Available online at http://www.ifgdg.org

Int. J. Biol. Chem. Sci. 17(1): 141-153, January 2023

ISSN 1997-342X (Online), ISSN 1991-8631 (Print)

International Journal of Biological and Chemical Sciences

Original Paper http://ajol.info/index.php/ijbcs http://indexmedicus.afro.who.int

The adult-centered teaching strategies for the livestock System resilience with a variety of extension agent workloads' demands: a case study of Thies and Diourbel Regions, Senegal

Ousmane KANE[1*], Alkaly BADJI[1] and Donna WESTFALL-RUDD[2]

[1]Université Alioune DIOP, BP: 54 Bambey, Senegal.
[2]Université de Virginia Tech
[*]Corresponding author; E-mail: ousmane.kane@uadb.edu.sn , Tel: 00221 77 506 63 58

Received: 06-11-2022 Accepted: 20-01-2023 Published: 31-01-2023

ABSTRACT

Senegalese extension services play a crucial role in Senegalese agriculture which is still characterized as family and peasant-based. Extension agents provide technical support and information to breeders. Today, an adaptation to the use of natural resources is necessary because of the degradation of the agro-pastoral ecosystem, hence the need for innovative training and awareness-raising strategies. Therefore, the purpose was the enhancement of the teaching approaches implemented to local breeders in the context of climate change in the Diourbel and Thies regions. The researcher collected qualitative data, including document analysis and in-depth interviews with 12 extension agents. Findings included insight into the training experiences of extension agents in the context of climate change. Besides, the results showed that the program planning is effective and helped to design practical teaching content. In addition, the adult-centered teaching approach is a new concept for the participants. However, the findings demonstrated the need to improve knowledge in teaching and learning innovations for extension agents in natural resource conservations. In sum, they need program planning and continuing professional development programs to be efficient in diffusing the concept to change the mindset and behaviors of breeders.

Keywords: Adult-centered teaching, extension agents, breeders, climate change, Senegal.

INTRODUCTION

The rural sector around the world abounds with diversified economic potentials and heterogeneous and unstable production systems with the issues of food security and food self-sufficiency (Urama & Ozor, 2011). The success of efforts to handle the challenging conditions of food security and food self-sufficiency is reflected in the desire to increase livestock productivities in developing countries. Hence, the Senegalese agriculture and livestock systems are still characterized as family and peasant-based with an important place of animals in the production system. The

DOI : https://dx.doi.org/10.4314/ijbcs.v17i1.11

weak performances of pastoral system, in addition, is related to technical, financial supports, producers' organizational issues, NGOs' leaders' works, local authorities' goals, extension agents' works, and inadequate partners' objectives (Povellato & Scorzelli, 2006; Aker, 2011; Brodeur et al., 2011; Knuth & Knierim, 2013; An & Mindrila, 2020). Further, the extension agents' technical capacities, training and professional development opportunities have declined due to financial restraints. Indeed, these restrictions negatively impact the extension goals to serve the breeders in the context of climate change (Knuth & Knierim, 2013; Ragasa et al., 2013; Burgess et al., 2018; Wingreen, & Blanton, 2018). Therefore, the extension agents should have a new role and position in the changing world and climate change conditions.

This study is informed by the planning programs for adult learners of Caffarella & Daffron (2013). Planning programs are a dynamic process that can apply to climate change. Also, they are moments of acquiring knowledge at the producer and organizational levels to catalyst change (Cervero & Wilson, 2006; Caffarella & Daffron, 2013). Caffarella & Daffron, (2013) explained program planning as social activities whereby learners develop educational programs to meet personal, organizational, and social interests. Program planning involves all parties of the communities such as producers, researchers, extension staff, institutional partners, farmers' organizations, and public and private sectors (Cervero & Wilson, 2006; Adekunle et al., 2013; Caffarella & Daffron, 2013; Gill, et al., 2016; Tien, 2018). In addition, the program-planning model is an interactive approach to plan which include social, environmental and political dimensions into planning processes by explaining the technical, rational, practical, and critical approaches (Cervero & Wilson, 2006).

The planners' ability to design curricula, choose teaching strategies and educational programs may understand the reality of the political and social forces that can lead to poor outcomes in the organizational level, programs' purpose, goals, stakeholders, and impact (Aker, 2011; Caffarella & Daffron, 2013; Galt, et al., 2013; Merriam & Bierema, 2013; Dowdy, & Boyd, 2018). Likewise, climate change call planning models that provide key guidance on understanding specific stakeholders' needs, negotiating and acting with equal relations of power, and institutional structures to control over adequate teaching approaches, contents, lessons as well as to drive equity and gender inclusion in program participation (Caffarella & Daffron, 2013; Merriam, & Bierema, 2013). In addition, program designers reflected in decision-making that leads to a more significant influence on curricula's purpose, goals, objectives, instructional tolls, implementation guides, evaluation processes and outcomes of actions. Thereby, the planning processes helped to identify the classroom needs and teaching resources for the stakeholders by using educational means to better engage in the learning processes and participate to prepare a detailed outline of actions (Gill et al., 2016; Burgess et al., 2018; An & Mindrila, 2020; Singh, 2020).

