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Original Article

Re-thinking teachers education curricula from indigenous curriculum construction principle: a case study of College of Teachers' Education in SNNPRS and Sidama Regional State, Ethiopia

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Indigenous knowledge; curriculum indigenization; curriculum alignment

Abstract

Integrating primary teachers' education curricula with the school curriculum through indigenous knowledge is a means of decolonizing the western curriculum and contextualizing it by assisting learners to understand and synthesize their own environments. The purpose of this study is to explore the extent to which indigenous knowledge is reflected in the college of teachers' education Science and Mathematics curricula in light of indigenous knowledge. Mixed research design with exploratory sequential method was employed. Data were gathered from 58 science and mathematics teacher educators, 91 Primary school Science and Mathematics teachers, 7 colleges of teacher' education deans and vice deans, 4 regional education bureau officials, and 4 regional education bureau senior curriculum experts. Among four colleges of teacher' education in SNNPR, Bonga and Hosaena colleges were selected by simple random sampling technique and the Hawassa College of teacher education was selected from Sidama Region regional state. The instruments used to collect data were: questionnaires, interview, FGDs and document analysis. The data obtained through questionnaires were analyzed quantitatively by using frequency, percentage and mean. Whereas the information gathered by interview guide, FGD, and documents analysis were transcribed qualitatively analyzed, interpreted and expressed thematically. The study finding revealed that the extent to which indigenous knowledge are reflected in the existing colleges of teachers' education Science and Mathematics courses is very minimal, the colleges of teachers' education curricula are dominated by the Western curricula knowledge. Furthermore, there are teacher educators who perceive IKs as old, traditional and contributing nothing. Teacher educators' commitment and motivation in applying IKs in the classroom instruction, lack of organized indigenous resources was also identified as hindering the inclusion and implementation of indigenous knowledge, besides, the effort to include indigenous knowledge in the curricula has remained unpractical. To this end, education stakeholders such as policy makers, educators, curriculum developers, and parents shall work together to overcome the challenges in the inclusion and implementation of indigenous knowledge in both the college of teachers' education and primary education Science and Mathematics curricula. It is recommended that both Western and Indigenous knowledge must coexist in the college/school Science and Mathematics curricula in order to serve the current needs of society.

1 Introduction

Every child has the right to an education and to a system of education that values the child's culture, language, and community as well as unrestricted access to schooling and participation (UNICEF, 2004). UNESCO (2011) mentioned the importance of Indigenous knowledge for sustainability by saying "Education program that promote Indigenous knowledge, sustainable lifestyles and sustainable development will further enhance these capacities such as critical thinking and problem-solving skills (UNESCO, 2011)

Indigenous knowledge is knowledge that arises directly out of the children's real-life experiences, and its incorporation into the school curriculum can motivate and bolster the intellectual fortunes and interests of the learners as students realize that recognition is given to what they already do, know, and say in their own communities (Mawere, 2015). Indigenous knowledge is resources that can help to solve local problems, to prevent conflict, to build solidarity in communities, to manage local affairs, and thus contribute to global solutions (World Bank, 2004).

Indigenous knowledge is a critical component of the economical low-income people social capital and a key asset in their efforts to reclaim control of their lives. Indigenous knowledge, like any other type of knowledge, must be constantly applied, challenged, and adapted to changing local contexts. To be liberating, education must focus on relevant contexts and local African knowledge's) that can assist African society in coping with the challenges of a rapidly changing global economy (Msila, 2016)

The basic component of any country's knowledge system is its IKs. It encompasses the skills, experiences and insights of people, applied to maintain or improve their livelihood (World Bank, 1998). Semali and Kincheloe (1999) define IKs as "The dynamic way in which the residents of a certain area have come to understand themselves in relationship to their environment and how they organize that folk knowledge of flora and fauna, cultural beliefs, and history to enhance their lives" (Semali and Kincheloe, 1999).

There is a growing consensus that some of the solutions to problems that currently plague developing societies and communities must proceed from understanding the dynamics within the local context. Such dynamics include the role of IKs (Indigenous knowledge) and practices in the development processes (Dei, 2002; Angioni, 2003; UNESCO, 2003).

