enhanced teaching practices (Barrera Castro et al., 2024; Mahmoud et al., 2024). According to Chen et al. (2020), AI is used to: 1) assess student work for accuracy, course expectations, and plagiarism, 2) develop individualized learning strategies, and 3) assist educators in locating resources for teaching, instruction, and research. By tailoring educational practices and academic offerings to individual needs, AI could foster a learning environment where learners can take greater ownership, resulting in better learning outcomes and greater personal satisfaction in their learning (Hock, 2024a; Seo et al., 2021; Xu, 2024). The introduction of conversational AI chatbots like ChatGPT has democratized access to AI tools, enabling users to interact with them in intuitive and human-like ways (Ray, 2023; Zhang & Tur, 2024). Chatbots have lowered technological barriers, streamlined AI usability, and often provides cost-free solutions for educators and students. Moreover, these applications are among the most widely used AI tools for improving scientific and creative writing and granting quick access to information materials in almost every subject area (Cope & Kalantzis, 2024; G et al., 2022; Khalifa & Albadawy, 2024). The latter functions of chatbots could reduce teacher workload and free time for other professional or personal activities while addressing the urgent overwork and burnout educators are experiencing everywhere (Mérida-López & Extremera, 2017; Walter, 2024; Zhang & Tur, 2024). Despite the promises AI holds, there remain multiple gaps in research and application within general education as well as agricultural education.

Original research published within the Journal of Agricultural Education on the application of AI in this field is lacking. Though the 2024 November/December edition of *The Agricultural Education Magazine* has started this conversation on our field of School-Based Agricultural Education (SBAE) (Hock, 2024b). This study seeks to address the existing literature gap by exploring the teacher's current use of AI in agricultural education and their perceptions of AI in agricultural education. Additionally, we intend to offer insights to support education in agriculture by implementing AI tools, enhancing teaching efficiency, and personalizing student learning.

Theoretical Framework

As AI innovations are adopted by more and more people in multiple settings of education, this phenomenological study aimed to investigate agricultural education teachers' adoption and usage of AI innovations in their teaching, along with their perceptions of opportunities and challenges experienced in their professional duties. Therefore, Roger's Diffusion of Innovations Theory (DOI) (Rogers, 1983) was used as the theoretical foundation of this investigation. The DOI is one of the most relevant theories across multiple disciplines investigating technology diffusion

and adoption (Sahin, 2006). According to Rogers, DOI is the most appropriate framework for researching and implementing technology adoption in education due to the inclusivity of a wide variety of adapters and categories of innovations, expecting that the diffusion and adoption of innovation will occur and culminate in the full implementation and usage of the innovation at its best performance and actionable process (Kouki et al., 2006; Menzli et al., 2022; Sahin, 2006).

Purpose and Objectives

The intent of this phenomenological study was to explore SBAE teachers' uses of and experiences with artificial intelligence (AI) tools in their teaching. Understand how SBAE teachers utilize (AI) in their classrooms to improve student learning. The following research questions guided our work:

1. Identify how SBAE teachers utilize artificial intelligence to improve their teaching practices.
2. Identify how SBAE teachers interpret artificial intelligence improving agriculture curricula.
3. Identify SBAE teachers' perceptions of how students utilize artificial intelligence to improve learning.

Methods

The goal of a phenomenology is to describe the lived experiences of the persons involved in the phenomena (Creswell, 2013). This study was designed to explore all possible implementations of AI use within the duties and roles of secondary teachers, as reported by teachers. with an eye toward developing practical recommendations and questions to consider as SBAE stakeholders continue to formulate a philosophy around AI use in education. As such, this study was informed by Patton's (2014) definition on pragmatism which states that it "directs us to seek practical and useful answers that can solve, or at least provide direction in addressing, concrete problems," (p.152). The three researchers are each involved with SBAE and higher education programming in agricultural education and acknowledge the biases which are inherently present from that experience. This study was conducted under the oversight of an approved Institutional Review Board protocol.

