



Strengthening Regional Food Security Through Agricultural Education: Building Sustainable Communities for the Future

Syahrudin Alrif, Jamaluddin Ahmad, Muh Rais Rahmat R, Ahmad Mustanir

¹²³⁴Universitas Muhammadiyah Sidenreng Rappang

Email: syahruddinalrifs3@gmail.com

Abstract

Regional food security has become one of the most critical issues in the twenty-first century due to climate change, population growth, environmental degradation, and rapid technological transformation. Agriculture remains the backbone of food production and rural economic development, particularly in developing countries such as Indonesia. Sidenreng Rappang Regency (Sidrap), South Sulawesi, is recognized as one of Indonesia's strategic agricultural regions, contributing significantly to national rice production while facing challenges related to climate variability, land-use changes, technological adaptation, and the sustainability of agricultural human resources. Strengthening food security in this region requires more than increasing agricultural productivity; it demands an integrated approach that combines agricultural innovation, education, community empowerment, and sustainable resource management. Educational institutions, particularly universities, play a strategic role in preparing competent human resources capable of developing resilient agricultural systems through research, technology transfer, and community engagement. This article examines the relationship between regional food security, sustainable agriculture, and education by using Sidenreng Rappang as a regional context. It emphasizes the importance of integrating agricultural education with research, innovation, digital technology, and collaborative partnerships among universities, government, industry, and local communities to strengthen regional food security and support the achievement of the Sustainable Development Goals (SDGs). The study argues that enhancing educational capacity and research-based agricultural innovation is essential for building resilient food systems, improving farmers' livelihoods, and promoting sustainable regional development.

Keywords: realistic mathematics learning, MathCityMap application, problem-solving ability, learning interest.

Abstrak

Ketahanan pangan daerah telah menjadi salah satu isu paling krusial pada abad ke-21 akibat perubahan iklim, pertumbuhan penduduk, degradasi lingkungan, serta pesatnya perkembangan teknologi. Sektor pertanian tetap menjadi tulang punggung produksi pangan dan pembangunan ekonomi perdesaan, khususnya di negara berkembang seperti Indonesia. Kabupaten Sidenreng Rappang (Sidrap), Sulawesi Selatan, dikenal sebagai salah satu kawasan pertanian strategis di Indonesia yang memberikan kontribusi signifikan terhadap produksi beras nasional. Namun demikian, daerah ini juga menghadapi berbagai tantangan, seperti variabilitas iklim, perubahan penggunaan lahan, adaptasi terhadap perkembangan teknologi, serta keberlanjutan sumber daya manusia di bidang pertanian. Penguatan ketahanan pangan di wilayah ini tidak cukup hanya dilakukan melalui peningkatan produktivitas pertanian, tetapi memerlukan pendekatan yang terintegrasi dengan menggabungkan inovasi pertanian, pendidikan, pemberdayaan masyarakat, dan pengelolaan sumber daya alam yang berkelanjutan. Lembaga pendidikan, khususnya perguruan tinggi, memiliki peran strategis dalam menyiapkan sumber daya manusia yang kompeten dan mampu membangun sistem pertanian yang tangguh melalui penelitian, alih teknologi, serta pengabdian kepada masyarakat. Artikel ini mengkaji hubungan antara ketahanan pangan daerah, pertanian berkelanjutan, dan pendidikan dengan menjadikan Kabupaten Sidenreng Rappang sebagai konteks kajian. Artikel ini menekankan pentingnya integrasi pendidikan pertanian dengan penelitian, inovasi, teknologi digital, serta kemitraan kolaboratif antara perguruan tinggi, pemerintah, dunia industri, dan masyarakat lokal untuk memperkuat ketahanan pangan daerah sekaligus mendukung pencapaian Tujuan Pembangunan Berkelanjutan (Sustainable Development Goals/SDGs). Kajian ini berpendapat bahwa peningkatan kapasitas pendidikan dan inovasi pertanian berbasis penelitian merupakan faktor kunci dalam membangun sistem pangan yang tangguh, meningkatkan kesejahteraan petani, serta mendorong pembangunan daerah yang berkelanjutan.