There have been robust debates on the integration of IKs into national curricula (O'Hern and Nozaki, 2014; Breidlid, 2013) and initial attempts to include IKs in the curriculum have sometimes met with resistance from different people who have varied views about the specific knowledge items which should be included (Hodson, 2009). Mpofu and Vhurumuku (2017) suggested that to achieve the education goals in African countries, integrating IKs with science, technology, engineering, and mathematics is the key. These shows including IKs both in colleges of teacher education and primary school science and mathematics curricula became imperative. Based on this background, the study intended to analyze the college of teachers' education science and mathematics curricula through indigenous Curriculum Construction perspectives.

2 Research Problem

Indigenous knowledge is the social capital of the people, their main asset to invest in the struggle for survival, to produce food, to provide for shelter or to achieve control of their own lives (Ellen and Harris, 1996). They are developed and adapted continuously to gradually changing environments and pass down from generation to generation and closely interwoven with people's cultural values. Significant contributions to

global knowledge have originated from indigenous people, for instance, in medicine and veterinary medicine with their intimate understanding of their environment.

The current global discourse on the value of incorporating indigenous knowledge in formal education systems in Sub-Saharan African countries, has been a central theme by scholars, African governments, and the United Nations Organizations (Angioni, 2003; Dei, 2002; UNESCO, 2006) particularly its potential contribution to sustainable development at the micro level and poverty alleviation. It is argued that if African states are to play a central role in directing goals of education for sustainable development, then there is need to integrate the African perspectives of knowledge as a reciprocal body of knowledge to western education in order to ensure relevance and practicality in addressing local problems affecting societies especially the devastating effects of HIV/AIDS pandemic (Dei, 2002; Mudimbe, 1988; Shiva, 2002; UNESCO, 2006). Indigenous knowledge's have now become the central issue in global discourses as a strategy to solutions on social, economic, and political problems of African states (Owuor, 2007) The indigenous approach to Education for Sustainable Development advocates for educational process that are based on a holistic perspective, practically based, and conceptualized to the local, national, and international needs of the students (Owuor, 2007).

In many Sub-Saharan African countries, there is tension between Eurocentric Western science and the IKs of African students, though both of which are products of their respective socio-cultural constructs. These two worldviews, when experienced by students in science classrooms, do not complement each other. If not properly mediated during science lessons, this could potentially lead to "complicating the learning process and potentially resulting in cognitive conflict" (Le Grange, 2007). Ethiopia is a country of more than 80 ethnic groups with diverse languages. Ethiopian society has diverse knowledge that relate to the natural and human built environment. Before the introduction of a western oriented curriculum, Ethiopians had their own indigenous knowledge that helped them to solve problems.

The findings of the National Learning Assessments conducted in the years 2000, 2004 and 2008 for grades four and eight students of Ethiopia show that the average score for mathematics was less than 40% while science subjects was 1023 than 50% (Ministry of Education, 2008). This is very contradictory with the Ethiopian Education and Training Policy which states that every student should score at least 50% in all subjects as a minimum requirement. In Ethiopia, the percentage of primary school teachers who passed the licensing examination is 24.3% (Ministry of Education, 2020b) Similarly, the SNNPR percentage of primary school teachers who passed the licensing examination is only 10% (SNNPR Education Bureau, 2020b). This implies that primary school teachers who failed in the examination have been deployed to teach primary school mathematics and science subjects. This implies the low achievement of the students is because of the integration and the alignment of curriculum by indigenous knowledge.

In the Ethiopian, IKs are marginalized in the existing school curriculum and it needs de-marginalization of IKs by incorporating them into the existing curriculum (Teshome, 2017). Furthermore, the Ethiopian Education Development Road map (2018) confirms the emphasis given to Ethiopian IKs in the general education curriculum is very minimal and efforts to incorporate them into the existing are still at infancy stage. Moreover, the FDRE, GECF (2020), mention the current curriculum of Ethiopia was not able to give appropriate space for the teaching and learning of indigenous knowledge and emerging and nationally pressing issues. Similarly, the ten year general education development plan (Ministry of Education, 2020b) reveals that there IKs are lack in the existing general education curriculum.

The Ethiopian Education Development Road map (2018) identifies that the frequent changes in teacher training modalities for primary schools is a serious handicap in teacher training and the existing teachers training modality is neither aligned to the country's primary

school education structure nor produces effective graduates for the specified level. Furthermore, it shows the medium of instruction in CTE's as well as university teacher training faculties is English. In the case of CTE's, graduates are deployed to teach in the mother tongue of the primary school students. As a result, it is difficult to deliver a subject matter in the mother tongue of the students. It also shows that graduates of English, mathematics and natural science are found to be least competent to teach their subjects were identified as the gaps and challenges in teachers' preparation.