The main purpose of extension services is to improve the educational level and understanding of most rural population such as breeders, farmers, women, agribusiness, producers' organizations, other urban entities about new technology and communication, policies and legislation, and practices that may increase environmental profitability, reduce climate pollution, or benefit society in other ways (Koundinya, 2010; Knuth & Knierim, 2013; Leeuwis, 2013; Ragasa et al., 2013; Meijer et al., 2015). The capacity buildings of extension agents should have today an important place to overcome the new challenges created by the climate change consequences and guided in future extension and livestock programs' implantations to serve as a lever and a formidable force to improve the services of extension agents to improve the livestock production system in coping the climate changes (Aker, 2011; Galt et al., 2013; Mbo'o-Tchouawou & Colverson, 2014; Burgess et al., 2018; An & Mindrila, 2020; Singh, 2020).

This research paper is essential because it contributes in dealing with the climate change by creating and improving the used

livestock training approaches for breeders by professionals' extension services. Also, its importance appears with the objectives to tackle the pedagogical issues with climate change in building and implementing of livestock extension programs and facilitating elders' professional education programs. The originality of this paper is its significant contribution to improving the current and new livestock extension systems and continuing professional education programs (Singh, 2020; Galt, et al., 2013). Besides, it is essential in the current conditions of degradation of rural livestock production systems along with climate change impacts and consequences to reinforce the extension agents' teaching strategies and capabilities to deliver breeders' programs in Senegal (Otsuka & Larson, 2013; Nuadi, et al., 2009)). Therefore, the purpose of this case study was the enhancement of the teaching approaches implemented to local breeders in the context of climate change in the Diourbel and Thies regions. The following questions guided this study:

1. How do the extension agents describe the teaching conditions of the livestock extension system in Senegal?
2. How do extension educators recommend adult-centered teaching strategy be used in the livestock extension system to cope with the degradation of pastoral environments?

MATERIALS AND METHODS

The researcher chose a descriptive case study method to address the research questions. Direct observations are the main focus of a descriptive case study to describe events under questioning, and interviews of the stakeholders involved in the events and phenomenon (Yin, 2017; Baskarada, 2014). The case study allows the use of multiple data sources for triangulation that ensure the validity of the research processes and results. Besides, the multiple data sources lays out multiple measures and answers of the research questions (Patton, 2015; Baskarada, 2014). The researchers focused on teaching methods associated with the livestock extension system to cope with climate change and its impacts to the pastoral environments to improve social life and economic growth. The harvesting data processes included one single in-depth interview for each of the extension agents and a single focus group (Yin, 2017; Patton, 2015; Baskarada, 2014) to develop themes for data analysis.

Sampling and participant selection

The selected stakeholders to collect the data were 12 livestock extension agents as the sample for this case study, as their experiences were relevant to the research questions (Patton, 2015;). The researchers selected these participants for the "information-rich" that were expected to be gathered from their insights, experiences and statements (Yin, 2017; Patton, 2015). All extension agents in the selected regions participated in the interviews and the single focus group.

Preliminary work

The use of a priori propositions (Table 1) assisted the researcher in designing the interview guide and focus group protocol (Yin, 2017). Indeed, the main propositions directed attention and provided guidance in where to focus for relevant evidences to justify detailed questioning and observing within the purpose of the study (Majid, et al., 2017; Yin, 2017; Patton, 2015). Table 1 explained how the propositions reflected and combined the participant interview guides, focus groups, and the supporting literature. Indeed, a pilot-tested interview was implemented with one extension agent to identify flaws and challenges in the designing processes. Because of the pilot test, the researcher were able to modify the interview protocol based on feedback. Also, the interview and focus group were carried out in French as it was more casual for both interviewees and interviewer to have comfortable discussions (Majid, et al., 2017). The researcher asked the interview questions in the flow of face to face discussion. An interview lasted from 45 minutes to one hour.

