



TEACHING COMPETENCE-BASED AGRICULTURE SUBJECT IN PRIMARY SCHOOLS IN KENYA: A REVIEW OF INSTITUTIONAL PREPAREDNESS

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Abstract

Lack of the critical competencies for employability and self-reliance have contributed to high levels of youth unemployment. Introduction of Competence Based Education (CBE) system is to ensure learners acquire communication, collaboration, critical thinking, problem solving, self-efficacy and digital literacy. *This article reviewed the literature related to institutional preparedness for instruction of agriculture. This study was grounded on desktop design that reviewed, relevant reports by several education commissions and peer reviewed journals with a focus on instructional, infrastructural resources, teacher training and sustainability plans for resources.* The result show that institutional preparedness is key in curricula changes. However, practical instruction to equip learners with competencies in vocational subjects has remained a challenge. This literature review findings indicated that for any curriculum implementation institutional preparedness is pertinent and failure to which schools end up producing learners who get it difficult to solve societal problems in agricultural education. This study is useful to stakeholders in education and practitioners to better understand research results in the field of agricultural education. Despite many articles having addressed need to promote practical teaching of vocational subjects in Kenya, less literature is available on institutional preparedness.

Keywords: Institutional Preparedness, Teaching, Competence Based Education, Primary school Agriculture

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1. Introduction

The economic, social and political development of many countries globally is dependent on the quality of education, equity, relevance and access which enables citizens acquire skills,

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knowledge and competencies necessary for sustainable development (Rieckmann, 2018). Globally, countries have and are shifting from cognitive based education system to Competency Based Education (CBE) which combines cognitive, psychomotor and affective domains (Khanna & Mehrotra, 2019). The CBE system aims at enabling learners acquire practical relevant skills, develop positive attitudes and critical thinking. Among other aims of CBE is facilitation of teaching and learning vocational subjects practically, enable learners identify their abilities and minimize school-dropout rate by learners (Mulder et al., 2017). Countries like Finland, Luxembourg, Germany United States of America, Australia, Netherlands and United Kingdom have proofed to achieve CBE due to high degree of institutional preparedness and development in terms of teacher training and provision of excellent learning facilities (Denis Goodrum et al., 2012).

Countries that have successfully embraced CBE in Africa include: South Africa, Rwanda, Zambia and Tanzania (Théophile Nsengimana et al., 2020). The Kenya Vision 2030 emphasizes on the connection between quality education and the labor market, the need to create invention, innovational skills and competencies that will support both public and private sector (Ministry of Education, 2019). The Kenyan education system has undergone various transformations before and after independence to ensure greater achievement of societal needs. Practical teaching of vocational subjects is one way of empowering youths in the development of cognitive, psychomotor and affective domains to reduce the level of poverty , unemployment and crime in society (Miriti et al., 2014). Previous education commissions like Phelps stroke commission of 1925, the Beecher report of 1949, Binn report of 1952 and the Mackay report which recommended the need to change the education system to 6-3-3 from 4-4-4 had a great aim in promoting practical teaching of vocational subjects, teachers training and availing resources in Kenyan schools.

It was expected that the 8-4-4 education system was to adopt and encourage more on practical teaching of vocational subjects but this was not the case in Kenyan schools since the implementation process was affected by several challenges including inadequate instructional resources, poor teaching staff preparedness, inadequate and in most occasions untrained staff. Therefore, teachers adopted theoretical teaching of agriculture compromising learners' competencies (Chepng & Boit, 2015). Due to criticism that the 8-4-4 education system was academic focused, the government of Kenya proposed Competence Based Education (CBE) system which was put under piloting in 2017. The CBE system whose first cohort is at grade four in the year 2020, aims at promoting the education competencies. It also aims attaining balance between academic specialization, technical skills and market industry. In the CBE, Agriculture has been re-introduced at primary schools as a an independent subject and its compulsory starting from upper primary (Ministry of Education, 2019).

1.1. Relevant scholarship

This section provides an overview of recent research related to institutional preparedness in teaching of Agriculture in public primary schools which have been divided into thematic headings which include; Institutional infrastructural preparedness, teacher preparedness in

teaching Agriculture, agricultural instructional resources for competence-based agriculture subject and sustainability plans for instructional and infrastructural resources

Teacher preparedness in teaching Agriculture

The quality of agricultural knowledge acquired by learners is partly dependent on the quality teacher training (Kyule et al., 2018). The CBE system aims at shifting the learning from teacher-centered to a learner-centered teaching approach in order to make education relevant , improve education quality and learners competencies in order to achieve Vision 2030 and make Kenya a middle class economy (Government of Kenya, 2019). Under CBE a teacher is neither a source nor a dispersion of knowledge but facilitates learning with greater focus on practical teaching of vocational subjects (Mulder et al., 2017). Successful countries like Finland, Germany, USA, Netherlands and South Africa in implementing CBE system have proved to promote high quality teacher training, more teacher employment to reduce high teacher-students ratio.

