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Assessment of the Teaching of Climate Change Education in Kenya

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Abstract
This paper is an examination of the assessment of the teaching of Climate Change Education (CCE) in Kenya through an audit of the Laikipia University teaching practice tool. The competencies demonstrated in CCE are learner centred and are closely related to the competencies expected from the competency based education reforms that Kenya is in the process of effecting. The assessment of teaching climate change requires a focus on evaluation of competencies in creativity, problem solving and collaboration, which are learner based and closely related to the competency based learning framework of the educational reforms on going in Kenya. This is a paradigm shift calling for a review not only in what is taught, but how to assess what is taught; this audit of the tool sought to address the gap of how to assess. The study question was on how effective the Laikipia University teaching practice tool is in evaluating the competencies in CCE and related competencies as proposed in the education reforms in Kenya. A survey was used from descriptive questions to collect data from lecturers who use the tool during teaching practice. The results indicated that the competencies as assessed by the current tool were more teacher centred than learner centred and that the tool requires revision to reflect the approach to teaching climate change which is competency based and therefore encourages assessment of creativity, innovativeness and reflective practice for sustainability.

Keywords: Assessment of climate change, climate change, climate change education, education, sustainable development

Introduction

This paper presents an audit of the tool used in the assessment of teaching practice in Laikipia University Kenya, and its effectiveness in assessing the competencies demonstrated in Climate Change Education (CCE). For CCE to be sustainable, assessment of learning what is taught, how it is taught and the importance of assessing what is taught is necessary for the sustainability of learning and its development into practice. The paper identifies the link between what is assessed and how it is assessed, in relation to competencies learnt and how they are acquired and retained. It is expected that the results may be used to assist student teachers reflect on their teaching, not only of CCE, but also other areas that may require a demonstration of related competencies. In addition, it is hoped that the paper will encourage a reflection of the expected competencies, emphasizing assessment methods that will encourage creativity and innovativeness right from preparation, classroom presentation as well as classroom practice and assessment. It is important to note that the tool can also be referred to as an instrument since it is used to evaluate the teaching practice and generate a report.

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Climate change and its impact on people and resources poses serious societal challenges. The actions taken today will influence the future as well as affect the ability of the nation to respond and adapt to change, and reduce the vulnerability of people and places to harm. The role of education is important in enlightening future generations about the causes and effects of global climate change. How to implement solutions depends on an informed public both for societal and individual actions (Stanford, 2012).

In focusing on teaching and learning, teachers are encouraged not just to lecture about climate change but to help the students: in their research; think critically and creatively; and form a worldview that looks into the future with action oriented thinking of teachers in all discipline areas beyond the traditional subjects of science or geography. Geography, Earth and Life Sciences are carrier subjects, which can be used to develop and integrate climate change. Non carrier subjects are more difficult to integrate; these include languages but they too have to be integrated in various diverse and effective ways (UNESCO, 2020). There is need for a transformative approach from the individual and the school, to the community, nation and global. Sustainable development requires that partnerships be built with everyone in the society, thus involving students, teachers and other staff while inspiring and encouraging one another. This is where and why the teaching, learning and assessment of what has been taught in CCE is important.

The assessment of teaching climate change requires that teachers are trained to assess learners' understanding using a range of strategies, how to use the assessment information to plan subsequent steps and keep records as well as how to teach learners to self-assess and peer assess their own work and investigation outcomes (Cartwright & Miller 2023). CCE presents assessment that focuses on evaluating skills and aptitudes such as creativity, curiosity, problem solving and the ability to work collaboratively with peers (The Organization for Economic Co-Operation & Development [OECD], 2019).