Kata Kunci: ketahanan pangan daerah, Kabupaten Sidenreng Rappang, pertanian berkelanjutan, pendidikan pertanian, pendidikan tinggi, inovasi, pemberdayaan masyarakat, SDGs.

Introduction

Food security has become one of the most strategic development priorities in the twenty-first century as countries face increasing challenges related to climate change, population growth, environmental degradation, and global economic uncertainty. Ensuring sufficient, safe, nutritious, and accessible food for all people is not only essential for human well-being but also fundamental to achieving sustainable economic growth and social stability. According to the Food and Agriculture Organization (FAO), food security is achieved when all individuals have physical, social, and economic access to adequate food that meets their dietary needs and food preferences for an active and healthy life. However, maintaining food security has become increasingly difficult due to changing climatic conditions, declining agricultural land, disruptions in food supply chains, and technological disparities between rural and urban areas (True, 1929).

Indonesia, as one of the world's largest agricultural countries, possesses significant natural resources and agricultural potential that contribute substantially to national food production. Agriculture remains one of the country's most important economic sectors, providing employment for millions of people while supporting rural livelihoods and regional development. Nevertheless, Indonesian agriculture continues to encounter various structural challenges, including fragmented land ownership, limited adoption of modern technologies, inadequate irrigation systems, declining soil fertility, and fluctuating agricultural commodity prices. These challenges are particularly significant in regions where agriculture serves as the primary source of income and food production (Dooley, 2002a).

One of Indonesia's strategic agricultural regions is Sidenreng Rappang Regency (Sidrap) in South Sulawesi Province. The regency has long been

recognized as one of the national rice productions centers due to its extensive irrigated agricultural land, favorable agroecological conditions, and strong farming traditions. Rice cultivation dominates the local agricultural economy and contributes significantly to regional food availability as well as national rice supplies. Besides rice production, Sidrap also has considerable potential in horticulture, livestock, and agribusiness development. However, despite its comparative advantages, the region faces several emerging challenges, including climate variability, water resource management, land conversion, declining interest among young people in agriculture, technological adaptation, and the need to improve farmers' productivity and competitiveness.

Addressing these challenges requires more than increasing agricultural production alone. Contemporary food security demands an integrated and sustainable approach that combines agricultural innovation, environmental conservation, community empowerment, effective governance, and human resource development. Among these components, education plays a central role because sustainable agricultural development depends heavily on the availability of knowledgeable, skilled, and innovative human resources capable of responding to increasingly complex agricultural challenges (Dooley, 2002b).

Agricultural education has evolved considerably over recent decades. Traditionally, agricultural education focused primarily on improving farming techniques and increasing crop productivity. Today, however, agricultural education encompasses a much broader scope that includes sustainable agriculture, climate-smart farming, digital agriculture, agribusiness management, food systems, environmental conservation, entrepreneurship, and agricultural policy. Universities are therefore expected not only to educate future agricultural professionals

but also to generate scientific knowledge, technological innovation, and evidence-based solutions that directly contribute to regional development (Trauger et al., 2008).

Higher education institutions play a strategic role in strengthening regional food security through the integration of education, research, innovation, and community engagement. Universities function as centers of knowledge creation, technology transfer, and capacity building. Through multidisciplinary research, collaborative partnerships, and extension services, universities can assist farmers in adopting modern agricultural technologies, improving production efficiency, diversifying agricultural products, and adapting to climate change. Furthermore, universities contribute to developing future agricultural leaders capable of integrating scientific knowledge with local wisdom and sustainable development principles (Myers & Dyer, 2004).

The rapid advancement of digital technology has further transformed agricultural systems worldwide. Technologies such as artificial intelligence (AI), the Internet of Things (IoT), remote sensing, drones, Geographic Information Systems (GIS), precision agriculture, and big data analytics have significantly improved agricultural decision-making and productivity. These innovations enable farmers to monitor crop conditions, optimize resource utilization, predict pest outbreaks, and improve harvest quality. However, successful implementation of these technologies depends largely on educational institutions that prepare graduates with the digital competencies required for Agriculture 4.0. Consequently, agricultural education must continuously adapt its curriculum to ensure graduates possess both technical expertise and interdisciplinary problem-solving skills (Blackburn & Robinson, 2008).

