MINISTRY OF EDUCATION

REPUBLIC OF KENYA

Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA)

Research & Development Knowledge Management (R&D KM)

A BASELINE STUDY ON IMPLEMENTATION OF CBC IN STEM RELATED SUBJECTS IN JUNIOR SECONDARY SCHOOLS

July, 2023

CENTRE FOR MATHEMATICS, SCIENCE AND TECHNOLOGY EDUCATION IN AFRICA

CEMASTEA –NAIROBI, KENYA

Vision: Excellent capacity development in STEM Education in Africa.

Mission: To continuously develop competencies for sustainable development through STEM Education.

P. O. Box 24214-00502 Karen- Junction of Karen Road and Bogani Road, NAIROBI-KENYA

Telephone
+254-20-2044406;
+254-706722697/+254-780797648

E-mail: ceo@cemastea.ac.ke
Website: http//www.cemastea.ac.ke
Facebook: Cemastea
Twitter: CemasteaKenya
YouTube: CEMASTEA Educational Channel
Portal: portal@cemastea.ac.ke

Approved for circulation

Jacinta L. Akatsa, HSC
CEO, CEMASTEA

Citation: CEMASTEA (2023), A BASELINE STUDY ON IMPLEMENTATION OF CBC IN STEM RELATED SUBJECTS IN JUNIOR SECONDARY SCHOOLS

Preliminary background

Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA) mission is to continuously develop competencies for sustainable development through STEM education. This is derived from the commitment by the Ministry of Education (MoE) to provide quality and relevant inclusive education, training and research to all Kenyans. This will be achieved through the provision of all-inclusive quality education and training that is accessible and relevant to all Kenyans. Implementation of the Centre's core mandate is informed by among other factors, global concerns on sustainable development, continental aspirations anchored on Science, Technology and Innovation (STI).

Kenya is in the process of implementing Competency based Curriculum (CBC). The Basic Education Curriculum Framework (BECF) was developed to actualize the CBC reforms. Its purpose was to provide a comprehensive conceptualization of reforms in basic education; pre-primary education, primary education, secondary education, as well as in special needs education (SNE). The education reforms to align the schooling experiences and outcomes to the national aspirations were based on the constitution, Basic Education Act No. 14 of 2013, sessional paper No. 1 of 2019 and curriculum policy leading to Basic Education Curriculum Framework (BECF). Consequently, the BECF and Competency Based Assessment Framework (CBAF) were developed to address issues of the structure of education, learning areas, the expected learning outcomes and assessment in the basic education sub-sector. The Competency Based Curriculum (CBC) focuses on acquisition of the desired knowledge, skills, values and attitudes to enable the learner to cope with life challenges. It also focuses on the achievement of learning outcomes in terms of the desired behavioural change. The CBC is expected to promote the seven competencies for learners. These are communication and collaboration, critical thinking and problem solving, imagination and creativity, citizenship, digital literacy, learning to learn and self efficacy. CBC was rolled out from 2017 at PP1 and will transit to JSS in 2023. From recommendations of sessional paper No. 1 of 2019, CEMASTEA is expected to provide training for curriculum implementers in STEM education. It is therefore important to conduct a situational baseline survey on implementation of CBC in STEM related subjects in Junior Secondary School (JSS) at the beginning of JSS in 2023 which will inform training gaps as CEMASTEA conducts training in line with its mandate.

Abstract

This study intended to establish the relationship between learners' attitudes, teachers' pedagogical approaches and headteachers pedagogical leadership in relation to STEM education at the inception of JSS. Positive learners' attitudes, teachers' pedagogical approaches and headteachers' pedagogical leadership can translate to effective gain of competencies. Learners are expected to acquire certain competences as they transit from grade 6 (upper primary) to grade 7 (JSS). This study was based on several theories, the major one being the *Theory of Multiple Intelligences* by Howard Gardner (1983). This study adopted descriptive survey design. The descriptive survey was suitable for this study because it seeks to describe study components as they are at the time a study is being conducted. A total of 167 JSS schools and the respective headteachers from seven regions of the republic of Kenya were sampled. 616 teachers responded to teacher's questionnaire while 167 others were observed for a lesson in class using a lesson observation guide. A total of 2883 learners across the republic of Kenya responded to learners questionnaire while 1185 participated in learner's focus group discussion. The independent variables were the target population and school infrastructure while the dependent variable were the existing learners' attitudes/competencies. The study involved both qualitative and quantitative data. Tables and graphs were used to present the findings of the analysis and there after the findings of the analysis were presented in a report. The data was analyzed using SPSS and Microsoft excel to establish the current status on implementation of Competency Based Curriculum (CBC) in STEM related subjects in JSS.