Data analysis procedures

Researcher used the Windows Media Player© and Express Scribe© transcription software and the Atlis ti© software package to

manage, code, categorize, create themes, and analyze the data transcriptions and gartered documents. Upon finishing the transcriptions, the researcher checked the accuracy of the data and started initial coding relied on the literature outlined in the *aPriori* propositions, the participants' words, and the researcher's interpretations. Then, interviewees reviewed the coded data to verify and identify the themes' properties. Last not least, the researcher checked for similarities within the themes to immerge and integrate into one category to represent the set of themes. Moreover, he referred to this process as analytic generalizations where theory well-developed was used to compare the results of this descriptive case study to guide the data analysis procedures (Yin, 2017).

Table 1: *aPriori* Prepositions.

Propositions	**Supporting Literature**	**Research Questions**	**Interview Questions**	**Observation Guide**
The participation of extension agents is crucial to the community education programs. The relationships between teaching methods and understandings will improve how the breeders answer or participate in managing program works in climate change.	The community education provides expert assistance to enhance awareness in climate change, raise understanding of the degradation of pastoral environment, increase productivity, diffuse information and supports on climate issues from theory to practice (Merriam et al., 2007).	1. How do the extension agents describe the teaching conditions of the livestock extension system in Senegal?	Can you explain your experience as an extension agent? What is the explanation of the current situation of the extension system? What are the main delivery methods used in the extension agent's class?	How do extension agents show their knowledge about teaching methods? How do extension agents apply their skills in teaching breeders? How do extension agents work in adult education program with climate change topics?
Adult education dynamics improve individuals' ability to participate in teaching, group discussions, and decisions to cope with the climate change processes and the degradation of pastoral environments?	Their knowledge helps individuals' ability to understand mitigate diffuse the degradation of pastoral environments and catalyzed group through engagement to adapt management and increase attention in climate change (Mills et al., 2016; Cervero & Wilson, 2006; Caffarella &, 2006).	2 How do extension educators recommend adult-centered teaching strategy be used in the livestock extension system to cope with the degradation of pastoral environments?	How the extension communication spread climate change? How teaching practices for groups increased knowledge and engagement? How the main delivery methods influence the extension agent's practices related to climate change? How do breeders react to adult-centered teaching strategy?	Extension activities reports Climate change lesson plan or Programs; Extension activities for breeders on the degradation of pastoral environments.

RESULTS

The extension agents' description of the teaching conditions of the livestock extension system in Senegal

The themes of this question (areas of workload and expectations, infrastructures, facilities and funding, limited sources of information, continuing professional development programs) demonstrate harsh working conditions.

Areas of workload and expectations

The results showed that participants are experienced well with different years and professional positions in the animal husbandry extension, and they presented different academic histories characterized by various education levels. These characteristics of extension agents demonstrated the ability to occupy diverse functions that explained the amount of the job expectations from breeders with their individual or community problems. Indeed, the participants declared that their foremost goal as extension agents should provide quick solutions and advice for breeders' needs. Diogoye said to illustrate the facts that "I had to handle different tasks in my daily work to fulfill my organization's commitments." In the same vein, although he is a livestock extension agent, he declared: "...during the precipitating season, I was responsible for implementing farming projects such as millet and peanut crops and fodder crops for breeders."

Moreover, Moussa, a livestock extension agent, talked about how "... I played a crucial function in agroforestry duties because of the degradation of pastoral environments." He highlighted the fundamental role of trees in response to the climate crisis, particularly when associated with crops and other perennial woody plants. Babacar focused on his diverse working conditions with different environmental structures to accomplish veterinary educational programs in one health and talk about the positive impacts of managing the natural resources adequately. Furthermore, Niokhor exemplified all functions that he directed in a grass crop program. He said "…I was at the regional for administrative duties, then went into the community for crop demonstration and seed identification. All participants understood that an extension agent should involve in various job commitments to satisfy breeders' needs and the current educational programs.

Infrastructures, facilities and funding

The results exhibited that livestock extension system assets are necessary for success and goal satisfaction. Participants stressed that they need to mobilize the potentialities of livestock extension to accomplish their appointments. Indeed, Dibokor, head of the local livestock extension office, claimed adequate support increases opportunities and decreases common challenges faced by the endeavors of the agents to increase the impact of advisory and extension services to accomplish their jobs. Diarra noticed that lack of suitable government investments in infrastructure, facilities, materials, and funding affected the viability and efficacy of the livestock extension. Also, Babacar focused on difficulties such as training support, limited local office facilities, teaching materials, and a substantial budget that may improve flows of broad and complex information and advice. Besides, the unfortunate teaching materials appeared to be the most challenging obstacle for extension activities in adult education.