According to Ondimu (2018), in a wide expansion of knowledge and curriculum change teachers' preparedness cannot be overlooked. In Netherlands, teacher preparedness starts at the university to ensure proper embracing and application of new skills needed in new curricula. Change in the curricula first starts at university to ensure the graduate teachers are prepared to new changes (M. Mulder et al., 2014). The in-service training is also done to increase teacher competencies and full transfer of knowledge and skills to learners. The Dutch University training primary teachers recommends a training session of 4 years to ensure a teacher if fully prepared. For instance grade 4 teachers in Netherlands have acquired more competencies making them use 30-45 minutes a week in teaching science (Velthuis & Pieters, 2014).

Successful countries like Finland, Germany, USA, Netherlands and South Africa in implementing CBE system have proved to promote high quality teacher training, more teacher employment to reduce high teacher-students ratio, supporting schools acquire modern instructional resources like use of information communication technology (ICT) tools and associated resources (Mulder et al., 2017). The start of CBE in USA schools has a close connection to the objectives of the 1950s movement which focused on teachers and learners' behaviors. However, CBE system was not embraced after implementations due to raised concerns on the teacher training, available resources and institutional autonomy with respect to competencies to be measured. Teacher training was crucial by orienting teachers on what a learner should be able to do at each level of learning, mechanisms of assessment and feedback.

Teacher's preparation and qualifications in Iceland and Luxembourg goes beyond attaining university training. For teacher certification, one must acquire master degree training from accredited university and have a subject specialization. During the master training, students are exposed to practical courses, a mandatory team work and each must be assigned a school for practical training (Sigurdardottir et al., 2018).

In Luxembourg, teacher training is key whereby in 2003 various institutions were merged to form Luxembourg University which is autonomous in teacher training (Peterka, 2016).

Attaining master degree training is not a guarantee of employment as a teacher since one must get teacher certification after passing state examinations. After employment, the teacher is assigned 7-18 hours per week and work under the guidance of a tutor who gradually orients the teacher to ensure one is competent and settled in a school (Ries, 2016).

In 2016, Finland introduced a new curricula starting grade six and in-service teacher training was done before, during and after the change of the curricula to increase teacher's preparedness to handle and transmit new skills and knowledge fully and effectively (Lavonen, 2018). However, teachers declined to embrace the 2016 changes since they felt the lesson-hours allocated in the new curricula were half the time allocated the lessons in 1970s. Therefore, teachers requested adjustment in the time allocation among subjects (Huhtala & Vesalainen, 2017).

On the onset of CBE introduction in South Africa, Concerns were raised regarding the quality and relevance of the teacher education and courses offered by colleges (Ramnarain & Hlatswayo, 2018). To improve teacher training and preparation, there was merging a number of universities and technical college to form few accredited universities to offer education for teachers. The South African government invested on in-service teacher training to upgrade professional development for the already employed teachers (Ogunniyi & Mushayikwa, 2015).

Teacher preparation and training is a challenge in African countries where learners who have always scored low marks and grades are the ones admitted to teaching profession something that has affected learner's competencies (Munishi & Road, 2016). For example, a survey conducted in Butimba public teachers' College in Mwanza Tanzania, more than two-thirds of the student pursuing Diploma course in teaching enrolled between 2010/2011 and 2011/2012 academic years had qualifications below the official requirement of two principal passes and a subsidiary (Munishi & Road, 2016).

The effectiveness of CBE system depends on relevant teaching methods, evaluation methods and teachers setting their own exams rather than relying on exam set by vendors since these exams do not measure competencies but topics. However the KICD and KNEC have not given a clear guide on how to conduct teacher training with respect to student evaluation (Momanyi & Rop, 2019).

Infrastructural resources in teaching of Agriculture

World over, school infrastructural resources are central in the teaching and learning process. The teaching of Agriculture requires proper infrastructure since it is a practical oriented subject. Effective teaching of agriculture subject goes beyond classroom instruction (Diise et al., 2018). Therefore countries that have a successful curricula implementation institutions have proofed to have in place adequate laboratories, workshops, classrooms, equipment, physical facilities and teaching aid (Rufai & Muhammad, 2013). Schools have different class structures ranging from iron-wall, timber -wall classrooms to those made by bricks (Bluyssen et al., 2018). However, the most important factor is the number of the students a class can accommodate without learners struggling during the learning process. For instance, countries

like Japan, South Korea, USA and Finland recommends a class to have between 20-30 students to ease learning and teaching process (D Goodrum et al., 2012).