1.1 General Research Objective

To establish the current status on implementation of Competency Based Curriculum (CBC) in Junior Secondary School.

1.2 Specific Research Objectives

1. To establish learners' attitudes towards STEM related subjects in Junior Secondary School
2. To determine teacher's ability to implement formative assessment to support learning in STEM related subjects
3. To establish the extent of pedagogical leadership support in implementation of CBC in JSS.
4. To establish the status of learning facilities that support STEM related subjects.

1.3 Justification of the study

Learners attitude towards learning is influenced by teachers' pedagogical approaches, learning resources and pedagogical leadership practices. In STEM related subjects, learner-centred pedagogical approaches, adequate provision of learning resources and efficient pedagogical leadership is necessary for effective learning. Since CBC is being taught at JSS domiciled at primary school for the first time in Kenya perhaps no studies have examined how learners' attitude, learning resources, and teacher's pedagogical approaches, would influence the learning of STEM related subjects. The outcomes of this study will inform interventions towards pedagogical leadership, learning pedagogy and learning resources for CBC implementation in JSS.

1.4 Significance of the Study

The findings of this study will provide insights on how teachers can mentor learners on how to improve their competences as they go through JSS. The study will guide CEMASTEA to develop interventions for in-service training programmes for teachers and headteachers. Further, the study outcome will provide useful information to policy makers and other stakeholder in the education sector concerning any gaps related to teachers and school infrastructure necessary for implementation of STEM education at JSS.

1.5 Sampling Techniques and Sample Size

Cluster and stratified sampling techniques were used in data collection. The respondents were drawn from the 7 regions of the republic of Kenya. The number of counties per region were determined according to the learners population at primary school level. The counties sampled in

each of the 7 regions were, Kilifi county from Coast region, Garissa county from North eastern region, Nyandarua and Kiambu counties from Central region, Homabay, Nyamira and Kisumu counties from Nyanza region, Bomet, Laikipia, Transnzoia and Narok counties from Riftvalley region, Busia and Vihiga counties from Western region and Marsabit, Embu, Makueni and Kitui counties from Eastern region. Stratified random sampling was used to select ten schools from each county based on the following criteria; locality, category, type or nature.

1.6 Key Findings and Recommendations

Objective 1

To establish learners' attitudes towards STEM related subjects in Junior Secondary School.

Objective 1 Findings:

1) Integrated Science was the most liked subject among science-related subjects with 41.5% of learners selecting it as their favourite. The main reasons learners gave for liking the subject included; *able to do my daily activities by using what we have learnt in science (84.0%), I find science lessons interesting (83.1%) I find Science easy to understand (83.0) and I would like to do a job that is related to science (80.3%).*

   Recommendation

   Teachers need to sustain this 'liking' of science-related subjects by supporting learners to apply science knowledge in their daily activities, making science lessons interesting, easy to understand and relating science to career.

2) Over 70% of learners agreed with the presuppositions about learning Mathematics indicating that the majority had a favorable attitude towards the subject. Among the reasons learners advanced for liking Mathematics were; *they were able to perform daily*

activities by using what they had learnt in Mathematics (83.53%), Mathematics lessons were interesting (80.4%) Maths is easy to understand (77.6%) and meeting expectations in Mathematics performance (73.3%).

Recommendation

Teachers need to sustain this 'liking' of mathematics by helping learners apply mathematics knowledge in daily activities, making mathematics lessons interesting, easy to understand, and supporting learners to meet expectations in mathematics performance.

3) The least liked subjects among Science related subjects were Life Skills at 2.5% and Pre-technical at 8.1%. Some of the reasons advanced by the learners, why Life Skills was least liked, were:

Because content is difficult to understand'

'A lot many things'

'We are given work but no answers and books to refer to'

'I don't know how to conduct some practical' Because it has not been taught so far…….

Recommendation

To achieve the essence of JSS there should be continuous support by teachers and parents to learners through mentor-ship and career guidance to understand the value of subjects offered that inform learners' career pathways or gain of intended competencies.