Moreover, Diarra stressed that livestock extension has limited financial funds from local authorities and governmental support are the issues to developing and enforcing climate change educational programs for breeders. In addition, she added that the lack of adequate budget growth constituted an obstacle to delivering services efficiently. The continuing decline of teaching tools demotivated the extension agents to provide educational opportunities in the context of the degradation of livestock environments. Hence, the local authority's funding was inadequate for extension agents to provide training opportunities to the community. Niokhor claimed that "it is the local or national authorities' responsibility to bring the necessary support for extension agents and

offices to limit the considerable negative impacts on the activities." All participants had experienced at least one partnership project and agreed advisory and extension systems can help improve profitability, sustainability, and equity as part of broader innovation of livestock systems**.**

Limited teaching resources of information

The results showed that participants voiced a lack of teaching materials to improve knowledge and skill of practices and functional communication techniques to spread in adulthood classrooms. Fatou claimed that to illustrate this unsuitable working and teaching conditions. She said, "I applied the top-down approaches most of the time in my classroom. ... we, extension agents, have a positive attitude toward experiencing top-down strategies in our community education activities." Also, Niokhor mentioned the obsolete instruction and learning methods that all participants experienced, despite their will to update the current recommended teaching processes in the livestock extension. Diarra and Dibokor emphasized that the limited information sources constituted the principal blockage to enhance approaches, but also they limited the spread of the information to the producers. Indeed, all participants agreed about the importance of having opportunities to access new teaching information to enhance livestock extension efficiency. Dibokor added that the current extension agents did not have the adequate circumstance to experience the most recent methods and practical class resources to diversify the extension delivery methods in climate change contexts.

Hence, climate change pedagogy is the most used framework in extension education. In his illustration of Dibokor claim, Niokhor expressed that "...it is harder for us to choose good approaches for behavioral changes focusing in climate change ... we all ended up lecturing class materials because of a lack of valuable resources." Besides, Moussa added that "... therefore, it is just about introducing new models and methods sometimes." Despite these challenges, extension agents respond positively to experiencing new information sources to improve their pedagogy procedures.

Capacity building and professional development programs

The results displayed that extension education is based on building the capacity of actors to understand and take advantage of contemporary training and advisory methods through better coordinated and contextualized work. Indeed, capacity-building and professional development programs are essential to creating new modes of exchange for the provision of services. Also, it makes it possible to increase the quality and quantity of information to be transmitted through their producer organizations. Ouse put in crucial points by saying, "...the urgent demand for professional development programs because they needed them to help be more effective in the teaching tasks and implement their curriculum efficiently." Niokhor added another illustration to these needs, "...the same issues regarding the necessity of updating our teaching methods and practices, and needed to make the capacity building and Professional development a priority to improve their teaching methods."

In addition, Dibokor mattered that extension agents needed the newest knowledge and skills to guarantee valuable understanding to satisfy task areas, workloads, and job expectations such as beef production, soil, and pastoral environment protections, and crops. Adiouma recognized the importance of documentation and classroom resources as essential to the services and training objectives. All participants agreed about the necessity of authorizing the extension agents to improve their professional careers through continuing professional development programs.

Extension educators recommend adult-centered teaching strategy be used in the livestock extension system

The gathered themes of this question through interviews and the focus group were lack of teaching strategies, limited teaching technologies, and recommendation of adult-centered.

Lack of teaching strategies

The results revealed a lack of teaching strategy resources and tolls within the livestock extension. All participants acknowledged the deficits in extension education because there is no well-studied support in its structural and organizational dimensions to increase the quality of educational supplies in terms of curricula, teaching materials, and infrastructure. However, participants enumerated the current teaching strategies of the livestock extension class lecture, round tables discussion, analyzing visual images, field practices and demonstrations, and group discussion as extension methods. Babacar recognized that extension agents did not have the opportunity to implement an adult-centered teaching strategy, despite all extension agents having a teaching history and experiences. Dibokor explained that extension agents did not have annual capacity-building programs for teaching and learning strategies for elders that could guide them to know and use adult-centered instruction techniques. Adiouma added that the capacity-building of extension workers allows them to adapt to new tasks and rethink their roles to develop the fundamental skills and knowledge required.

Moreover, Niokhor explained, "as an extension agent, we need to know what we are talking about in terms of pedagogical approaches with the necessary skills and know how to build the capacities of local herders so that they are able to make informed decisions to protect their working tools and natural resources." Bass focused on his class design by explaining, “I designed my class in a classic form to engage all participant in-class exercises.