The current pressing issues in the teacher education program are mentioned as follows: issues related to the quantity and relevance of subject matter knowledge, nonalignment between pre-service teacher education program and the school curriculum, challenges related to program structure, relevance and effectiveness of professional courses, pedagogical content knowledge and concerns related to incentives for good teachers (SNNPR Education Bureau, 2020a). These mismatches are related to content, skills in handling hands-on and minds-on activities, the use of a wide range of teaching and learning strategies, the use of methods for continuous assessment and methods of meeting the needs of students with special educational needs.

Although, there are some researchers who have done about IKs in Ethiopian general education (from 'O' class-grade12) curricula, it is hard to get research result for the college of teachers' education science and mathematics curricula. Thus, the researchers want to fill the gap by explore the extent to which IKs are integrated in the colleges of teachers' education science and mathematics curricula and the alignment between college and school curricula in light of the IKs curriculum construction principle.

2.1 Research questions

To what extent do the mathematics and science curricula at colleges of teacher education include IKs content in the light of curriculum construction principle?

How do colleges of teacher education instructors perceive IKs and its inclusion in mathematics and science subjects?

2.2 Objectives

The overall objective of the study is to explore the extent to which IKs are reflected in the college of teachers' education science and mathematics curricula, and how the colleges of teachers' education and primary school natural Science and mathematics curricula are aligned with the light of IKs. This helps to:

Investigate the extent to which the existing colleges of teachers' education science and mathematics curricula reflect the IKs. Explore perceptions of teacher educators' on IKs and its inclusions in mathematics and science subjects.

2.3 Significance

The study analyzes the extent to which IKs are integrated into the existing college of teachers' education science and mathematics curricula and the alignment between college and primary education Science and Mathematics curricula. In doing so, the study will possibly have the following significance:

It informs the Ministry of Education, Regional Education Bureau, policy makers and experts, and other concerned bodies of the importance and inclusion of IKs in the colleges' Science and Mathematics curricula.

It provides information to the Ministry of Education, Regional Education Bureau, collage of teachers' education, and other concerned bodies on the alignment between college and primary school Science and Mathematics curricula in the light of IKS.

It helps the Ministry of Education and regional education bureaus to take remedial measures so as to produce critical citizens.

It provides information for further studies on IKs related to Science and Mathematics subjects.

3 Research Methods

3.1 Research design

The positions of the researcher are pragmatism perspectives and apply explanatory mixed research design so as to collect, analyze, interpret and report the data scientifically (Creswell and Plano Clark, 2007). It is the overall plan for connecting the conceptual research problems with the pertinent (and achievable) empirical research. In other words, the research design sets the procedure on the required data, the methods to be applied to collect and analyze this data, and how all of this is going to answer the research question (Grey, 2014).

Creswell (2009) defines research designs as plans and procedures for research that span the decisions from broad assumptions to detailed methods of data collection and analysis. He says that the selection of a research design is based on the nature of the research problem, the researchers' personal experiences and the audiences for the study.

In order to achieve the objectives of the research employed an exploratory mixed method. A mixed methods research design is a procedure for collecting, analyzing, and "mixing" both quantitative and qualitative methods in a single study or a series of studies to understand a research problem (Creswell and Plano Clark, 2011). The basic assumption is that the uses of both quantitative and qualitative methods, in combination, provide a better understanding of the research problem and questions than either method by itself.

The purpose of an exploratory sequential mixed method design involves the procedure of first gathering qualitative data to explore a phenomenon, and then collecting quantitative data to explain relationships found in the qualitative data. A popular application of this design is to explore a phenomenon, identify themes, design an instrument, and subsequently test it (Creswell, 2009). In the exploratory sequential approach, the researcher first begins with a qualitative research phase and explores the views of participants. The data are then analyzed, and the information used to build into a second, quantitative phase (Creswell, 2009). The purpose of the exploratory study is to elaborate a concept, build up a model or advocate propositions (Yin, 1984).