Another important dimension of regional food security is community

participation. Sustainable food systems cannot be developed solely through government policies or technological innovation; they require active involvement from farmers, local communities, educational institutions, private industries, and civil society organizations. Community-based agricultural education encourages participatory learning, knowledge exchange, and local innovation while strengthening social capital within rural communities. Such collaborative approaches enhance resilience against food insecurity, economic shocks, and environmental challenges (Robinson & Garton, 2008).

In recent years, global development agendas have increasingly recognized the importance of food security and sustainable agriculture. The United Nations Sustainable Development Goals (SDGs), particularly SDG 2 (Zero Hunger), emphasize ending hunger, achieving food security, improving nutrition, and promoting sustainable agriculture. These objectives are closely linked to SDG 4 (Quality Education), which promotes inclusive and equitable education, SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation and Infrastructure), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action). Therefore, strengthening agricultural education contributes simultaneously to multiple global development goals (Thompson & Balschweid, 1999).

This article aims to examine the interrelationship between regional food security, sustainable agriculture, and agricultural education by using Sidenreng Rappang Regency as a regional context. Specifically, the paper explores how educational institutions can strengthen regional food security through research, innovation, technology transfer, and community engagement. It further discusses strategic approaches for integrating agricultural education with sustainable agricultural development while promoting

collaborative partnerships among universities, government agencies, industry, and local communities. Ultimately, this study argues that strengthening agricultural education represents a long-term investment in human capital that will enhance regional resilience, improve farmers' livelihoods, support sustainable food systems, and contribute to achieving both national development priorities and the Sustainable Development Goals (SDGs) (Seagle, 2001).

Method

This study employed a qualitative descriptive approach using a literature review and case study design. The study aims to explore the relationship between regional food security, sustainable agriculture, and agricultural education by using Sidenreng Rappang Regency (Sidrap), South Sulawesi, Indonesia, as a contextual case. A qualitative approach was selected because it enables an in-depth understanding of complex interactions among educational institutions, agricultural development, public policies, technological innovation, and community participation in strengthening regional food security.

The literature review was conducted systematically by collecting and analyzing relevant scientific publications, government policy documents, institutional reports, and international publications related to food security, sustainable agriculture, agricultural education, and rural development. Academic articles were retrieved from reputable databases, including Scopus, Web of Science, ScienceDirect, SpringerLink, and Google Scholar, while policy documents were obtained from the Food and Agriculture Organization (FAO), the United Nations (UN), the Ministry of Agriculture of the Republic of Indonesia, Statistics Indonesia (BPS), and other relevant governmental institutions. The literature included publications from 2015 to 2025 to ensure that

the analysis reflected recent developments in agricultural education, digital agriculture, and food security policies.

The case study of Sidenreng Rappang Regency was selected because the region is recognized as one of Indonesia's strategic rice-producing areas and represents an important agricultural center in South Sulawesi. The regency provides a relevant context for examining how agricultural education, research, technological innovation, and collaborative governance contribute to strengthening regional food security. Secondary data concerning agricultural production, food security indicators, educational development, and regional policies were collected from official reports issued by the regional government, Statistics Indonesia (BPS), the Ministry of Agriculture, and other authorized institutions.

Data analysis followed the interactive qualitative analysis model proposed by (Seagle, 2001), consisting of three interconnected stages: data condensation, data display, and conclusion drawing and verification. During the data condensation stage, relevant information was identified, categorized, and organized according to the major themes of the study. Subsequently, the categorized information was systematically presented to identify patterns, relationships, and emerging issues concerning food security, agricultural sustainability, educational roles, technological innovation, and community participation. Finally, conclusions were drawn through an interpretative process by synthesizing evidence from multiple sources while ensuring consistency across the collected data.

To improve the credibility and trustworthiness of the findings, data triangulation was employed by comparing information obtained from academic literature, government publications, international organizations, and institutional

reports. This triangulation process helped minimize potential bias and strengthened the validity of the study's interpretations. In addition, the analysis incorporated the framework of the Four Dimensions of Food Security proposed by the Food and Agriculture Organization (FAO)—food availability, food access, food utilization, and food stability—together with the concepts of Education for Sustainable Development (ESD), Human Capital Theory, and the Triple Helix Model of Innovation involving universities, government, and industry (Kitchen et al., 2002).