Hence, I formed inclusive mixed groups between the youth and elders for the class activities to allow everyone to speak by investigating the resources materials." Bass still used a demonstration approach to implicate learners to manage their working ability and identify the relevant information that enhanced their breeding conditions. Bass explained he did not implement any other teaching method because of his knowledge and skills as many extension agents. To add more argument to Bass's explanation, Gorgui depicted that "... at the end of my class activities, the participants communicated their arguments and understanding of the class activities to improve the learning environments." In sum, the results proved that teaching methods used by the extension personnel depended on the knowledge and skills of extension agents rather than being learner-centered which is a new method.

Limited teaching technologies

The data showed that the extension agents have old instruction technologies, and the continuing professional training requires modernizing how to use technical knowledge and skills in livestock extension. Indeed, all participants agreed about the limited characteristics of pedagogical technologies. Moussa said that to demonstrate the deficiency of technology tolls: "Maybe there are other new technology methods that I do not know concerning extension program executions." Dibokor described a dramatic situation about using technology tools. He said, "until today, I did not have an email address or a social media network to communicate with the learners or my manager. I need pedagogy and technology reinforcements to access technical materials and resources because they are indispensable in achieving the teaching goals." The results focused on the circumstance that few agents owned a laptop in their extension office or connected to the internet. Therefore, the participant did not understand or get the chance to enhance their knowledge and skills in technology tools because connectivity constraints constituted a barrier.

Recommendation of adult-centered

The participants investigated adult-centered teaching approach in livestock extension. Participants shared their expertise and practices using adult-centered instruction in their educational curricula. Despite, their

different backgrounds, levels of study, and variety of teaching experiences, participants recognized the novelty of the adult-centered concept because they never had a capacity building about it. Mame focused on several current educational programs to represent the existing teaching strategies to illustrate their unfamiliarity with the adult-centered theory. Babacar brought a fundamental example of pedagogical constraint, "...I worked on poultry and cattle and sheep fattening by applying practice and demonstration in my teaching and learning activities since he was an extension agent." Ngouye added that I spent more than ten years without having any pedagogical training to improve my ability to implement educational curricula. He emphasized "practices and demonstrations are the only teaching method I know to use soundest in the extension system. They are my favorite pedagogy approaches in implementing extension programs." Moussa explained that he implemented field practices, demonstration techniques, and top-down approaches to teach breeders when he delivered meat and milk programs. Further, Adiouma explained his weakness in educational strategies so that he does not know other methods except demonstration, top-down, and class lectures.

The results revealed that the adult-centered method was not a used terminology as a teaching strategy in the livestock extension. All participants admitted that they did not have training sessions related to this pedagogical approach. Niokhor argued that the lack of pedagogical innovation does not allow extension agents to implement the adult-centered strategy to push learners to engage in their learning process. Data showed significant constraints in implementing this educational approach for adults. Thus, Diarra and Niokhor proved this pedagogical difficulty by explaining the extension agents did not understand the adult-centered method well. Also, they continued complaining about the rarety of capacity-building opportunity, which is often insufficient and superficial in terms of objectives and purposes. Besides, Moussa declared that many good extension agents mix several teaching strategies in their program implementation, which adapt the work and the resources they have access to, regardless, none of the educational approaches are adult-centered. All participants recognized the imperative requirement to execute continuing professional development programs in teaching and learning strategies for all the livestock extension agents.

DISCUSSION

Areas of workload and expectations

The agents' position and role in the extension system showed the diversity of their well-experienced in providing services to the breeder community by focusing on teaching needs and expectations (Gill, et al., 2016; Koundinya, 2010; Kwaw-Mensah, 2008). The results seem to support job demand for personal skills and knowledge, which is the main point of the person-fit paradigm (Wingreen, & Blanton, 2018). The findings established that extension agents answered more than one area of breeders' expectations, as explained by Diogoye. He said "while an extension agent in livestock, I was responsible for implementing farming projects such as millet and peanut crops, and fodder crops for breeders" (Mbo'o-Tchouawou, & Colversion, 2014; Leeuwis, 2013; Swanson, 2008). And then, Moussa reinforced, as a livestock extension agent, "... I played a crucial function in agroforestry duties because of the degradation of pastoral environments." The task areas and workloads may be due to the organization's expectations in providing appropriate breeding guides to the breeder community (Ragasa et al., 2013; Belay, & Abebaw, 2004). The knowledge of their working conditions in various job commitments and workloads to satisfy breeders' needs and the current educational programs have proven that extension agents have the ability to fulfill demands in terms of teaching content and learning techniques.