Climate change as presented in this study is the natural process where temperature, rainfall, wind and other elements may vary over decades or more. It refers to long term shifts in temperatures and weather patterns and can be due to natural or human activities (UNDP, 2023). CCE helps people understand and address the impact of the climate crisis, empowering them with the knowledge, skills, values and attitudes needed to act as agents of change (UNDP, 2023). The international community recognizes the importance of educational training to address climate change. The UN Framework convention on climate change, the Paris Agreement (2016) and associated Action for Climate Empowerment (ACE) call on governments to educate, empower and engage all stakeholders and major groups on policies and actions relating to climate change (UNESCO, 2020).

Climate Change Education Assessment is the assessment carried out on the teaching and learning of climate change to ensure that learning within the education system is carried out effectively with learners acquiring the knowledge, skills and attitudes needed to promote sustainable development goals (SDGs) (target 4.7). Effective Assessment of CCE education should encompass the key areas proposed in the SDGs, which are climate mitigation, adaptation, impact reduction and early warning. It should also strengthen the relationship between knowledge (Climate Science) and practice (Climate Action) in CCE both at a local and global level. In addition, CCE assessment should be able to assess the teaching and learning in relation to the SDG global indictors facilitating knowledge exchange and replication across contexts and countries (Sainz, et al., 2019).

Kenya is in the process of carrying out education reforms. These reforms are a move from the content based learning to a competency based learning framework. It is a massive reformation

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from traditional time-based learning to learning-based learning with a focus on the following competencies; communication and collaboration, self-efficacy, critical thinking and problem solving, creativity and imagination, citizenship, digital literacy, and learning to learn (Kenya Institute of Curriculum Development [KICD], 2017) These skills are closely related to the skills needed to address climate change as proposed by the United Education Science and Cultural Organization (UNESCO) which are; information management, skills of critical thinking, skills of action, skills of interaction, future oriented skills and personal skills (Selby & Kagaway, 2013). These are competencies based on open-ended learning, which are skills that learners need to address climate change in relation to sustainable development. The education reforms in Kenya will extend not only to the preparation for teaching and the actual teaching but also the assessment of teaching and learning.

Traditionally, assessment has focused on an overloaded assessment system with the preparation of teachers and assessment of the teacher on teaching practice using a tool that addressed the competencies as planned for. The reforms in the education sector pose a paradigm and cultural shift in the outlook of both those responsible for education provision and the learners involved in this process; the intention is to reduce the theory to practice gap (Imbunya, 2021). This will involve a shift in the focus of how to evaluate and assess what is taught and how it is taught. The education reforms have raised the need for review of the curriculum across board for basic education, secondary education, and tertiary education up to university education. Faculties or Schools of Education in universities and institutions that are involved in teacher education are in the forefront in leading the review of their curricula, what is taught and how what is taught is evaluated. This review is important not only to evaluate the effectiveness of what is being taught in class, but equally important, is how to evaluate the learning that takes place.

Laikipia University is involved in teacher education, which includes the professional development and subject specialization of the student teachers. In reviewing the university curricula for the different programmes, the tools used in evaluating teaching practice cannot be overlooked. This is because the paradigm shift in classroom teaching will require a shift in the way assessment is carried out and the tools used. This study examined how the tool used for assessment of teaching practice captures the skills that learners need to address climate change in relation to sustainable development skills which are closely related to those advocated for in the education reforms in Kenya.

The Enquiry

The study sought to explore how effective the Laikipia University teaching practice tool is in evaluating the competences needed to address CCE and related competencies as proposed in the education reforms in Kenya.

The objectives of the study were to: examine the tool used in teaching practice assessment and how it assesses the teaching of CCE; evaluate the tool used for assessment in teaching practice in relation to the competencies proposed in the education reforms in Kenya; and determine what the implications of change are for assessment.

Literature Review

The literature reviewed is discussed as follows; the scope of climate change education (CCE) in Kenya, the role of universities in CCE, a discussion on the teaching and learning outcomes and competencies in CCE and how they relate to the education reforms in Kenya, and assessment of the teaching of CCE.