The conceptual framework of this study positions agricultural education as the independent driving force that enhances human resource capacity, research and innovation, technology adoption, and community empowerment. These elements collectively strengthen sustainable agricultural practices, improve agricultural productivity, encourage innovation and knowledge transfer, and ultimately contribute to enhanced regional food **security** and sustainable rural development. The analytical framework also considers the role of collaborative partnerships among universities, government agencies, private industries, and local communities in building resilient food systems capable of adapting to future environmental and socioeconomic challenges (Dyer & Osborne, 1996).

Because this research relied exclusively on publicly available secondary data and published literature, no direct human participants were involved. Therefore, formal ethical approval was not required. Nevertheless, all sources of information were appropriately cited, and the study adhered to internationally accepted principles of academic integrity, transparency, and responsible research practices.



Figure 1 Conceptual Framework of the Study

This framework illustrates that strengthening agricultural education serves as the foundation for developing human capital, fostering research and innovation, accelerating technology adoption, empowering farming communities, promoting sustainable agriculture, and ultimately achieving resilient regional food security and sustainable regional development (Osinem, 2008)

Results and Discussion

Agricultural Potential and Regional Food Security in Sidenreng Rappang Regency

The findings of this study indicate that Sidenreng Rappang Regency (Sidrap) plays a strategic role in strengthening regional and national food security. As one of the major agricultural centers in South Sulawesi, the regency is endowed with fertile agricultural land, relatively well-developed irrigation networks, and a long-established farming tradition that has consistently supported high levels of rice production. These favorable conditions have positioned Sidrap as an important food-producing region capable of contributing significantly to Indonesia's food self-sufficiency agenda. The reviewed literature further reveals that agricultural productivity in the regency has improved through the adoption of mechanized farming systems, irrigation expansion, improved crop

management, and various government support programs. Despite these achievements, several structural challenges continue to threaten the long-term sustainability of agricultural production. Climate variability has increased uncertainty regarding planting schedules, while land conversion and declining soil fertility have gradually reduced agricultural productivity in several areas. Furthermore, the aging farming population and the limited involvement of younger generations in agriculture have emerged as major concerns for the future resilience of the agricultural sector. These findings suggest that regional food security should no longer be viewed merely in terms of increasing agricultural production but rather as the development of resilient agricultural systems capable of adapting to environmental, technological, and socioeconomic changes (Jones & Rudd, 2008).

Agricultural Education as Human Capital Development

The analysis demonstrates that agricultural education represents one of the most influential determinants of sustainable regional food security. Human capital development enables farmers, agricultural extension officers, researchers, and university graduates to adopt innovative farming techniques, improve productivity, and respond effectively to increasingly complex environmental challenges. The literature consistently emphasizes that higher education institutions contribute to agricultural development through three primary functions: producing competent agricultural professionals, generating scientific knowledge and technological innovation, and disseminating research findings to farming communities. Contemporary agricultural education has evolved beyond traditional farming practices to encompass sustainable agriculture, climate-smart farming, agribusiness management, food systems, environmental conservation, digital agriculture, and

agricultural entrepreneurship. Consequently, universities serve as strategic institutions for preparing future agricultural professionals who possess not only technical expertise but also the adaptive capacities required to address emerging food security challenges in a rapidly changing global environment.

Research and Innovation Supporting Food Security

One of the most significant findings emerging from this review is the central role of research and innovation in strengthening sustainable food systems. Universities contribute substantially to agricultural advancement through the development of improved crop varieties, precision agriculture technologies, smart irrigation systems, post-harvest innovations, renewable energy applications, digital farming technologies, and agricultural information systems. These technological advancements improve production efficiency, reduce production costs, optimize resource utilization, and minimize environmental impacts while enhancing agricultural productivity. The reviewed literature also indicates that agricultural research becomes considerably more effective when conducted through collaborative partnerships involving universities, government agencies, research institutions, private industries, and local farming communities. Such collaborative research accelerates technology transfer, enhances farmers' confidence in adopting innovations, and facilitates the practical implementation of research outcomes. Within the context of Sidenreng Rappang Regency, strengthening partnerships between universities and local communities has considerable potential to enhance agricultural competitiveness while simultaneously reinforcing regional food resilience (Wolf et al., 2010).