Teaching of Agriculture requires learners to draw and carry out practicals within and outside the classroom and this requires learners to have a free space for these activities. Also, learners carry out projects outside classroom either in the farm, store and laboratories. This learning activities needs students to be supplied with clean water for washing of hands, protective clothing like gloves, gumboots, safety goggles during practical to ensure students health is not at risk (Omae et al., 2017). Spacious classes, clean, well furnished, well ventilated have a great mental satisfaction to students and teachers. According to Mokaya (2013), Schools with adequate structures, and well-furnished infrastructure have always performed better in the Kenya National Examinations since they motivate students and teachers and offer the ideal environment for learning.

A study on the factors impacting the curriculum implementation and learner's performance in Agriculture science in South Africa indicated that lack or inadequate infrastructure affects curriculum implementation which later affects learner's competencies (Chauke & Kabiti, 2016). Learning is a process and not an outcome(Hodges, 2012). Therefore, the calm environment with modern classrooms with proper air ventilation, classroom furniture , perimeter wall and floor surface that is free from dusts have been confirmed to contribute to learners' competencies (Hodges, 2012). In Zambia, for a school to be allowed to offer agriculture it must put into place agricultural land, physical facilities and laboratories for conducting experiments (Chauke & Kabiti, 2016).

Use of the school farm in teaching Agriculture

The availability of diverse learning resources reduces learner's boredom and motivates both the teacher and the student during the teaching and learning process (Puspitarini & Hanif, 2019). Vocational subjects requires learners to carry out projects and experiments both at school farm and laboratory to increase knowledge retention and help students acquire practical skills, develop a positive attitude towards learning and apply the skills learnt in and out of schools(Moore, 2017).

A research conducted in Finland on learner's competencies in vocational subjects indicated that no matter how trained and competent a teacher is, learners cannot understand fully, apply skills and concept leaned without practicing them (Rissanen et al., 2019). Therefore, schools use farms in the practical teaching of vocational subjects since they make learning real and authentic. An ideal school farm should have plants and animals used to teach across all grades, a section for museum, demonstration, commercial section and project section (Njura et al., 2020). A school farm that has no activities and projects meant for learning is a field and not a farm (Smeds et al., 2015). Poor student performance is neither a measure of the subject difficulty nor incompetence of a teacher but it's as a result of the resources available for instruction and the degree to which students interact with their environment. Provision of instructional resources remained key in implementation of 8-4-4 education system. The main

resources for teaching of agriculture included; agriculture workshop equipped with metal and woodworking tools, gas and electric welders, tractors, power generators, cultivators, fuel storage tank, combined harvester, a science laboratory, laboratory facilities, the school farm, a departmental vehicle and funds for running the department.

Use of Information Communication Technology resource in teaching Agriculture

Information Communication and Technology is a collection of resources that have ability to generate, transmit, keep, control, communicate and manipulate information with the aid of a skilled personnel and they include but not limited to: radio, television, internet, portfolios, projectors and use of video simulations(Ondimu, 2018).

Education in the 21st century has made a teacher not a source of knowledge but a facilitator, a mentor and or an instructor. In this century, there is more emphasis on student-centered learning approach which requires facilitator's flexibility and use of varying approaches in his/her instruction (Akyildiz, 2019). Information communication technology is important in practical teaching since it helps to increase conceptualization and retention of knowledge in teaching vocational subjects since some of the animals and plants that are not in the student's disposal can be acquired through use of tape slides, video recording, audio recording, simulations and still pictures of the actual object being discussed, (Johnson et al., 2014).

Teachers 'competencies and technological skills aid smooth transfers of knowledge during classroom instruction (King, 2017). Teachers' willingness, ability and competencies in use of ICT in instruction is dependent on the variety of ICT resources provided by the school since most ICT tools are expensive to be purchased by teachers (Ondimu, 2018). Apart from the school providing the ICT resources, conducting seminars, workshops and bench marks have proofed to have a great input to teachers' skills. A research conducted in Kenya in 2014 on utilization of ICT in Kenya secondary schools revealed that only 13.75% of Kenyan teachers had the competencies of using ICT in classrooms. This was due to the fact that most secondary schools did not have ICT resources, (Ondimu, 2018).