Study data were collected through a Qualtrics questionnaire distributed nationwide with a series of open-response questions about teacher AI use and a request to participate in one-on-one interviews, at the discretion of the respondents. Teachers who expressed willingness to be interviewed were contacted directly and participated in a 15-minute semi-structured interview with one of the researchers. The open-ended questionnaire items included four items teachers could respond to offering description on their uses of and viewpoints on AI use in agricultural education. The semi-structured interviews dived deeper into the thought processes behind teacher's adoption of AI technologies and why they have chosen to utilize them.

We employed traditional qualitative analysis procedures (Creswell, 2013) and utilized ChatGPT analysis prompts as recommended by Lee et al. (2024). The researchers reviewed the open-ended responses and developed a set of open codes and preliminary themes. Next, each set of responses for each of the questionnaire items were saved in a Word.doc and uploaded to ChatGPT and the query prompt "Summarize into common themes" was utilized. The theme headings produced

from ChatGPT were compared to the initial researcher-developed themes for confirmation (Lee, et al. 2024). We employed triangulation through the collection of multiple data sources. Those data included the open-ended questionnaire items, interview transcripts, and researcher field notes from the interviews. To help ensure the accuracy and validity of our interpretation, the findings were reviewed by the interview participants (Creswell, 2013).

The population of this study was all secondary high school agriculture teachers (N = 14,756) (Smith, et al., 2024). Implementing a purposive sampling scheme, we utilized the NAAE listserv (US Ag Ed Listserv, 2024) and the Facebook group 'Ag Education Discussion Lab' (Ag Education Discussion Lab, 2024) as a framing and contact information base to recruit participants. There was an accepting population of 129 (*n*) teachers for the questionnaire and from that group, 12 (*n*) teachers volunteered to participate in the one-on-one interviews. Therefore, any interpretations of the findings reported herein are limited to those respondents. Our respondents were comprised of individuals across a broad age range from 23 years of age to 65 years of age. To maintain confidentiality, all participants names used in this study are pseudonyms (Creswell & Poth, 2018). Further, 19 states were represented by the questionnaire respondents. Sixty-seven percent (*n* = 87) identified as female, 36% (*n* = 41) as male, and one individual as non-binary/third gender.

Findings

Findings for this study are reported in five themes from the questionnaire data and 12 interviews.

Efficiency

A majority of respondents wrote about how they use artificial intelligence to save time. When it comes to lesson planning, finding new ideas to engage students, and assessing student work, the teacher does not have to spend all of their time purely in creation mode. They have more time to spend building out new classes, making more in-depth activities, and giving their students more time in class. One teacher stated that using AI tools assists in, "Reducing time spent on creating lessons and papers, more time spent on details to make teachers more prepared". AI allows teachers to take work that initially would take hours or days and make it happen in minutes. Charlie highlighted the efficiency of AI in their classroom prep,

it can reduce... the amount of workload that's on an educator. If you can get it to... help increase your efficiency, which I mean, so many teachers just have so much on their plate, and so, being able to... reduce some of that workload, or at least help expedite the lesson planning and instructional planning process is really valuable.

The basics that are involved in creating education materials are accomplished at a much faster rate with a wider knowledge base than any teacher could ever have. Tasks that go beyond the normal working environment of the classroom can add up such as writing letters to parents, creating rubrics, social media posts, and grading. Several participants wrote about having used AI to give them time back in their day to focus on other work.

Individualization

The teachers utilize artificial intelligence for far more than just helping create materials, but also editing the materials they use in class to accommodate their learners. In nearly every interview it

was mentioned that they use AI to change the reading level of different readings to address rigor needs. Sharing the workload with special education staff where there may be a lack of workforce in a school. Finding faster ways to address student's individual education programs (IEP) was addressed by Callie:

...knowing that if there are reading components that I maybe need to change the grade level of the accessibility if it needs to be switched from a 9th grade reading level to a 5th grade reading level.

This sentiment was talked through in some form in every interview. Teachers are looking to get effective learning strategies implemented that meet the needs of their learners. Having the ability to tailor the learning to each student's needs in just a matter of minutes is a huge time saver and will better help the students engage.