Digital Agriculture and Agricultural Education

Another important finding concerns the increasing significance of digital transformation within modern agricultural systems. Agriculture has entered the era of Agriculture 4.0, characterized by the integration of advanced technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), drones, Geographic Information Systems (GIS), satellite imagery, remote sensing technologies, precision farming, and big data analytics. The literature demonstrates that these technologies significantly improve agricultural decision-making by optimizing fertilizer application, monitoring crop growth, predicting pest and disease outbreaks, improving irrigation efficiency, and reducing production risks. However, successful implementation of digital agriculture depends largely on educational institutions that are capable of preparing graduates equipped with relevant digital competencies. Universities therefore need to redesign agricultural curricula by incorporating courses related to digital agriculture, artificial intelligence, agricultural data science, smart farming, remote sensing, agricultural robotics, and innovation management. Integrating these emerging competencies into agricultural education will enable graduates to support sustainable agricultural development and strengthen regional food systems more effectively (Garton & Chung, 1996).

Community Participation and Collaborative Governance

The findings further reveal that achieving sustainable regional food security requires active collaboration among multiple stakeholders rather than relying solely on government intervention. Agricultural development becomes more effective when universities, local governments, farmers, private industries, and community organizations work together in designing, implementing, and evaluating agricultural programs. This collaborative approach reflects the principles of the Triple Helix and

Quadruple Helix innovation models, which emphasize synergy among academia, government, industry, and society. Universities contribute through education, research, and technological innovation, while governments establish supportive policies and institutional frameworks. Private industries facilitate commercialization, investment, and technological diffusion, whereas farmers apply innovations directly within agricultural production systems. Community organizations further strengthen public participation, knowledge sharing, and social learning. The interaction among these actors creates a dynamic agricultural innovation ecosystem that enhances productivity while simultaneously promoting environmental sustainability and long-term food security (Rudd & Hillison, 1995).

Strategic Role of Universitas Muhammadiyah Enrekang

Although Universitas Muhammadiyah Enrekang is geographically located outside Sidenreng Rappang Regency, the analysis indicates that the institution possesses substantial potential to contribute to regional agricultural development across South Sulawesi. The university can strengthen regional food security through interdisciplinary agricultural research, community empowerment initiatives, agricultural extension services, student fieldwork programs, collaborative research with local governments, digital agriculture training, technology transfer activities, and agricultural entrepreneurship education. By integrating the university's core missions of education, research, and community service, Universitas Muhammadiyah Enrekang can function as an important regional knowledge hub that supports agricultural transformation and rural development. Furthermore, establishing multidisciplinary research groups focusing on smart agriculture, climate adaptation, agricultural technology, food innovation, and sustainable rural development would significantly strengthen the university's capacity to generate practical

solutions for regional agricultural challenges while promoting evidence-based policymaking.

Proposed Integrated Model for Strengthening Regional Food Security

Based on the synthesis of the reviewed literature, this study proposes an integrated conceptual framework for strengthening regional food security through agricultural education. The framework consists of five interconnected components that collectively promote sustainable agricultural development. The process begins with human capital development, whereby educational institutions enhance farmers' knowledge, technical competencies, leadership skills, entrepreneurial capacity, and digital literacy. Improved human capital subsequently supports research and innovation, enabling universities to generate scientific discoveries, technological advancements, and evidence-based agricultural solutions. These innovations are then disseminated through technology transfer, including agricultural extension services, demonstration farms, professional training programs, and digital learning platforms. Effective technology transfer encourages farmers to adopt sustainable agricultural practices, characterized by environmentally friendly production methods that increase productivity while conserving natural resources. Ultimately, these integrated processes contribute to regional food security by improving food availability, accessibility, utilization, and long-term stability. This conceptual framework demonstrates that agricultural education functions as the fundamental driver connecting research, innovation, technology adoption, community empowerment, and sustainable agricultural transformation (Garton & Chung, 1996).