Limited teaching resources of information, infrastructures and facilities

The results showed a shortage of pedagogical approaches because of limited sources of information, teaching tools, outdated curricula, and technologies. Improved training methods and programs should denote knowledge of the different ways individuals or groups learn, communicate, and use information. A lack of this knowledge can cause training programs to fail. These agents need to acquire new knowledge and pedagogical skills to make informed options on training strategies for development (Gill, et al., 2016; Frisk & Larson, 2011). Niokhor illustrated this shortage situation by saying, "as an extension agent, we need to know what we are talking about in terms of pedagogical approaches.... so that they are able to make informed decisions to protect their working tools and natural resources." Therefore, it is necessary to develop the potential and strengthen the pedagogical capacities of the agents to avoid the negative impacts of their teaching methods because of limited access to the newest practical teaching information (Galt, et al., 2012). Otherwise, the results demonstrated the restricted teaching methods implemented by the extension agents. Consequently, they must improve them to allow bottom-up articulation and the exchange of information on needs and knowledge.

Moreover, limited sources of information and technologies appeared clearly in the results of this study. To illustrate this assertion, Dibokor, "until now, I did not have an email address...." Indeed, sources of information and technologies are effective instruments for understanding common challenges faced by innovation to increase the impact of rural and agricultural advisory and extension services (Aker, 2011). This result aligned with Aker's (2011) finding where he spoke, "... This includes levels of education, wealth, risk preferences, expected returns, tastes, and access to information and learning." Yet, sources of information and technologies can bring about transparency, better access to information, and the transformation of the rural production system in the climate change context (Alexander, & Khabanyane, 2013). Thus, this gap ought to be bridged and filled out by professionals who can intervene and link extension with new technologies and teaching practices to disseminate agricultural skills and knowledge to rural stakeholders. Niokhor exemplified this need by saying, "…making the capacity building and professional development of agents a priority to improve their teaching methods..."

Capacity building and professional development programs

Regardless, much remains to be done to ensure that educational programs are truly developed based on participatory processes in the context of climate change. Strengthening the intervention capacities of extension workers for organizations of rural actors is essential to ensure that the main guidelines and programs meet the needs of the fight against the degradation of rural areas (Gill, et al., 2016). Therefore, the new extension approaches will foster extension agents to accomplish influential and fundamental works in planning and implementing extension services. In this way, Diogoye emphasized, "...the ability to implement effective programs and develop leadership in the extension system could be obtained by attending in-service training, conferences, and symposiums." Indeed, strengthening the capacities of extension agents and their organizations may guarantee valuable knowledge and skills to satisfy a variety of job expectations such as beef production, soil protection, and crops (Brodeur et al., 2011; Urama & Ozor, 2011). Thereby, they will disseminate on a large scale allowing the transition from inefficient production systems to more sustainable and productive systems.

Financial resources

Furthermore, the results exhibited financial technical and organizational network issues. Indeed, limited funding opportunities

exacerbated problems related to appropriate technology tools, working conditions, and teaching materials (Anderson, & Feder, 2004). Indeed, financial investments in extension are necessary and crucial to reach extension goals and innovation. The extension system results depend on how they are financed which can become a means of holding them accountable for the quantity and quality of the services they provide (Anderson & Feder, 2004). Therefore, it is necessary to learn from experiences to find new ways to finance the activities of agents and the equipment of extension services with the support of governmental funds, based on performance criteria. Besides, access to financial resources represents a fundamental constraint to extension reform in the context of natural resource degradation and to rise in inefficacity of designing, implementing, and evaluating extension activities (Anderson & Feder, 2004). Thus, the state authorities must be able to fund agents to facilitate discussions and coordinate the various stakeholders in the field of natural resource management and technical support, from production to marketing.

Recommendation of adult-centered

The investigation of the adult-centered approach in livestock extension revealed that it was not a current teaching strategy. Additionally, the experienced extension agents acknowledged their ignorance of the adult-centered concept because they never had a capacity building about it. Also, Niokhor's arguments confirm this situation described by the participants explaining that the lack of pedagogical innovation does not allow extension agents to implement the adult-centered strategy to push learners to engage in their learning process. Besides, several teaching strategies appeared in the findings where Moussa illustrated several current educational programs to represent his existing teaching strategies, such as field practices, demonstration techniques, and top-down approaches.

While research has shown that the learner-centered approach is a collaborative and cooperative learning method because it offers better opportunities, more scope for learner involvement, and ease in the teaching and learning experience (An, & Mindrila, 2020; Renzaho, 2020; Burgess, et al., 2018; Galt, et al., 2013; Nuadi, et al., 2009). Although recognizing the importance of improving teaching methods, the extension agents persisted by complaining about the rarety of capacity-building opportunity, which is often insufficient and superficial in terms of objectives and purposes. Hence, diversified teaching strategies inevitably lead to diversities in training practices, teaching competencies, and learning methods. Despite the importance of the adult-centered approach, extension agents did not receive any updated skills in pedagogy to improve the extension education systems and competencies (Galt, Parr, & Jagannath, 2013). Since Adiouma confirmed these issues by talking about his weakness in educational strategies so that he does not know other methods except demonstration, top-down, and class lectures. Therefore, these agents could not fulfill the current pedagogical challenges without continuing professional development programs.