Ethical Use

In every interview the teachers talked through needing to find a balance between allowing students to use the new technology in their learning and not letting them lose foundational skills of learning. Teachers cannot assume students will be able to differentiate what is good use of AI and what is poor use of AI. Several teachers talked in depth about how their students are relying on ChatGPT too much for their assignments. Others are blatantly cheating with AI on their assignments by copying the prompt and pasting it into their papers. Callie discussed "I think the easiest one is the thought of cutting corners and using it as a tool to just be lazy and copy and paste things again." While all of the teachers spoke about concerns for the students over-using AI in their classrooms, several of the teachers talked about incorporating AI use into their classroom so they can better prepare students for the use of AI in their working life. Winston said, "they already have access to it... they're gonna use it...instead of banning it, let's embrace it and figure out."

Barriers to Usage

Several respondents were unaware of how to use artificial intelligence and what AI can be used for. Beyond that we had responses expressing they do not want to train students to take the easy way out or promote a dependency on technology. Hesitancy was a strong attitude expressed by some respondents who shared they had not used AI in their classrooms. One teacher expressed, "I don't want the world taken over or to promote students taking the easy way out.", and another teacher expressed, "can't see a use for it".

Need for Professional Development

Many interviewees had some form of training into artificial intelligence whether it was in their schooling or in a professional development day. These professional development days can address how to use AI to better their classrooms and make them more streamlined. Several teachers expressed admiration for their professional development days, but wished they had a tailored day with other agricultural educators. Naomi stated about how having a professional development day changed her perspective on AI,

Honestly, up until a professional development that I attended, to me AI was a dirty word. And so, I think if teachers could have someone show them ... how it could be useful for

them and the benefits that it could help them with. I think that would really help to get them on board

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Conclusions

School-based agricultural education teachers who chose to be part of this study have found Artificial Intelligence tools to be helpful in performing diverse tasks in their professional responsibilities. These AI natives are developing a critical eye towards their own limitations in technical and operational knowledge base as well as building an ethical educational environment for them and their students to reach new levels of learning. The incorporation of the Menzli et al., (2022) adaptation of Diffusion of Innovations theory was ultimately appropriate for the foundation of this work. Teachers directly and indirectly addressed each of the attributes of Relative Advantage, Compatibility, Complexity, Trialability, and Observability across both means of data collection. Complexity was met by some as a barrier to fully adopt and utilize AI tools whereas with others this barrier was a gate to walk through. Nearly all have decided there is clear advantage to using the tools and through extensive Trialability, AI is Compatible with their practices as a teacher.

We are left with the conclusions that AI can be a transformative tool for the agricultural education classroom. There are significant benefits to the speed in which content can be produced and experienced at higher cognitive levels. With that being said, the content can also be taken down to different learners' individual needs very quickly. For those individual learners, they can take materials and AI can help them create note sheets, helping them think through content in different ways, and supporting them how they see fit (Hock, 2024a). AI can be like another peer in the classroom for a teacher looking to develop more content and different content, however the teacher needs to know how to use AI to be successful. Training levels for teachers is shown to increase the use of AI in the agricultural education classroom through professional development days in schools and at ag teacher conferences. AI does come with a set of problems that needs to be addressed and that is how to control student use of the technology while still ensuring students have a good working knowledge on how to leverage the technology.

Teachers should find ways to learn about how AI can support their teaching (Seo et al., 2021; Xu, 2024). Whether that is in their own research of the technology or by finding a training to attend. Schools need to provide opportunities for professional development about how to teach with artificial intelligence tools. In addition to developing user ethics, including students. Further, teachers need the tools to be aware of what to look for when it comes to analyzing students' work. Teachers who adopt the technology will be able to better serve their students' individual learning needs and have access to a much larger body of knowledge when it comes to creating new materials for their curricula (Chen et al., 2024). Future research needs a deeper dive into how agricultural educators can benefit from using AI. One avenue would be through a greater understanding what and how different AI platforms can be used to benefit the classroom. The student perspective should not be ignored however, research should be done into how students can best use it while still building foundational knowledge for their future careers and work. Lastly, although it was not a substantial proportion of our findings, there are barriers to

adoption for many teachers out there. We should approach these questions with an eye towards seeking to understand those barriers because not only can we develop appropriate educational experiences for their learning, we can enhance AI tools to meet the needs of a broader user audience in educational development.

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