In an exploratory design, qualitative data is first collected and analyzed, and themes are used to drive the development of a quantitative instrument to further explore the research problem (Creswell and Plano Clark, 2011; Teddlie and Tashakkori, 2008; Onwuegbuzie et al., 2010). As a result of this design, three stages of analyses are conducted:

after the primary qualitative phase, after the secondary quantitative phase, and at the integration phase that connects the two strands of data and extends the initial qualitative exploratory findings (Creswell and Plano Clark, 2011).

3.2 Target Population

Creswell (2012) defines a target population or the sampling frame as a group of individuals or a group of organizations with some common defining characteristic that the researcher can identify and study. The target populations for the study are CTEs (Arbaminch, Dilla, Bonga, Hosaena and Hawssa) and Science and Mathematics teacher educators.

3.3 Sample Size and Sampling Techniques

Creswell (2012) defines a sample as "It is a subgroup of the target population that the researcher plans to study for generalizing about the target population" Creswell (2012): 142). In this study, two types of sampling techniques; simple random and purposive sampling were used. Before determining the sample size of the study, it is essential to consider some aspects of determining the sample size.

According to Cohen et al. (2018), the number of respondents acceptable for a study depends on the type of research design involved. He suggest a sample should be 30% if the population is large, while 35% may be required if the population is small. As a result, Bonga and Hosaena CTEs from SNNPR were selected using random sampling method (lottery method) and Hawassa CTE is selected based on availability sampling. Furthermore, the sample size for science and mathematics teacher educators was determined using Cohen et al. (2018) suggestion and out of two hundred eight (208) science and mathematics teacher educators in the three sample colleges of teachers' education sixty-two (62) were sampled using availability random sampling method. Furthermore, to get the insight of primary school science and mathematics teachers on alignment between the colleges' and primary education science a total of ninety one (91) primary School science and Mathematics teachers from twelve (12) nearby schools to the selected CTEs were sampled based on availability sampling technique.

Moreover, four senior curriculum experts (Mathematics, Physics, Chemistry and Biology) from SNNPR education Bureau and four Education officials, seven college deans and vice deans were sampled to get their insight concerning the major challenges that affects the inclusion of indigenous knowledge's into the existing colleges' Science and Mathematics curricula. The total number of the research target group and sample was presented as follow in Table 1.

Table 1: Target population and Sample size

S.no	Target group	Total po
1	Science and mathematics teacher educators	208
2	Primary school science and mathematics teachers	96
3	College deans/vice deans	9
4	Regional Education Bureau Officials	6
5	Regional Education Bureau science and mathematics subject curriculum experts	4
	Total population	173

3.4 Sources of data

To get valid and reliable information, the uses of appropriate data sources were vital. In this study, two sources of data namely primary and secondary data were used. The primary source of data includes the colleges' science and mathematics teacher educators, primary school chemistry, mathematics, physics and biology teachers, the colleges' deans and vice deans, and regional education bureau officials and senior curriculum experts.

Secondary data sources were considered from the college of teachers education curriculum frame framework, syllabi, and training modules and grade four and eight textbooks, teachers guides, minimum learning competencies for science and mathematics subjects. Moreover, Ethiopian Education and training policy (1994), Ethiopian Education Development Road map (2018), Ethiopian general education curriculum framework (2002,2020), and SNNPR Education Bureau reports (2020) were considered.

3.5 Data collection tools

3.5.1 In-depth interview

Using interview, one can explore and probe participants' responses to gather in-depth data about the types of data used for the study were both quantitative and qualitative. Accordingly, the instruments, questionnaires, in-depth interview, focus group discussions, documentary analyses checklists were used as data collection tools.

Questionnaires for colleges' science and mathematics teachers and primary school teachers were designed to collect the necessary data. The questionnaires were developed based on the review of relevant literatures and the researcher's knowledge and experience on the issues under the study. The items contained the background information about the respondents, their views on the extent to which IKs are included both in college and primary school science and mathematics curricula, their perceptions on IKs, the alignment of the college and primary school science and mathematics curricula, and major challenges to include and implement IKs into the colleges' science and mathematics curricula. The questionnaires were translated from English to Amharic before administered to both the teacher educators and primary school teachers to make easy and better understating of the contents of the questionnaires for the respondents.