Conclusion

All participants are well-experienced with various job expectations. Also, a lack of capacity-building and professional development programs appeared crucial to the livestock extension system. In addition, the results revealed the lack of teaching methods established in the extension system, despite the current teaching strategy implementation such as class lectures, round table discussions, analyzing visual images, field practices, demonstrations, and group discussions. Besides, the adult-centered teaching strategy was not enforced by participants to teach breeders because it was not used terminology as a teaching strategy. Moreover, the results exhibited the need for financial support to improve limited knowledge, skills, and

teaching tools through capacity-building and professional development programs. The recommendations of the study are the integration of teaching strategies through continuing professional development programs and program planning.

COMPETING INTERESTS:

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

OK is the principal author of this manuscript. He designed the research questions, and method and participated in all phases of its implementation. DWR supervised the designing process, research orientation, corrected and edited the final manuscript. AB worked on the accuracy of the data and advice for the experimental work.

ACKNOWLEGMENTS

The author acknowledges the support of Donna and other members of the Department of Agriculture, leadership, and community education from Virginia Tech University. Also, the author recognizes deep in my heart the extension agents who participated in the interviews and the focus group discussions.

REFERENCES

Adekunle AA, Ellis-Jones J, Ajibefun I, Nyikal RA, Bangali S, Fatunbi AO, Angé A. 2013. Agricultural Innovation in sub-Saharan Africa: experiences from multiple stakeholder approaches. Accra, Ghana: Forum for Agricultural Research in Africa (FARA).

Aker JC. 2011. Dial "A" for agriculture: a review of information and communication technologies for agricultural extension in developing countries. *Agricultural Economics*, **42**(6): 631-647. DOI: https://doi.org/10.1111/j.1574-0862.2011.00545.x

Alexander G, Khabanyane M. 2013. Service learning as a response to community/school engagement: Towards a pedagogy of engagement. *Perspectives in Education*, **31**(2): 102-113. DOI: https://www.ajol.info/index.php/pie/article/view/97081

An Y, Mindrila D. 2020. Strategies and tools used for learner-centered instruction. *International Journal of Technology in Education and Science*, **4**(2): 133-143. DOI: https://doi.org/10.46328/ijtes.v4i2.74

Anderson JR, Feder G. 2004. Agricultural extension: Good intentions and hard realities. *The World Bank Research Observer*, **19**(1): 41-60.

Baskarada S. 2014. *Qualitative case studies guidelines. The Qualitative Report*, **19**(40): 1-25. DOI: https://doi.org/10.46743/2160-3715/2014.1008

Belay K, Abebaw D. 2004. Challenges facing agricultural extension agents: A Case Study from South-western Ethiopia. *African Development Review*, **16**(1): 139-168. DOI: https://doi.org/10.1111/j.1467-8268.2004.00087.x

Brodeur CW, Higgins C, Galindo-Gonzalez S, Craig DD, Haile T. 2011. Designing a competency-based new county Extension personnel training program: A novel approach. *Journal of Extension*, **49**(3): 1-16. From https://archives.joe.org/joe/2011june/a2.php

Burgess DJ, Dowdy S, Boyd C. 2018. Developing culturally responsive teaching through learner-centered teaching during content and field immersions. *The Journal of Sustainability Education*, (General).

Cafferella RS, Daffron SR. 2013. *Planning Programs for Adult Learners: A Practical Guide for Educators, Trainers, and Staff Developers* (Third edn). Jossey-Bass: San Francisco.

Cervero RM, Wilson AL. 2006. *Working the Planning Table: Negotiating*

Democratically for Adult, Continuing, and Workplace Education. Jossey-Bass: San Francisco.

Frisk E, Larson KL. 2011. Educating for Sustainability: Competencies & Practices for Transformative Action. *Journal of Sustainability Education*, **2**.