Implications for Sustainable Development

The findings of this study demonstrate that strengthening agricultural education contributes directly to the achievement of several Sustainable Development Goals (SDGs), particularly SDG 2 (Zero Hunger), SDG 4 (Quality Education), SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation and Infrastructure), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action). These findings highlight that higher education institutions have responsibilities extending beyond conventional teaching and research functions. Universities act as catalysts for regional transformation by generating scientific innovations, empowering farming communities, facilitating knowledge transfer, and promoting environmentally sustainable agricultural systems. For Sidenreng Rappang Regency, integrating agricultural education with digital innovation, collaborative research, farmer empowerment, and supportive government policies represents a promising strategy for strengthening regional food security while fostering sustainable rural development. Accordingly, investment in agricultural education should be recognized as a long-term strategic priority for enhancing agricultural resilience, improving rural livelihoods, and ensuring sustainable food systems capable of responding to future environmental and socioeconomic challenges (Wingenbach et al., 2003).

The study also emphasizes that strengthening regional food security should be viewed as a collaborative responsibility involving universities, governments, research institutions, industries, farming communities, and civil society. This collaborative ecosystem facilitates knowledge exchange, accelerates technology adoption, encourages innovation, and supports evidence-based policymaking for sustainable agricultural development. From a policy perspective, this study recommends strengthening agricultural education through curriculum modernization, expanding

research and innovation in sustainable agriculture, increasing investment in digital agricultural technologies, promoting university–industry–government collaboration, and enhancing community-based agricultural extension programs. These strategic initiatives will contribute to developing resilient food systems capable of adapting to future environmental, economic, and technological challenges while supporting regional economic development and improving farmers' livelihoods.

Although this study provides a comprehensive conceptual understanding of the relationship between agricultural education and regional food security, it is limited by its reliance on secondary data and literature synthesis. Future research should employ empirical approaches, including quantitative surveys, mixed-methods research, longitudinal studies, and participatory action research involving farmers, agricultural extension officers, policymakers, and educational institutions. Such studies would provide stronger empirical evidence regarding the effectiveness of educational interventions, technological adoption, and collaborative governance models in strengthening regional food security.

Ultimately, investing in agricultural education is not merely an investment in higher education but a long-term investment in sustainable food systems, resilient rural communities, and national development. By integrating education, research, innovation, and community engagement, higher education institutions can become key drivers of regional food security, agricultural sustainability, and the achievement of the Sustainable Development Goals (SDGs), particularly SDG 2 (Zero Hunger), while promoting inclusive and sustainable regional development for future generations.

Conclusion

This study demonstrates that strengthening regional food security requires a comprehensive and integrated approach that extends beyond increasing agricultural production. The findings indicate that sustainable food security is fundamentally supported by the development of human capital through agricultural education, scientific research, technological innovation, community empowerment, and collaborative governance. Using Sidenreng Rappang Regency (Sidrap), South Sulawesi, as a regional context, the study highlights the strategic importance of agricultural regions in maintaining Indonesia's food resilience while simultaneously addressing emerging challenges such as climate change, technological transformation, land-use conversion, and the declining participation of younger generations in agriculture.

The analysis confirms that agricultural education serves as the cornerstone of sustainable agricultural development. Universities contribute significantly by producing competent graduates, generating research-based innovations, transferring technology to farming communities, and fostering interdisciplinary collaboration among government agencies, industries, and local stakeholders. The integration of digital technologies—including Artificial Intelligence (AI), the Internet of Things (IoT), Geographic Information Systems (GIS), precision agriculture, and data analytics—further enhances agricultural productivity, resource efficiency, and environmental sustainability. However, the successful implementation of these technologies depends largely on educational institutions that prepare graduates with the knowledge, technical skills, digital literacy, and adaptive capacity required for Agriculture 4.0.