Their experiences and feelings (Gay et al., 2009). Interviews are useful to elicit factual data Patton (1990), Wallace (1998)) and are a very useful way of collecting data. Patton (1990) notes that people are more willing to talk in an interview than the case would be if they were asked to write. In order to explore a topic before designing for the details and to identify potential problems, conducting interviews with the key informants is crucial.

We have conducted the total of 15 interview sessions with the colleges' deans and vice deans and regional education bureau officials and senior curriculum experts. The discussions were mainly focused on their perceptions' on IKs and its relation with students' academic achievement, the effects of globalization on IKs, the relation between medium of instruction and IKs, and the major challenges to include and implement IKs in the colleges' science and mathematics curricula. The interviews were made face-to-face in Amharic language and then translated in to English.

3.5.2 Focus group discussion (FGDs)

Kothari (1992) states that the focus group discussion is meant to focus attention on the given experience of the respondents and their effects. Under it, the interviewer has freedom to decide the manner and sequence in which the questions would be asked and also offers the opportunity to explore reasons and motives of the respondents. Hence, I have had conducted a total of fifteen (15) focus group discussions, FGDs, each group comprises of a total of members paying attention to gender balance, with college teacher educators and primary school science and mathematics teachers.

The FGDs were focused mainly on the extent at which IKs are included into the colleges' science and mathematics curricula, teacher educators' perception on IKs and the alignment between CTEs and primary schools' science and mathematics curricula, major challenges to integrate and implement IKs into the existing colleges' curricula. The FGDs were conducted entirely in Amharic language, since this is the language in which we can communicate each other's easily. The FGDs were first recorded by note-taking, and then translated and transcribed into English.

3.5.3 Document analysis

Document analysis is a form of qualitative research in which documents are interpreted by the researcher to give voice and meaning around an assessment topic. It includes gathering information used in a formal description of the electronic text, studying the content and structure of the documents, identifying and naming the components of some class of documents specifying their interrelationships and naming their properties. Weiss (1998) holds that documents are "a good place to search for answers. They provide a useful check on information gathered in an interview." He further adds that when "other techniques fail to resolve a question; documentary evidence can provide a convincing answer." A part from providing evidence, Weiss (1998) has noted that documentary analysis also allows the analyst to become thoroughly familiar with the materials and helps to save on time.

The usefulness of documents as research tools is that they help corroborate and strengthen the evidence gathered using other tools. Document analysis observe Ary et al. (2010) are a good source of data that can provide good descriptive information, are stable source of data, and can help ground a study in its context (Ary et al., 2010).

This research made use of document analysis. The researcher collected and analysed the existing Ethiopian Education and Training Policy, 1994, Ethiopian Education Development Road map, 2018, Ethiopian general education curriculum framework, 2020, ten year Ethiopian Education Sector development plan, 2020, college of teachers' education Science and Mathematics courses curriculum framework, course outlines, grade four and eight Science and Mathematics subjects text books, teachers guides, syllabi, Ministry of education and SNNPR education bureau reports and SNNPR teachers licensing examination results.

3.6 Data collection procedures

The data was collected through questionnaires, interviews, focus group discussions, and document analysis. After administering the tools, we have contacted colleges' deans and school principals to request for cooperation having an official support letter from SPNNR. After getting the consent of the participants; first, the questionnaires were disseminated

to selected respondents. Then after, the concerned participants also interviewed and FGDs were carried out simultaneously.

3.7 Validity and reliability test

Validity explains how well the collected data covers the actual area of investigation (Ghauri and Gronhaug, 2005). Validity basically means measure what is intended to be measured (Field, 2005). Huck (2007), indicate testing for reliability is important as it refers to the consistency across the parts of a measuring instrument. Moreover, Wilson (2010) suggests although reliability is important for study, it is not sufficient unless combined with validity. In other words, for a test to be reliable, it also needs to be valid.

Hence, the validity of the questionnaires designed for teacher educators and primary school teachers, the interview guides for the colleges' deans and vice deans, regional education bureau official and curriculum experts, and the guiding questions for FGDs was checked by my research advisors, SNNP education bureau senior English language expert (colleague), education specialist (friend).

Furthermore, the reliability of the questionnaires, which were commented by my research advisors and then modified by the researcher, administered to seventeen (17) primary school science and mathematics teachers selected and nine (9) science and mathematics teacher and checked the reliability using Cronbach alpha coefficient. Cronbach Alpha coefficient is the most appropriate measure of reliability when making use of Likert scales (Whitley, 2002, Robinson et al., 2009). No absolute rules exist for internal consistencies, however most agree on a minimum internal consistency coefficient of .70 (Whitley, 2002, Robinson et al., 2009).