Galt RE, Parr D, Van Soelen Kim J, Beckett J, Lickter M, Ballard H. 2013. Transformative food systems education in a land-grant college of agriculture: The importance of learner-centered inquiries. *Agriculture and Human Values*, **30**(1): 129-142. DOI: https://doi.org/10.1007/s10460-012-9384-8

Galt RE, Clark SF, Parr D. 2012. Engaging values in sustainable agriculture and food system education: Toward an explicitly values-based pedagogical approach. *Journal of Agriculture, Food Systems, and Community Development*, **2**(3): 43-54. DOI: 10.5304/jafscd.2012.023.006

Gill T, Jones K, Hammett T. 2016. Agricultural education and training system capacity development for sub-Saharan Africa: the role of InnovATE. *Journal of Development and Communication Studies*, **4**(2): 401-415. DOI: 10.4314/jdcs.v4i2.1

Majid MAA, Othman M, Mohamad SF, Lim SAH, Yusof A. 2017. Piloting for interviews in qualitative research: Operationalization and lessons learnt. *International Journal of Academic Research in Business and Social Sciences*, **7**(4): 1073-1080. DOI: 10.6007/IJARBSS/v7-i4/2916

Knuth U, Knierim A. 2013. Characteristics of and challenges for advisors within a privatized extension system. *The Journal of Agricultural Education and Extension*, **19**(3): 223-236. DOI: https://doi.org/10.1080/1389224X.2013.782166

Koundinya VSC. 2010. An analysis of the food safety educational processes in the Cooperative Extension System of the North Central Region of the United States. Graduate Theses and Dissertations. 11216. Iowa State University, Iowa, p. 155. DOI: https://lib.dr.iastate.edu/etd/11216

Kwaw-Mensah D. 2008. Perceptions of agricultural extension educators regarding livestock waste management education in the north-central region. Graduate Theses and Dissertations. 15807. Iowa State University, Iowa, p. 154. DOI: https://doi.org/10.31274/rtd-180813-17010

Leeuwis C. 2013. *Communication for Rural Innovation: Rethinking Agricultural Extension*. John Wiley & Sons.

Mbo'o-Tchouawou M, Colverson KE. 2014. Increasing access to agricultural extension and advisory services: How effective are new approaches in reaching women farmers in rural areas? ILRI (aka ILCA and ILRAD).

Meijer SS, Catacutan D, Ajayi OC, Sileshi GW, Nieuwenhuis M. 2015. The role of knowledge, attitudes, and perceptions in the uptake of agricultural and agroforestry innovations among smallholder farmers in sub-Saharan Africa. *International Journal of Agricultural Sustainability*, **13**(1): 40-54. DOI: https://doi.org/10.1080/14735903.2014.912493

Merriam SB, Bierema LL. 2013. *Adult Learning: Linking Theory and Practice*. John Wiley & Sons.

Nnadi FN, Chikaire J, Nwakwasi RN. 2009. Revitalizing Agricultural Extension Curriculum for Effective Extension Training. *International Journal of Tropical Agriculture and Food Systems*, **3**(4): 346-350.

Otsuka K, Larson DF. 2013. Towards a green revolution in Sub-Saharan Africa. In *An African Green Revolution*. Springer: Dordrecht; 281-300. DOI:

https://doi.org/10.1007/978-94-007-5760-8_14

Patton MQ. 2015. *Qualitative Research and Evaluation Methods: Integrating Theory and Practice* (4th edn). Sage : Los Angeles, CA

Povellato A, Scorzelli D. 2006. The Farm Advisory System: A Challenge for the Implementation of Cross Compliance. Deliverable D14 of the CC Network Project.

Ragasa C, Ulimwengu J, Randriamamonjy J, Badibanga T. 2013. *Assessment of the Capacity, Incentives, and Performance of Agricultural Extension Agents in Western Democratic Republic of Congo* (Vol. 1283). Intl Food Policy Res Inst.

Renzaho A, Twizeyimana E, Dufitumukiza B, Mujawimana E. 2020. Cooperative learning approach: A learner-centered methodology for alleviating the nonrepresentational nature of science education among learners of secondary schools in Rwanda. *Journal of Global Research in Education and Social Science*, **14**(2): 45-56.

Singh V. 2020. Toward an effective pedagogy of climate change: Lessons from a physics classroom. *arXiv preprint arXiv:2008.00281*.

Swanson BE, Samy MM. 2003. Decentralization of agricultural extension systems: Key elements for success. World Bank.

Tien CH. 2018. Investigation of Adult Education Program Planning From a Power and Interest Perspective: A Case Study of a Transnational Ph. D. Cohort Program. *US-China Education Review*, **8**(2): 43-51.

Urama K, Ozor N. 2011. Agricultural innovations for climate change adaptation and food security in Western and Central Africa. *Agro-Science*, **10**(1). DOI: 10.4314/as.v10i1.68717.

Wingreen SC, Blanton JE. 2018. IT professionals' person-organization fit with IT training and development priorities. *Information Systems Journal*, **28**(2): 294-317.

Yin RK. 2017. *Case study research and applications: Design and methods*. Sage Publications.