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Climate change is associated with challenges including food security, mass migration and biodiversity change (Zurek et al., 2022). Climate Change Education (CCE) in schools in Kenya is sporadic and limited, in spite of the growing urgency of the issues as temperatures rise and weather patterns become more severe. Education is part of the set of tools needed to address the climate crises at whatever level. United Nations Education Scientific and Cultural Organization (UNESCO) has identified the professional development of teachers in education for sustainable development as the top priority in recognition of the transformative role that teachers and teacher education play in re-orienting education to help realize a sustainable future (Vavrus et al., 2011). In the UNESCO project 'Implementing a whole school approach to climate change', classroom learning was enforced by the formal and informal messages promoted by the school's values and actions. As action for reducing climate change is included across all aspects of school life, it becomes everyone's priority (UNESCO, 2020).

Universities have the potential to play a key role in combating climate change as advanced by (Moltham et al. (2019), through innovative teaching as well as pioneering new teaching and learning concepts and design and review of curriculum to address societal and market needs. The Teacher Education Programme in Laikipia University is no exception and has set out to examine how the teaching and learning of CCE can be evaluated, as well as determine what innovations can improve the effectiveness of the tool used in assessment of the teaching practice. The role that universities play in CCE is significant in addressing the scientific, social, environment and political challenges the world faces. The teaching and learning of CCE is influenced to a large extent by the emphasis on what is taught and how that which is taught is assessed. Teachers and educational practitioners are cognizant of the fact that what is measured in schools both informally through classroom assessment and formally in the end of year or end of phase examinations has a high impact on the content and approach to teaching in the classroom (Bermingham & Chainey, 2022). What is measured matters, so the tools used for measurement must be appropriate for the task and also be aligned to the task.

Teaching competencies in CCE are closely related to the reforms in the competency based education. Many countries in Africa, Kenya included, are in the process of reforming the teacher-centred curriculum method of teaching, thus seeking to promote creativity, critical thinking and problem solving skills. Open ended learning skills are based on a range of learning outcomes, which are broad and holistic in nature leading to lifelong skills. These skills require not only understanding of concepts but a demonstration of skills or application, based on mastery of learning outcomes. These reforms in education in Kenya are a shift from the historical content based approach to a broader competency based approach. In CCE the emphasis is on building a link between education and sustainable development, and building up skills for 'green jobs' leading to a skills development policy in the education sector (Jeppe & Mochizuki, 2015).

In an article on recent trends in national policy on education for sustainable development and climate change, Jeppe and Mochizuki (2015) expound on how Education for Sustainable Development (ESD) as a concept and term has been proposed by the United Nations. They note that a lot of effort has gone into mainstreaming of Education for Sustainable Development into internal policy and practice at different levels and in different types of education and learning. This mainstreaming of policies on sustainable development and the practice of education is what the education sector in Kenya is faced with and is working to accommodate in policy and practice.

A task team in UNESCO on climate change emphasizes the importance of climate change for transformative sustainable development. It shows how CCE and public awareness enables informed decision making and plays a big role in empowering sustainable lifestyles (UNESCO,

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2016). The ongoing education reforms in Kenya emphasizes change in competencies with a focus on practice, problem solving skills, critical thinking and creativity while showing how these competencies are closely related with the teaching of climate change. In addition, CCE is more effective when incorporated across the whole school curriculum, with innovative teaching concepts while providing new teaching and learning concepts (UNESCO, 2016).

In the assessment of the teaching of climate change education, this study seeks to promote a teaching learning process that stimulates and enhances learner's critical and reflective thinking skills centred on students' knowledge construction, discovery, and acquisition of skills and transfer of those skills and knowledge into real life thus translating into usefulness and applicability. The teaching of CCE focuses on two pillars of the twenty first century skills as presented in the competency based education reforms. One is the learning to know; students need to understand the causes and consequences of climate change as well as mitigation and tools. The other is learning to do; students need to develop cross-cutting skills such as being able to adapt to different situations and learning contexts as well as envisioning different solutions and future scenarios (Molthan et al., 2019). This can be done through a change in attitude towards teaching and learning as well as assessment of what is taught. In both the CCE and competency based education, assessment focusses on learners and learning as well as what the learners are interested in and their abilities, therefore putting ownership of learning into the hands of the learner (Imbunya, 2021).