The use of ICT increases learners' concentration, retention of knowledge and skills in Agriculture subject. The current generation of students have a positive attitude and attraction to use of technology and its therefore important for the instructor to go extra mile and prepare slides, use of E-cases and video simulation in teaching and assessing students (Tondeur et al., 2017). However, there are challenges and concerns raised by teachers on ICT utilization. A research done in Finland disclosed that despite the higher quality education and performance by students, teachers feared use of ICT since some devices needed technical knowledge and more planning which teachers felt they lacked competence. ICT is not meant only for teaching but also it should enable a learner to develop skills on how to apply and even innovate technology associated devices (Huhtala & Vesalainen, 2017).

In Kenya, 8-4-4 education system learners were not allowed to attend schools with any electronic devices both at primary and secondary schools since they were believed to influence students' behavior and performance negatively, (Muia, 2016). However, ICT has been found

to have a positive impact in instruction globally and under CBE, strand 2 in grade four agriculture requires a grade four student to watch video simulations, use digital devices with appropriate software to search for information has led schools to allow learners to have relevant electronics for learning. Individual students are required make presentations on pictures (photos with dates) taken by their cameras and observing/watching video clips on various activities to enable learners acquire, demonstrate and apply digital literacy competencies (MoE, 2019). Strand 3 aims to help learners acquire and apply communication and collaboration competencies in group activities while classifying and identifying the vegetables after watching video clips with agriculture content. As learners work in groups, they will be sharing ideas by consulting and directing one another, leading to improving communication and collaboration.

Sustainability plans for Facilities and Resources in teaching Agriculture

Resources used in teaching vocational subjects need repair storage, modification and maintenance practices for continued utilization over a period of time (Rufai & Muhammad, 2013). For instance, the ICT tools requirements and their facility is different from the facility required in the storage of crop produce after harvest. The Kenya CBE expects a grade four to learn and acquire competencies in crop harvesting, to consistently clean tools and equipment after use and practice maintenance of these tools. Therefore for a farm tool to be used more than one cycle it requires good maintenance, handling and storage (MoE, 2019). However, some tools, equipment and facilities sustainability require an extra resource person for increased durability. For example, the ICT tools require an expert who will be monitoring and controlling the use of internet and the computers. A grade four learner is expected to collaborate with an ICT resource person to guide him/her on methods of storing photos (MoE, 2019).

Theoretical analysis and application

This study is guided by Constructs of the Theory of Curriculum Implementation. Constructs of the Theory of Curriculum Implementation by Rogan & Aldous (2005) is more applicable to this study since it has constructs which are key in curriculum implementation. This theory creates a detailed collection of factors surrounding the curriculum implementation processes. It consists three main parts called constructs which include (i) the profile of implementation, (ii) the capacity to support implementation and (iii) the external factors. The Profile of Implementation (figure 1) shows how the intentions expected in the curriculum are put in practice in the form of classroom interactions, science practical work and assessment. The profile plays a major role in enabling teachers at school to identify their strengths by interacting with students through the sub-constructs of the profile. The diversity and adequacy of the resources will improve the intensity of sub-constructs of the profile implementation (Kurczewska et al., 2018). The schools' capacity to support implementation is depended on a number of factors not limited to the sub-constructs like school management, learner factors, teacher factors and physical resources. The school management cannot be ignored. School heads are expected to collaborate with subject teachers and students to identify inadequate

resources and plan on how to provide them timely. Schools have different capacity in terms of resources and curriculum implementation will depend on the degree of innovation put into place by teachers and learners to utilize locally available resources (T Nsengimana et al., 2020). Teacher factors like motivation, confidence, commitment to teach and subject matter are important in curriculum implementation and improvement. Inadequate mastery of the subject matter and lack of or inadequate of pre-service, in-service and seminars training, will become a long-term, ongoing hinderance in the implementation of curriculum (Rogan & Aldous, 2005). Learner factors like home background may be a factor in curriculum implementation if the learner lack support from parents to practice learned skills at home. According to figure 1, the external factors like monitoring, funding agencies and community have a greater contribution to school curriculum improvement. From the framework, successful curriculum implementation calls for the three constructs in order to to succeed in practical instruction of vocational subjects Education is meant to satisfy needs of the community and solve problems by ensuring learners acquire relevant education.

This theory is relevant to this study since institutional preparedness rely on the teacher training physical resources, which are infrastructural and instructional resources. According to the MoE (2019), learners are expected to visit the community farms for practical lessons to improve the competencies. This study also focuses on sustainability plans for resources which need to be put into place, be maintained and repaired. For sustainability to be achieved, the school management and subject teachers are expected to work as a team.

