Bridging the Data Analytics Skills Gap: A Needs Assessment for Industry-Aligned Curriculum in Food and Agriculture

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Introduction

The Food, Agriculture, Natural Resources, and Human Sciences (FANH) encompass diverse disciplines to study and manage food systems, agricultural practices, natural resource conservation, and human well-being. The rapid advancement of data analytics is transforming industries by enhancing decision-making processes—particularly vital in addressing challenges ranging from seasonal variability and environmental pressures to sustainable resource management. It is needed that FANH scientists employ integrated data analytics to optimize outcomes (Tantalaki et al., 2019). Despite its transformative potential, a significant data analytics skills gap persists in the FANH disciplines. integrating data analytics into postsecondary education programs is challenged by limited faculty expertise, resource constraints, and limited interdisciplinary approaches. Collaboration between data scientists and FANH professionals is essential to develop technically robust and contextually relevant curricula (McKim et al., 2018).

This study explored perceived importance of data analytics knowledge and skills and examined how perceptions varied across groups, based on workplace usage and work experience. The research questions were: RQ1: What are the perceived important knowledge and skills for data analytics? RQ2: Are there significant differences in overall perceived knowledge and skills between groups with different data analytics usage or work experience levels? RQ3: Are there significant differences in perceived sub-knowledge and skills (e.g., basic concepts, data visualization, statistical techniques, higher-order analytical skills) when examined by data analytics usage or work experience?

Literature Review

The integration of data analytics in the Food, Agriculture, Natural Resources, and Human (FANH) sciences is increasingly recognized as essential for enhancing decision-making, improving resource management, and driving innovations regarding sustainability (Marvin et al., 2017). Despite the transformative potential of data analytics in FANH, a significant skills gap persists, as traditional agricultural education often falls short in addressing unique challenges and lacks the inclusion of data analytics (Braganza et al., 2017). Many graduates lack sufficient skills in statistical techniques, machine learning, and data visualization (Kumar & Singh, 2019). Studies highlight the growing demand for data-proficient professionals, yet FANH graduates frequently report challenges in applying advanced analytics in their careers (Rejeb et al., 2022).

A needs assessment is critical to identifying essential competencies and aligning curricula with industry demands, ensuring that both undergraduate and graduate students receive targeted training suited to their career trajectories. The rationale for conducting a needs assessment in data analytics for the FANH sciences stems from the critical role these disciplines play in addressing global challenges such as food security, sustainability, and climate change.

Methodology

Participants were former students at [State] University. The researchers developed a questionnaire with eight core knowledge and skills areas according to a review of previous literature in data analytics (Ariyachandra, 2020; Guttmann, 2018; Jones, 2020; World Economic Forum, 2018; Zin et al., 2022). Demographic questions included educational level, gender, age group, years of work experience, and workplace usage of data analytics. The marketing department at [State] University provided a list of 13,962 alumni who graduated from one of 15

departments in the College of Agriculture and Life Sciences. The questionnaire was distributed online with an incentive offered to the first 300 respondents who completed it. 535 valid responses were retained for analysis. Descriptive statistics, MANOVA tests, ANOVA tests, pairwise comparison tests were used for data analysis in STATA.

Findings

Perceived importance of knowledge and skills ranged from most to least important: communication skills (M = 4.39, SD = 1.56), critical thinking (M = 4.32, SD = 1.59), data visualization (M = 3.8, SD = 1.71), basic concepts (M = 3.61, SD = 1.32), statistical techniques (M = 3.14, SD = 1.72), high-order analytical skills (M = 3.08, SD = 1.39), data management and security (M = 3.08, SD = 1.76), and machine learning (M = 2.67, SD = 1.55). These results highlight the workforce's prioritization on effective communication and critical thinking in data analytics roles, while technical skills such as machine learning were perceived as less critical.

MANOVA results (Table 4) revealed a statistically significant main effect for usage status [Wilks' Lambda = .90, F (8, 492) = 6.62, $p < .001$], indicating that individuals using data analytics perceived its overall importance differently compared to non-users. No significant main effect was found for work experience [Wilks' Lambda = .94, F (24, 1427.60) = 1.28, p = .16], nor was the interaction effect between usage status and work experience [Wilks' Lambda = .94, F (24, 1427.60) = 1.21, p = .22]. These results suggest that hands-on exposure to data analytics fosters a deeper appreciation for its relevance, regardless of career stage. Results from univariate ANOVA analyses demonstrated that sub-skills such as basic concepts, data visualization, statistical techniques, and higher-order analytical skills showed significant differences among use and non-use groups.

Conclusions

This needs assessment study highlights the importance of integrating core knowledge and skills such as statistical techniques, basic concepts, data visualization, and high-level analytical competencies into higher education offerings focused on data sciences in FANH discipline programs. Results from the MANOVA test indicated that individuals using data analytics perceived its overall importance differently compared to non-users. Sub-skills such as basic concepts, data visualization, statistical techniques, and higher-order analytical skills showed significant differences among use and non-use groups.

Implications/Recommendations

Respondents perceived statistical techniques as essential, particularly in data-driven decision-making. Both statistical techniques and higher-order analytical skills require educational programs that intentionally integrate them into the curriculum and instructional methods, allowing future professionals to address problems that simulate the environmental, social, and economic complexity of current work settings, encouraging their potential to propose innovative data-based solutions. Based on our findings, we recommend a modular progressive curricular design for incorporating data analytics into the FANH sciences. Content should be structured from basic concepts to advanced skills/techniques with emphasis on data visualization skills to facilitate learning. In addition, training in basic concepts, data visualization, statistical techniques, and higher-order analytical skills should account for learners' characteristics and include critical and ethical use of data to promote informed and responsible decisions. respondents' assessment of essential data analytics knowledge and skills were significantly affected by workplace use and experience. Postsecondary education programs should adapt their curricula and instruction of data analytics in the FANH sciences to ensure students develop desirable data science competencies for future employment.

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