The assessment of learning to **know** and learning to **do** hinges on assessment **as** learning and assessment **for** learning. This inculcates a culture of empowerment that stimulates and enhances the learner's critical and reflective thinking skills, with a philosophy of the promotion of the learner's knowledge construction, discovery acquisition of skills and transfer of those skills and knowledge into real life. The challenges of assessing these skills cannot be overlooked as student teachers are equipped in various disciplines of teacher education. These challenges have been captured succinctly by Vavrus et al. (2011) who group them into three; the first challenge being the way student teachers teach. They argue that teachers largely teach the way they were taught and if learner centred methods were not the practice, this may pose a challenge when adopting and adapting to the reforms in teacher education.

The second challenge as presented by Vavrus et al. (2011) is in the assessment model. If assessment is based on the model that most student teachers in sub-Saharan Africa utilize, which is the Technical Rationality Model, then this will involve transmitting knowledge about the content of their subject and the 'correct' ways for teaching it to student teachers. According to the Technical Rationality Model, there are some sort of uniformities in problems, so all professionals apply standardized knowledge to solve concrete problems (Ghajargar &Bardzell 2019). Student teachers, therefore, will be evaluated on the extent to which their lesson plans, methods and teaching demonstrate these technical skills as expected and taught. Vavrus et al. (2011) propose an improvement on this model, by the inculcation of the reflective practitioner model. This is where those in teacher education create conditions for student teachers to use active learning strategies and to think critically about the authoritative knowledge in their field. This makes the assessment more learner centred and appropriate because the student teacher will be reflecting on their practice and how to change or improve on it. Reflective practice is a part of participatory learning, which demands that those involved in the teaching and learning process reflect on their facilitation. Identifying what went well and what improvement could be integrated into their facilitation in future, is part of continuing practice. Part of being reflective is the creation of an open and enabling atmosphere for eliciting and receiving feedback (Selby & Kagaway, 2013).

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The final argument presented by Vavrus et al. (2011) is that the faculty in schools that produce student teachers may not be trained as teacher educators, or they may have expertise in education, which includes theories of learning, materials development, and teaching methods but not in specific academic subjects. This may be a challenge in that though they have excellent knowledge of the content of their courses such as history or chemistry, they may have limited understanding of how to teach content using methods appropriate to their subjects and contexts, especially methods aligned to learner centred pedagogy. This happens across many universities where faculty teaching may be experts in specific content disciplines but not in the methodology, therefore, it would be important for the student teacher during assessment to be guided on reflective practice.

Reorientation of assessment from traditional time-based to learner-based calls for a change of attitude and retooling of skills. The implication for present and future climate change and sustainable development is influenced greatly by the learner, teacher and others' understandings of perceptions and personal experiences. In CCE for sustainable development, the authors capture reorientation of attitude and skills in assessment to be influenced largely by the learning processes employed Selby and Kagaway (2013). They recognize interactive, participatory and experiential learning, with an emphasis on values, and ways of being as well as ways of relating which are key for climate change and sustainable development. In this case, assessment will be seen to be effective if it responds to the particular needs and characteristics of the teacher or lecturer, students and the subject content. Both teachers and learners are encouraged to facilitate learner empowerment, and to promote critical and practical learning as well as participatory democracy. Assessment will be informed by changing the climate of the classroom, which include the 'medium' and the 'message'; in other words, the teacher and what is taught and what is assessed passes a message of what is important and therefore learned for CCE (Selby & Kagaway, 2013).