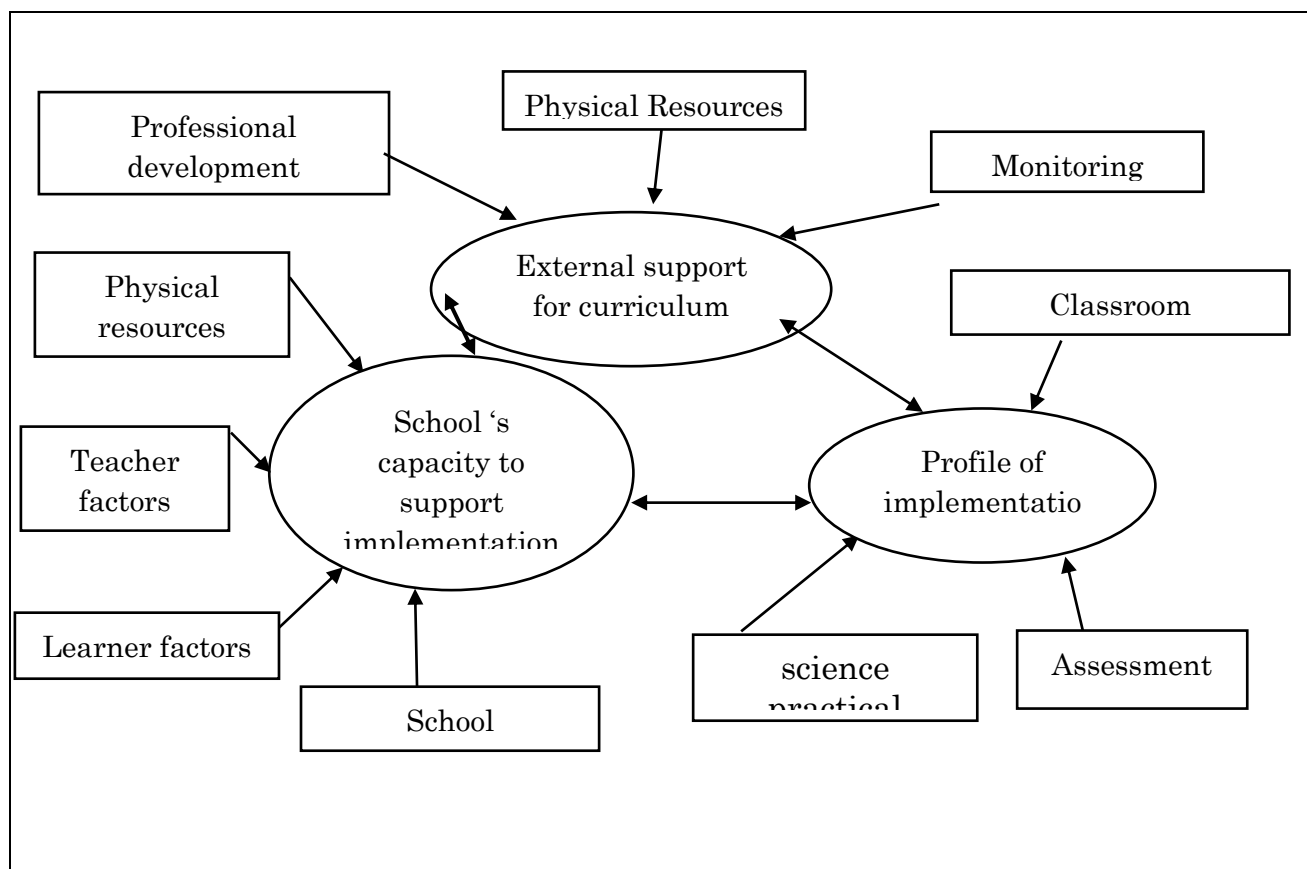


Figure 1: Theoretical model for curriculum implementation.

2. Method

Desktop research was done by reviewing relevant Government documents like the Basic Education Curriculum Framework by Kenya Institute of Curriculum development (KICD), relevant policies report by several education commissions and peer reviewed journals by a number of scholars and authorities around the globe.

3. Results

Our results showed that successful curricula implementation requires periodic teacher training, revising courses offered in institutions of higher learning to prepare pre-service teachers and in-service teachers. Longevity of infrastructural and instructional resources relies on care, maintenance and innovativeness of teachers. Also, practical instruction makes learners through provision of adequate instructional and infrastructural resources to enable learners acquire and demonstrate effective communication, collaboration which makes individuals to

embrace team work in agriculture since agriculture needs local, regional and global collaboration in imports and exports. critical thinking is key since currently agriculture is under threat by harsh climatic conditions, global warming greenhouse effect, deforestation which have led to food insecurity and self-efficacy if realized it will give the learners and school graduates self confidence in their daily activities. In addition, resources meant for instruction together with infrastructure requires thorough care in order to improve their sustainability.

