Integrating STEM with Agriculture: Guiding Career Exploration in Precision Agriculture Through Video Intervention

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Introduction/Need for Research

Agricultural labor shortages have become a persistent issue, prompting the development and adoption of automated, intelligent, and labor-efficient technologies, such as precision agriculture (Koutsos & Menexes, 2019). Precision agriculture adoption faces challenges due to a shortage of trained professionals with skills in data interpretation, machinery operation, and adapting to rapidly evolving technologies (Erickson et al., 2018; Mitchell et al., 2020).

While enrollment in agriculture majors has declined, Science, Technology, Engineering, and Mathematics (STEM) fields have experienced steady growth, especially among rural students who often pursue four-year STEM degrees (Tran et al., 2021). Many precision agriculture practices, such as automated steering and variable-rate applications, align with STEM principles, including engineering and data analysis (Lowenberg-DeBoer & Erickson, 2018; Mansoor et al., 2025; Miller et al., 2019). Thus, STEM students represent a vital and underutilized talent pool for precision agriculture careers. This creates an opportunity to bridge the gap between declining agricultural enrollment and rising STEM interest by raising awareness among STEM undergraduates about emerging career pathways in precision agriculture (Fassakhova et al., 2020).

Theoretical Framework

Rogers' (2003) diffusion of innovations theory guided this study, focusing on the knowledge stage and five key attributes influencing adoption, including *relative advantage*, *compatibility*, *complexity*, *trialability*, and observability, to introduce precision agriculture and its related career pathways. This study explored whether a brief, educational video introducing the foundational concepts and theoretical attributes of precision agriculture influences STEM students' awareness and interest in precision agriculture careers.

Methodology

This study employed a survey design and distributed questionnaires to 104 undergraduate students in Georgia majoring in STEM fields, of which 75 completed the survey (a 72% response rate). Data were collected via a Qualtrics online survey instrument with three main sections: pre-test, video intervention, and post-test. All items were derived from the literature and adapted to fit the context of the study.

IBM SPSS 30.0 statistical software was used to perform descriptive and inferential statistics. To assess the reliability of the instrument, Cronbach's (1951) alpha coefficient and composite reliability indices were used. Multicollinearity was computed to ensure that the independent variables used in the regression model were not highly correlated with each other. Multiple linear regression was conducted.

Results and Conclusions

The results of the multiple linear regression analysis ($n = 75$) provided insight into the impact of increased knowledge of precision agriculture on STEM students' intentions to pursue further academic or career opportunities in the field. The model explained a substantial proportion of variance in career intention, with an R^2 value of .53, indicating that 53% of the variability in students' intentions could be accounted for by the variables included in the model.

Among the variables, *relative advantage* ($p < .01$) and c*ompatibility* ($p < .01$) both emerged as significant positive predictors, suggesting that STEM students who perceived precision agriculture as offering clear benefits over other career paths were more likely to express interests in pursuing it and felt that precision agriculture aligned well with their existing skills and values. The results also revealed that *trialability* had a statistically significant negative relationship with career intention ($p = .01$), suggesting that STEM students who perceived fewer opportunities to explore precision agriculture were less likely to pursue a career in this field. Neither *complexity* nor *observability* significantly predicted career intention, suggesting that they may not play a significant role in affecting STEM students' decision-making. As STEM students often have prior exposure to data analysis and engineering principles, these two attributes may not act as barriers in their decision-making.

Implications, Recommendations, and Impact on Profession

The findings of this study highlighted a strategic opportunity in the industry demand landscape. Emphasizing the integration of precision agriculture with automation, data analytics, and remote sensing technologies could attract a new generation of professionals, particularly those in STEM fields, individuals who may not have previously considered agriculture as a career option. However, to capitalize on this strategic opportunity, the agricultural industry must invest in creating more accessible pathways. Internship programs, college courses, virtual simulations, and collaborative projects (e.g., project-based learning) with universities can serve as effective mechanisms to provide hands-on experience and lower entry barriers. Such approaches offer tangible trial opportunities, reinforce perceptions of compatibility and relative advantage, and position agriculture as a career path combining technological foresight with social impact. These measures not only enhance recruitment effectiveness but also cultivate a diverse workforce with cross-disciplinary capabilities to address complex agricultural challenges.

Based on the findings and implications of this study, several recommendations can be made for future research and practice. First, future research should explore the long-term effects of brief educational interventions. While this study demonstrated immediate shifts in career intention, longitudinal studies are needed to assess whether these intentions translate into actual academic or career decisions. Additionally, future studies should investigate the effectiveness of various intervention types (e.g., interactive modules, mentorship programs, or immersive experiences) to determine which formats are most effective in influencing career trajectories.

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