The participatory classroom calls for the use of a diverse range of carefully contrasted learning approaches and modalities. Not all approaches will appeal to all students; Assessment is context-specific and what works well in one class may not necessarily work in another. Therefore, in calling for learners and teachers to assess learning processes, reflective learning can be structured and included in the assessment process. This too is a way of assessment and enables improvement on the processes and skills that require change. Assessment and learning are inextricably linked with not only the learner, but the teacher's strategies and mode of delivery being assessed (Imbunya, 2020). This participatory learning will require structured facilitation of class discussion and reflection, which is a skill that can be encouraged and evaluated. The teacher educator needs to reflect on their facilitation and interrogate the learning experience to optimize learning (Selby & Kagaway, 2013).

Theoretical and Conceptual Framework

The theoretical framework underpinning this study is constructivism. The basic principle of constructivism states that learners develop new knowledge by building upon previous learning, and that they learn best when engaged in the learning experiences. Learners take part in a learning process and assemble the knowledge gained in a unique way with each learner constructing something distinct from the others. Social constructivism emphasizes the collaborative nature of learning. The major proponent of social constructivism is Lev Vygostsky who proposed that social interactions promote learning and that knowledge is co-constructed (Vygotsky, 1980). Learners can establish meaning with the information they visualize during learning and every learner may take part actively in the process before they can learn.

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Learning is inherently a social process because it is embedded within a social context as learners and teachers work together to build knowledge (University of Buffalo, 2023). Engaging with the world around them can help learners to be active participants in their continued educational growth. Therefore, the constructivist theoretical framework was found to be most appropriate in the teaching, learning and assessment of CCE due to the social and co-construction nature of knowledge.

The constructivist approach emphasizes the active participation of those seeking change, and how they can work towards creating that change. According to Muni (2020), the principles of social constructivism preserve the interpersonal structure of learning. The principles assume that education is an outcome of shared communication process, with peer groups and members of the community possessing a significant impact on the perspective and education of a learner. Muni (2020) notes that constructivism enhances the assessment of CCE as a social process. Muni further maintains that constructivism can lead to the understanding of how certain meanings have emerged and been framed, while others have been obscured or understood differently. The argument is that the constructive perspective allows for a more dynamic notion of structure since it seeks to identify the nature of structure based on socially defined and intersubjective meanings.

Of importance is how the constructive framework emphasizes the construction of social structures as well as how these structures in turn influence and reconstruct agents resulting in mutually constituted knowledge and putting climate change in the respective historical and social context (Muni, 2020). As opposed to the traditional approach in teaching which focusses on delivering information, constructivists argue that one cannot directly impart this information; only experience can facilitate students to constitute their own knowledge, therefore the goal of teaching is to design these experiences. The use of this theoretical framework as a basis for the study, therefore, confirms the importance of focusing on applicable assessment in CCE as relates to creating these learning experiences.

On the conceptual framework, the key constructs in the study and how they relate to one another, as justified by the literature review on climate change, CCE and how it relates to the education reforms in Kenya, as well as in relation to assessment was presented. The literature review has focused on what climate change is, and how it affects both individuals and communities. Additionally, how best CCE can be delivered for sustainability and change was presented. This was done with an emphasis on effective assessment and the need to align CCE to appropriate assessment methods and tools. This, therefore, results in the need to examine the assessment tools, just like how the education reforms bring about a need for review of the curriculum, what is taught, how it is taught and evaluated, and the appropriateness of the tools used in assessment.

Methodology

The Survey method was used as a research design. Using questionnaires, primary data was collected from participants who are lecturers that participate in supervision of students during the Laikipia School Practice. Additionally, these were lecturers who had earlier attended the Laikipia University Teaching Practice Workshop of January 2023, The participants were drawn from all the four schools in the university; namely, School of Education (18 staff), School of Human and Development Studies (12 staff), School of Science (11 staff), and School of Commerce (4 staff).