Objective 2

To determine teacher's ability to implement formative assessment to support learning in STEM-related subjects

Objective 2 Findings:

1) Based on the lesson observation which focused on various performance indicators of a lesson delivery, a lesson delivery index of 2.7342 on a scale of 1 to 5 was recorded. This is between fairly adequate and adequate. Some of the lesson performance indicators that rated lowly included " *Learners were given an opportunity to discuss how their observations / results of the experiment / calculations differed from those of others"* which had a mean rating of 2.26 and *"Teacher addressed learners' questions, misconceptions and reinforced learning at each step"* rated at 2.38.

Recommendation:

While the mean index indicates a baseline level of fairly adequate, the emphasis should be placed on continuous capacity building to grow the teachers professionally towards the third quartile of between 3 to 4. There is need for professional development opportunities that target learner-centred pedagogies on how to address learners' questions, misconceptions and reinforce learning at each step.

2) Based on learners' questionnaires, over 60% of the learners reported that teachers used assessment as a form of active engagement in the learning process. Although 97.5% of teachers indicated that they conduct assessment during lessons to gauge learners' understanding of the concepts taught, lesson observation revealed that teachers had challenges in implementing formative assessment in the classroom. For instance, 57.9% of teachers either did not address learners' questions, misconceptions and reinforce learning at each step or did it inadequately. Lesson observation also indicated that 53.1% of teachers used lecture/teacher-centred method and did not encourage questions from learners or did it inadequately.

Recommendations:

a) There is a need for further training of teachers on CBA specifically on formative assessment to enhance the understanding of how assessment as and for learning needs to be done in the learning process.

b) Teachers require further support/training on how to elicit learners' ideas and how to address misconceptions from learners.

c) Teachers require further training on strategies of engaging learners in meaningful activities/learning experiences during and after lessons.

d) *TSC should use an affirmative approach when advertising for teachers to ensure more teachers of science related subjects are recruited.*

3) Some of the newly recruited teachers are unfamiliar with CBC components, CBA, professional documents components and have challenges handling the learning process. According to teachers content in integrated science, pre-technical studies, life skills, and majority of the optional subjects is very technical to the teachers. Most teachers lack the pedagogical skills to integrate ICT into teaching and learning.

Recommendations

a) The teachers need to be trained regularly on ICT integration, formative assessment, and CBC components as well as be sensitized on professional documents.

b) *There is need for school-based teacher support which will encourage teachers to form communities of practice and cluster lesson study to assist one another in CBC implementation.*

c) On content delivery, Quality Assurance and Standards monitoring and evaluation unit, (QASO) should ensure that effective quality teaching and learning take place in all JSS schools in Kenya.

4) The CBC has many new and unique areas which were not there in the previous curriculum, such as integrated science, physical education and sports, pre-technical studies, life skills, performing arts, visual arts among others. Head-teachers and teachers expressed the need to be further grounded on the contents of these areas. Comments were, *"I didn't learn agriculture even in high school yet am teaching, I don't know how to go about teaching PE, I didn't do physics in high school, I don't know how I'll teach some topics in integrated science'*

Recommendation

a) Heads of Institutions require more capacity building on the various aspects of the competency Based curriculum and more particularly on pedagogical content knowledge to be able to support the teachers.

b) The teachers require continuous in-service training and school-based support especially on areas they were not trained in or even did not pursue in their secondary school to effectively implement the CBC.

5) The interpretation of the CBC curriculum designs, planning of the CBC lesson plan with various new aspects, such as pertinent and contemporary issues and values, key inquiry question were other areas cited by participants as challenging.

Recommendation

Teachers need continuous training and school-based teacher support on pedagogical content Knowledge

Objective 3: To establish the extent of pedagogical leadership support in implementation of CBC in JSS.

Objective 3 Findings

1) Head-teachers have been trained on leadership strategies, learner management, resource mobilization, financial management and CBC but not much on mentoring novice teachers, especially with a higher academic qualification than them. However, the level of application/support of the concepts trained varied from one head-teacher to the another.

   Recommendation:

   There is a need to provide head-teachers with continuous professional development opportunities to enhance the implementation of CBC in JSS, particularly training on various aspects of pedagogical leadership, such as mentoring novice teachers on quality lesson planning and implementation.

2) The largest proportion of learners (89.9%) agreed that their teachers supported them whenever they experienced challenges in learning science. Similarly (89.3%) liked sharing ideas with their classmates and (77.8%) agreed that their teachers involved them during science lessons and that their science teachers made learning fun (75.3%). There was however a substantial proportion of learners who felt that science teachers did not check their work in every lesson (27.2%) and they did not undertake any activities during Science lessons (25.2%).