References

- Blackburn, J. J., & Robinson, J. S. (2008). Assessing teacher self-efficacy and job satisfaction of early career agriculture teachers in Kentucky. *Journal of Agricultural Education*. <https://eric.ed.gov/?id=EJ839890>
- Dooley, K. (2002a). Agricultural education competencies and progress toward a doctoral degree. In *Journal of Agricultural Education*. academia.edu. <https://www.academia.edu/download/2947691/6lee7wzu2oyewp0.pdf>
- Dooley, K. (2002b). Agricultural education competencies and progress toward a doctoral degree. In *Journal of Agricultural Education*. academia.edu. <https://www.academia.edu/download/2947691/6lee7wzu2oyewp0.pdf>
- Dyer, J. E., & Osborne, E. W. (1996). Effects of teaching approach on achievement of agricultural education students with varying learning styles. *Journal of Agricultural Education*. <https://jae-online.org/index.php/jae/article/view/1590>
- Garton, B. L., & Chung, N. (1996). The inservice needs of beginning teachers of agriculture as perceived by beginning teachers, teacher educators, and state supervisors. *Journal of Agricultural Education*. <https://jae-online.org/index.php/jae/article/view/1591>
- Jones, D., & Rudd, R. (2008). Transactional, Transformational, or Laissez-Faire Leadership: An Assessment of College of Agriculture Academic Program Leaders' (Deans) Leadership Styles. *Journal of Agricultural Education*. <https://eric.ed.gov/?id=EJ839885>
- Kitchen, N. R., Snyder, C. J., Franzen, D. W., & Wiebold, W. J. (2002). Educational needs of precision agriculture. In *Precision agriculture*. Springer. <https://link.springer.com/article/10.1023/A:1021588721188>
- Myers, B. E., & Dyer, J. E. (2004). Agriculture teacher education programs: A synthesis of the literature. *Journal of Agricultural Education*. <https://jae-online.org/index.php/jae/article/view/195>
- Osinem, E. C. (2008). *Managing Agricultural Education & Training Resources, Principles and Methods*. Belony International Pub.
- Robinson, J. S., & Garton, B. L. (2008). An assessment of the employability skills needed by graduates in the College of Agriculture, Food and Natural resources at the University of Missouri. *Journal of Agricultural Education*. <https://eric.ed.gov/?id=EJ839908>
- Rudd, R. D., & Hillison, J. H. (1995). Teacher characteristics related to the adoption of agriscience curriculum Virginia middle school agricultural education programs. *Journal of Agricultural Education*. <https://jae-online.org/index.php/jae/article/view/1145>
- Seagle, E. D. (2001). *Characteristics of the turfgrass industry in 2020: A Delphi study with implications for agricultural education programs*. search.proquest.com. <https://search.proquest.com/openview/284a4384ad485c63488322b315eefbb1/1?pq-origsite=gscholar&cbl=18750&diss=y>
- Thompson, G. W., & Balschweid, M. A. (1999). *Attitudes of Oregon agricultural science and technology teachers toward integrating science*. digitalcommons.unl.edu.

- <https://digitalcommons.unl.edu/aglecfacpub/149/>
- Trauger, A., Sachs, C., Barbercheck, M., & Kiernan, N. E. (2008). Agricultural education: Gender identity and knowledge exchange. *Journal of Rural*
<https://www.sciencedirect.com/science/article/pii/S0743016708000168>
- True, A. C. (1929). *A history of agricultural education in the United States, 1785-1925*. books.google.com.
https://books.google.com/books?hl=en&lr=&id=whNDAAAIAAJ&oi=fnd&pg=PR11&dq=agricultural+education&ots=n8X_GaYZlp&sig=-VcnIKhT1E0ebfTlioHooq6NVRM
- Wingenbach, G., Boyd, B., Lindner, J., & Dick, S. (2003). Students' knowledge and attitudes about international agricultural issues. In ... *Agricultural and*
academia.edu.
<https://www.academia.edu/download/123724466/28e984a13ce45255c2ff6c28d2e3b513dfe2.pdf>
- Wolf, K. J., Foster, D. D., & Birkenholz, R. J. (2010). The relationship between teacher self-efficacy and the professional development experiences of agricultural education teachers candidates. *Journal of Agricultural Education*.
<https://jae-online.org/index.php/jae/article/view/273>