Specifically, the interest of the study was in getting information about the participants' experiences while using the Teaching Practice tool for assessment in relation to the competencies identified. Additionally, secondary data was gathered in the literature review on climate change,

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CCE, assessment and the curriculum reforms in Kenya. The data gathered was relevant to the research question because the lecturers involved in the School Practice are supposed to carry out the assessment of the students' teaching and are guided by the assessment instrument, which is instrumental in developing a report that informs and evaluates the student teacher.

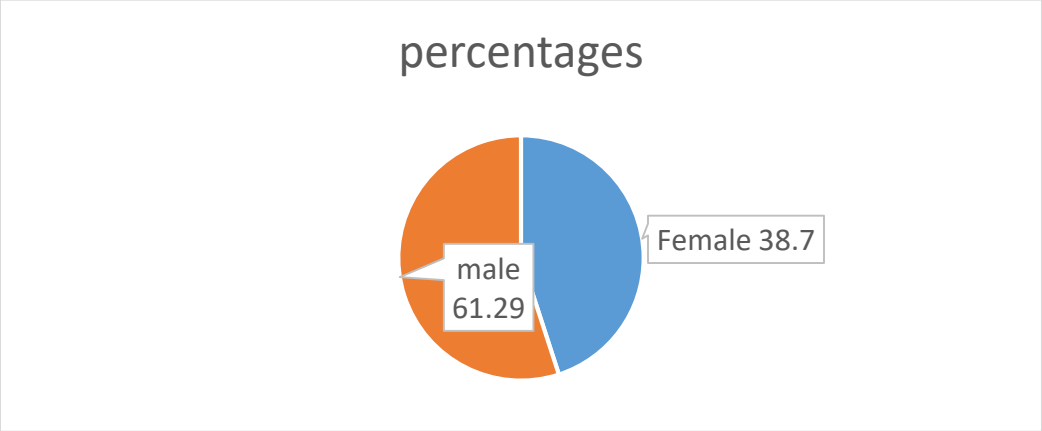

Fig. 1: Gender of Participants in the Study

The following were questions asked in the survey on use of the teaching practice tool in relationship to competency based assessment:

1. How can the tool used for assessment make the supervisory approach more creative and innovative
2. What on-site observation of student teachers' teaching performance can be assessed and informed by the tool
3. How can the tool be used to help student teachers develop lesson plans which encourage an activity-based approach.
4. How does the pre-established teacher performance standards influence assessment
5. What role does the tool play in the interactions with student teachers, their teaching experience and their progress
6. What needs to change in analyses of the whole of the student teacher's file

This approach was used to elicit participation from the different schools and disciplines who prepare the students for teaching practice, both in the professional aspect and the content or subject areas. The goal of this approach was to gather perspectives from the different disciplines and subject areas taught by the practising teachers. The responses received were similar from the different disciplines represented. Given that those who participated in the survey were limited to the lecturers who attended the teaching practice workshop and not all the lecturers who go out for teaching practice, the responses may not account for all perspectives. Future empirical work may probably require a quantitative study capturing a bigger scope in terms of audience.

The process of data collection involved a discussion on the following areas measured by the actual tool as seen in table 1.

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Table 1: Areas Measured by the Assessment Tool

1	Lesson Preparation of schemes, objectives, format and layout
2	Lesson Presentation introduction, development and connection, style of teaching, learner involvement and motivation, questioning technique achievement of objective
3	Subject Matter, mastery of content, depth of coverage and appropriateness usefulness, applicability and relevance
4	Teaching Learning Resources relevance and suitability, creativity and use, proper use of chalkboard, legibility of letters
5	Teaching Personality time management and punctuality, interaction and disposition, confidence and voice projection, decency.
6	Class organization and management discipline, class environment, class control and supervision.
7	Assignment and Evaluation past and current assignment, students' records

The responses from the discussion elicited from these areas formed the data for the study which were used to address objective one and two of the study. Objective one was to evaluate the tool used for assessment in teaching practice in relation to the competencies proposed in the education reforms in Kenya. Objective two was to determine what the implications of change are for assessment.