   Recommendations

   a) *Teachers need to be trained on strategies of supporting learners whenever they experience challenges in learning, to share ideas among themselves and how to involve learners during science lessons .*

b) *Teachers should also be trained on how to involve learners in practical activities during science lessons and make learning fun.*

Objective 4:
To establish the status of learning facilities that support STEM related subjects.

Objective 4 Findings:

1) From the group discussion with learners, a significant proportion of learners reported to dislike their schools because of;

a) *Unclean environment which includes dirty toilets, walls, dusty floors, leaking roofs and littered compounds*.

b) *Fields not being adequate for sports*.

c) Congested c*lassrooms, poor arrangements of seats and the physical learning environment*

Recommendation

To enhance learner appreciation of their schools, it is important to provide conducive school environment in terms of cleanliness, adequate toilets, well maintained classrooms, adequate field activities, interpersonal relationships and clear school rules.

Split the classes to more streams to meet the expanded population in some schools.

MoE through QAS unit to follow up on implementation of guidelines on CBC seating arrangement in classrooms.

2) Only 16.78%, of public schools, either have a science room or get access to one when required. Availability/access and use of school resources and infrastructure is inadequate and both learners and teachers were unable to use the relevant instructional materials/content intended to develop the desired competencies at JSS level.

Recommendations:

a) *All classroom teachers handling JSS learners should undergo short course training on improvisation and innovation of learning resources as a deliberate effort geared towards jump-starting effective learning process for competency development.*

b) *Ministry of education together with the relevant government agencies and strategic stakeholders/partners should provide appropriate and sufficient school resources and infrastructure such as the science kit, drawing instruments and equipment career brochures and magazines among other basic resources. This could follow the manufacturer/publisher-direct-to-school distribution model/policy for efficiency and cost-effectiveness.*

c) *Digital resources like virtual labs should be availed to teachers as a supplement to the actual science rooms/science kits for lesson preparation. Teachers can use the same to simulate laboratory activities promoting deeper understanding of scientific knowledge. ICT offers affordance to both learners and teachers since the virtual content does not get depleted; it is self-paced and can be repeated over and over again without affecting the results.*

3) 9.58% of JSS schools were more than 10km from TVET institutions especially in the rural areas. 37.13% of headteachers indicated that they don't know any TVET institution near their JSS, which could as well imply that such institution were not near their schools. Moreover, many JSS schools though near/neighbouring secondary schools had not made mutual agreements with the neighbouring secondary schools. Only 30.8% and 13.5% of schools had made mutual agreements on sharing integrated science and pre-technical studies resources respectively with TVETs or secondary schools. Lack of adequate resources compromised learning.

Recommendation:

Ministry of education at county level and other government agencies such as KEMI and CEMASTEA should proactively sensitize management teams (BoM/PTA) from both JSS and secondary schools on the need to adhere to MoE guidelines on institutional resource sharing.

4) The text books though being the main source of instructional content were not adequate. None of the subjects had a textbook-learner ratio of 1:1. The textbook-learner ratio even in the new learning areas such as pre-technical studies, Physical education and sports and Business education was as low as 1:8 in some public schools. Additionally, some schools had textbooks for optional subjects that they were not offering to their learners. In SNE schools, textbooks had been distributed however they were not adapted to their specific needs.

Recommendations:

a) *MoE should streamline the textbooks distribution policy to ensure timely delivery of the books directly to schools or at least to the sub-county level.*
b) *There is need to establish JSS content hubs/repositories/clouds under the MoE/KICD/CEMASTEA/KISE websites as a stopgap measure for teacher's use in the process of textbooks distribution.*

5) 56.9% of the digital resources in JSS located in rural and semi-urban localities were not functional and those functional were rarely used.

Recommendation:

Regular monitoring and support of schools by the ministry of education to ensure regular maintenance of these digital resources for effective development of digital literacy skills as envisioned in CBC curriculum.

1.7 Conclusion

This research had four specific objectives which were all achieved to a great extent. Based on the key findings, there is need to implement the suggested recommendations to address the challenges facing the current pioneer JSS learners and teachers.

1.8 Suggestion for further studies

1) Based on the findings of this study and being aware of the important role played in teacher-preparedness as well as the centrality of learner-centred content delivery approach in CBC, we recommend a further study focusing on learner involvement in ICT integration during content delivery to mitigate inadequate physical resources in schools.

2) Considering that this is a baseline study, a mid-line study should be done on CBC implementation in JSS at grade 8 and a JSS end-line study by grade 9.