4. Discussion

Institutional preparedness is key in curricula changes. Adequacy of resources are essential in implementation of Agriculture curriculum. The aim of this study was to document the extent of institutional preparedness in teaching agriculture with respect to teacher training, availability, adequacy and use of both infrastructural and instructional resources.

Teacher preparedness in teaching Agriculture

Findings from literature indicated that successful countries have invested in education by providing quality teacher training and availing relevant resources in schools for instruction. Teacher preparedness includes employing more trained and qualified teachers to have a low student -teacher ratio, offering regular seminars, workshops, trips for bench marking in order to give the teachers a new insight and approach in order for them to embrace the new curricula. Pre-service and in-service teacher trainings are also important since they have proofed to enable the teachers acquire and improve competencies, their teaching methods, evaluation and measurement. In addition, time allocation in various subjects when revised it makes teachers more flexible compared to using the initial time allocation in the curricula which may be more or less demanding in terms of hours. Admission of preservice teachers to universities and colleges with low entry grades has been found to negatively affect learners' competencies since these teachers happen to be below average. In this regard, some countries that admit the top students in teaching have been confirmed to produce global and competent students in vocational subjects.

Infrastructural and Instructional resources in teaching of Agriculture

Schools with adequate resources have been posting positive results in national examinations compared to the schools with limited resources. Instruction of vocational subjects requires early and continuous planning in terms of resources. Resources like ICT, school farm, cameras, computers, video simulations, availability of domestic animals in school and availability of practical resources like containers, boxes, indigenous and exotic crops have proved to increase content retention in agriculture once availed. Availability and adequate agricultural library, laboratory, classrooms, workshops for construction, repair and maintenance of farm tools and equipments have also promoted high content retention amongst learners and increased teachers' competencies. started curriculum implementation at tertiary institutions by training pre-service teachers who normally attain highest grades in national examinations and in-service teachers then provision develop a framework for care, maintenance and replacement. From the literature, curriculum implementation.

Use of the school farm in teaching Agriculture

A functional school farm must have museum section for growing crops which are exotic to the area but relevant to syllabus, a commercial section for generating income, a project plot for students to carry out their individual or group projects and demonstration plot for carrying out illustrations and teaching. A school farm without those sections then it will be a field. A school farm where its wrongly utilized by punishing learners using farm tools like in the case of Uganda, it has led to students hating the agriculture subject and even drop it. Poor performance in agriculture is not a that the subject has been hard but most cases its as a result of unavailability of school farm and poor use of the school farm by teachers.

Use of Information Communication Technology resource in teaching Agriculture

ICT resources include but not limited to the following; tape slides, video recording, audio recording, simulations and still pictures. These resources have been found to increase learner performance since they break monotony and even improve creativity when watching them. However, some countries and teachers perceive use of mobile phones and video slides as a waste of time and creating a poor character among students. This led some countries like Kenya to ban use of mobile phones and other related devices in schools.

5. Conclusions

From the preceding literature, successful curricula are a challenge especially at the onset since it calls for a strong collaboration among various stakeholders. Curricula implementation is a gradual process which must be grounded on institutions provision of instructional resources, provision of adequate infrastructure and ensure there is sustainability plans for these resources. Quality teacher training is essential in CBE implementation. The MoE and KICD should develop a clear framework for repair, storage and replacement of instructional resources in schools. ICT should be embraced in schools fully and ensure there is a functional internet connectivity in schools. Schools without a school farm needs to adopt vertical gardening to utilize the available space or use ICT in practical instruction by use of video with agricultural content in teaching. There is need for higher learning institutions to offer training which is relevant to CBE system. Also, the in-service teachers should be subjected to regular seminars and workshops training to improve their teaching methodologies and skills. African countries need to review the admission criteria for selecting individuals into the teaching profession in order to improve education quality like developed countries.

Future Research

We hereby recommend future research to be done but not limited to;

1. Determine why Kenya teaching institutions and African counties admit pre-service teachers to teaching with low grades.
2. Determine the influence of ICT on gender performance in agriculture subject in Kenyan schools.
3. Document the effects of 100% transition on performance of vocational subjects in Kenya.
4. Determine whether CBE is the only system of improving learner competencies.