Analysis of the data collected was informed by the need to understand the experiences of those who use the tool and how their experiences can be used to improve on assessment and evaluation of the competencies identified. The analysis was done by examining each of the areas of assessment against the expected competencies.

Findings and Discussion

The question the study sought to answer was the effectiveness of the Laikipia University teaching practice tool in measuring the competences needed to address climate change education and related competencies as proposed in the education reforms in Kenya. The general findings indicated that the teaching practice report developed from the tool would need to address the competencies captured in assessment, which would have to be in line with the transformative role of creativity, innovativeness, participatory and reflective practice.

Specifically, in the lesson preparation of schemes, objectives, format and layout, it was found that it was difficult to use the tool to encourage creativity and innovativeness. One participant said; '...the report is based on responses to sections that address specific competencies therefore it may be difficult to divert from the intended objective'. The use of the tool assessed specific competencies in each section which were inflexible, for example, in this section on Lesson Preparation, a participant expressed that '…learning objectives focus on what the teacher hopes to achieve by the end of the lesson…it would be better if this was replaced with the use of 'learning outcomes' since this was more learner centred'.

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The Lesson Presentation section focused on the competencies of the teacher. A participant indicated that the focus was on the teacher directed style and choice, as evidenced by terms such as 'mastery of content', and 'appropriateness to level of the class'. Yet another participant indicated that these terms reflected more of the teacher ability in relation to the content. This section on lesson presentation can be improved by more clarity and focus on learner directed rather than teacher directed styles of learning and choice of teaching learning activities, with the assessment focused on the promotion of interaction with the environment, other students and the teacher.

In the choice of the teaching or learning resources, a participant indicated that; '…this section, would be improved greatly by involving learner choices and an indication of their involvement in the learning process....' This observation was found to be very plausible if the whole process was to become learner centred. Further, the section on subject matter would benefit from reflection and recognition of prior knowledge.

The evaluation and assignment given would be improved by including learner choices and direction as well as direction on the rubrics used. This, a participant shared, '…. would benefit the evaluation process especially if some of the learners would be encouraged to carry out some of the assignments outside the classroom and not all assignments would require marking and grading....'. This section would, therefore, require evidence of learner choices and direction, as well as rubrics used in assessment.

Generally, the participants indicated that competencies assessed in the current tool were more focused on teacher competencies and would need to be rethought. This would have implications for practice in view of the ongoing education reforms that focus on competency based learning which are competences based on open-ended learning skills that are desirable in addressing sustainable climate change. From the discussion, it emerged that, the tool requires revision to reflect the approach to teaching climate change which is a learner centred approach. It would be prudent to revise the tool to address creativity and innovativeness, for sustainability of what is learned and actions taken.

Conclusion and Implications for Future Research

In conclusion, the challenge to enhance the education response to climate change as well as making education and learning a proactive reality in addressing climate change can be addressed from different fronts. This study sought to address the response from assessment as a form of managing the learning process and education practice. It matters not only what is taught and the learning taking place, but also the assessment and its relevance to the maintenance and application of learning. This study argues that what is taught and how it is assessed matters in the quest for education and sustainable development. The role played by assessment in the process of the professional development of the teacher cannot be overemphasized and the transformative role that teacher education plays in reorienting education to help realize a sustainable future is not negotiable.

This study was limited to the audit of only one tool used in the assessment of teaching practice in the School of Education of Laikipia University. Further research can be extended to other tools used to assess industrial and field attachment in other schools of Laikipia University that have an impact on CCE as well as the ongoing education reforms. This study has concentrated on an audit of the assessment tool, but there is need to address the student preparation book so that student preparation may be in line with the assessment guided by the changes in the education reforms. Finally, this study was carried out with the lecturers who supervise teaching practice in

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the School of Education. However, the study can be extended to include a larger group of faculty who teach students in teacher education, but do not go out for the assessment of teaching practice.

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