Acknowledgements

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References

- Akyildiz, S. T. (2019). Do 21st Century Teachers Know about Heutagogy or Do They Still Adhere to Traditional Pedagogy and Andragogy? *International Journal of Progressive Education*, 15(6), 151–169. <https://doi.org/10.29329/ijpe.2019.215.10>
- Bluyssen, P. M., Zhang, D., Kurvers, S., Overtoom, M., & Ortiz-Sanchez, M. (2018). Self-reported health and comfort of school children in 54 classrooms of 21 Dutch school buildings. *Building and Environment*, 138, 106–123. <https://doi.org/10.1016/j.buildenv.2018.04.032>
- Chauke, P. K., & Kabiti, H. M. (2016). *Teachers' Perceptions on Agricultural Science Curriculum Evolvment, Infrastructure Provision and Quality Enhancement in Limpopo Province, South Africa*. 9.
- Chepng, E., & Boit, R. (2015). *Contribution of Secondary School Agricultural Knowledge on Farmer;s Crop and Livestock Diversification Activities in Uasin-Gishu County, Kenya*. 9.
- Diise, A. I., Zakaria, H., & Mohammed, A. A. (2018). *Challenges of Teaching and Learning of Agricultural Practical Skills: The case of Deploying Project Method of Teaching among Students of Awe Senior High School in the Upper East Region, Ghana*. 13.
- Goodrum, D, Druhan, A., & Abbs, J. (2012). *The status and quality of year 11 and 12 science in Australian schools*. Canberra: Australian Academy of Science.
- Goodrum, Denis, Druhan, A., Abbs, J., Australian Academy of Science, Australia, Office of the Chief Scientist, Australia, & Department of Industry, I., Science, Research and Tertiary Education. (2012). *The status and quality of year 11 and 12 science in Australian schools: Report*. Australian Academy of Science.
- Government of Kenya. (2019). *Report on Sessional Paper No. 1 of 2019 on Policy Framework for Reforming Education and Training for Sustainable Development*.
- Hodges, p. (2012). *Differences In The Quality Of Jamaican Primary School Facilities Are Correlated To Differences In The Performance Of The Schools In The Grade Six Achievement Tests*.
- Huhtala, A., & Vesalainen, M. (2017). *Challenges in developing in-service teacher training: Lessons learnt from two projects for teachers of Swedish in Finland*. Apples: Journal of Applied Language Studies, 11.
- Johnson, Becker, S. A., Estrada, V., & Freeman, A. (2014). *NMC horizon report: 2014 K (pp. 1-52)*. The New Media Consortium.
- Khanna, R., & Mehrotra, D. (2019). The roadmap for quality improvement from traditional through competency based (CBE) towards outcome based education (OBE) in dentistry. *Journal of Oral Biology and Craniofacial Research*, 9(2), 139–142. <https://doi.org/10.1016/j.jobcr.2019.02.004>

King, J. (2017). *Reimagining the Role of Technology in Education: 2017 National Education Technology Plan Update*.

Kurczewska, A., Kyrö, P., Lagus, K., Kohonen, O., & Lindh-Knuutila, T. (2018). *The interplay between cognitive, conative, and affective constructs along the entrepreneurial learning process. Education+ Training. The interplay between cognitive, conative, and affective constructs along the entrepreneurial learning process. Education+ Training*.

Kyule, M. N., Konyango, J. J. J. O., & Nkurumwa, A. O. (2018). TEACHERS IN THE IMPLEMENTATION OF PRACTICAL AGRICULTURE CURRICULUM IN KENYA'S ARID AND SEMI ARID SECONDARY SCHOOLS. *Problems of Education in the 21st Century*, 76(4), 533–543. <https://doi.org/10.33225/pec/18.76.533>

Lavonen, J. (2018). Educating Professional Teachers in Finland through the Continuous Improvement of Teacher Education Programmes. In Y. Weinberger & Z. Libman (Eds.), *Contemporary Pedagogies in Teacher Education and Development*. InTech. <https://doi.org/10.5772/intechopen.77979>

Ministry of Education. (2019). *Upper primary level curriculum designs Vol.3*. Kenya Institute of Curriculum Development Nairobi.

Miriti, G. M., Ochieng, R. J., Mugambi, M. M., & Box, P. O. (2014). *The critical role of curriculum in addressing youth unemployment in Kenya: Opportunities and challenges*. 2(4), 16.

Momanyi, J. M., & Rop, P. K. (2019). *Teacher Preparedness for the Implementation of Competency Based Curriculum in Kenya: A Survey of Early Grade Primary School Teachers' in Bomet East Sub-County*.

Moore, G. E. (2017). *The status of agricultural education prior to the Smith-Hughes Act. The Agricultural Education Magazine*, 89(4), 21.

Muia, W. M. (2016). *Influence Of Social Media On Deviant Behaviour Among Secondary School Students In Langata Sub-County, Nairobi County, Kenya*.

Mulder, m, Gulikers, J., Wesselink, R., & Biemans, H. (2017). Models and principles for designing competence-based curricula, teaching, learning and assessment. In *Competence-based Vocational and Professional Education*. In *Competence-based Vocational and Professional Education* (Vol. 23, pp. 533–553). Springer International Publishing. https://doi.org/10.1007/978-3-319-41713-4_25

Mulder, M., Nieuwenhuis, L., Poell, R., Biemans, H., & Wesselink, R. (2014). Competence-based VET in the Netherlands: Background and pitfalls. *Journal of Vocational Education & Training*, 56(4), 523–538. <https://doi.org/10.1080/13636820400200268>

Munishi, D. E. J., & Road, B. T. M. (2016). *FACTORS CONTRIBUTING TO LACK OF EMPLOYABLE SKILLS AMONG TECHNICAL AND VOCATIONAL EDUCATION (TVET) GRADUATES IN TANZANIA*. 2, 19.

Njura, H. J., Kubai, K. I., Taaliu, S. T., & Shem Khakame, K. (2020). *The Relationship between Agricultural Teaching Approaches and Food Security in Kenya. Education Research International, 2020.*

Nsengimana, T, Mugabo, L., Hiroaki, O., & Nkundabakura, P. (2020). *Reflection on science competence-based curriculum implementation in Sub-Saharan African countries. International Journal of Science Education, Part B, 1-14.*

Nsengimana, Théophile, Rugema Mugabo, L., Hiroaki, O., & Nkundabakura, P. (2020). Reflection on science competence-based curriculum implementation in Sub-Saharan African countries. *International Journal of Science Education, Part B, 1–14.* <https://doi.org/10.1080/21548455.2020.1778210>

Ogunniyi, M. B., & Mushayikwa, E. (2015). *Teacher Education in South Africa: Issues and Challenges.* 21.

Omae, N. S., Onderi, H., & Mwebi Benard. (2017). *Quality Implications Of Learning Infrastructure On Performance In Secondary Education: A Small Scale Study Of A County In Kenya.* <https://doi.org/10.5281/ZENODO.344956>

Ondimu, S. M. (2018). *Teachers' Preparedness for Implementation of the Competency Based Curriculum in Private Pre-schools in Dagoretti North Sub-county, Nairobi City County.* 111.

Peterka, J. (2016). *Education-Policy-Outlook-Country-Profile-Luxembourg.*

Puspitarini, Y. D., & Hanif, M. (2019). Using Learning Media to Increase Learning Motivation in Elementary School. *Anatolian Journal of Education, 4(2), 53–60.* <https://doi.org/10.29333/aje.2019.426a>

Ramnarain, U., & Hlatswayo, M. (2018). *Teacher beliefs and attitudes about inquiry-based learning in a rural school district in South Africa. South African Journal of Education, 38(1).*

Rieckmann, M. (2018). *Learning to transform the world: Key competencies in Education for Sustainable Development. Issues and trends in education for sustainable development, 39.* <https://unesdoc.unesco.org/ark:/48223/pf0000261445>

Ries, F. (2016). A Study of Teacher Training in the United States and Europe. *The European Journal of Social and Behavioural Sciences, 16(2), 2029–2054.* <https://doi.org/10.15405/ejsbs.184>

Rissanen, I., Kuusisto, E., Tuominen, M., & Tirri, K. (2019). *In search of a growth mindset pedagogy: A case study of one teacher's classroom practices in a Finnish elementary school. Teaching and Teacher Education, 77, 204-213.*

Rogan, J., & Aldous, C. (2005). Relationships between the constructs of a theory of curriculum implementation. *Journal of Research in Science Teaching, 42(3), 313–336.* <https://doi.org/10.1002/tea.20054>

Rufai, A., & Muhammad, U. (2013). *Facilities Provision and Maintenance Necessity for Effective Teaching and Learning in Technical Vocational Education*.

Sigurdardottir, A. K., Johannesson, I. A., & Oskarsdottir, G. (2018). *Challenges, contradictions and continuity in creating a five-year teacher education programme in Iceland*. 21.

Smeds, P., Jeronen, E., & Kurppa, S. (2015). *Farm Education and the Value of Learning in an Authentic Learning Environment*. *International Journal of Environmental and Science Education*, 10(3), 381-404.

Tondeur, J., Scherer, R., Siddiq, F., & Baran, E. E. (2017). *A comprehensive investigation of TPACK within pre-service teachers' ICT profiles: Mind the gap!*. *Australasian Journal of educational technology*, 33(3).

Velthuis, C., & Pieters, J. (2014). *Teacher training and pre-service primary teachers' self-efficacy for science teaching*. *Journal of Science Teacher Education*, 25(4), 445-464.

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