Accordingly, the Cronbach alpha coefficient for the primary school teachers and teacher educator's questionnaire values were 0.78 and 0.83 respectively. These values are supported with **straub2004validation<empty citation>** suggestion; the reliability should be equal to or above 0.60. Furthermore, **hinton2004spss<empty citation>** have suggested four cut-off points for reliability, which includes excellent reliability (0.90 and above), high reliability (0.70-0.90), moderate reliability (0.50-0.70) and low reliability (0.50 and below) (**hinton2004spss**).

However, as it is seen see from Appendixes F and G there were items both in the questionnaires developed for primary school teachers and teacher educators which need content and translation. Such as from primary teacher questionnaire items related teacher perceptions on the inclusion of IKs in the existing school science and mathematics curricula, items P1 (0.79), A5 (0.79) and C6 (0.80) and also from questionnaire developed for teacher educators, items P9 (0.853) and C7 (0.85) were revised in content wise, translation and rearrangement of the items so as make them clear for the respondents.

3.8 Method of data analysis

Data analysis is the vehicle used to generate findings and to answer research questions (Creswell and Plano Clark, 2007: 147). In this study, both quantitative and qualitative data analysis techniques were employed.

3.8.1 Quantitative and analysis

To analyze the quantitative data, both descriptive and inferential statistics were used. Depending on the nature of the basic research questions the descriptive analysis such as percentage, mean score, standard deviation was used to guide the analysis and interpretation of the findings. I have applied SPSS software version 26 for quantitative analysis purpose.

3.8.2 Qualitative and analysis

Data collected from open-ended questionnaires, interviews, FGDs, and from documents were analyzed qualitatively. Content analysis was used to explore the extent to which IKs are integrated into the existing colleges and primary school mathematics and science curricula and also the alignment between the college and school mathematics and science curricula. Content analysis is a strict and systematic set of procedures for the rigorous analysis, examination and verification of the contents of written data (Flick, 1998; Mayring, 2004). Krippendorff (2004) also defines content analysis as "a research technique for making replaceable and valid inferences from texts (or other meaningful matter) to the contexts of their use" Krippendorff (2004): 18).

3.9 Ethical consideration

Blanche et al. (2009) asserted that the purpose of research ethics is to protect the welfare of the research participants. They argued that research ethics also involved not only the welfare of the informants but extend to areas such as scientific misconduct and plagiarism. The ethical consent was obtained before collecting information from respondents through formal communication. In conducting the study, I could consider different ethical issues. These are: the purpose of the research and who the researcher is and the study's potential benefits to the profession in the field of education. The responses were anonymous, they were offered to withdraw if and when they felt uncomfortable to continue, and how long they would be required to respond to the instruments them to participate in the study as ethical issues.

After going through the consent with the participants, the participants were also advised that the final copy of the research study would be made available to them through the regional education bureau and college of teachers' education in case they needed to see it.

4 Result and discussion

This section includes the presentation, analysis and interpretation of data collected on re-thinking college of teachers' education curricula through indigenous curriculum construction principles: College of teachers' education in focus in SNNPRs

Table 2: Background information of the participants

	Male	%	Female	%
College teacher educators	55	94.8	3	5.2
Primary school teachers	75	82.4	16	17.6
College deans and vice deans	7	100.0	0	0.0
Regional Education Bureau Officials	3	75.0	1	25.0
Regional Education Bureau curriculum experts	3	75.0	1	25.0
Total	**143**		**21**	

Source: Field survey, 2021

From Table 2 above, it can be shown that, the total number of the study respondents from the five groups were 58 (female = 3) College teacher educators, 91 (female = 16) primary school teachers, 7 College dean and vice deans, 4 (female = 1) regional education bureau officials and 4 (female = 1) regional education bureau Science and Mathematics subjects senior curriculum experts. Hence, a total of 164 participants were involved in the study.

4.1 The place of IKs in the college of teachers' education science and mathematics curriculum

This section presents data analysis and a discussion of the extent to which IKs have been incorporated into the college of teachers' education science and mathematics curricula. The focus is to ascertain how much IKs contents are included in the curriculum frame work, course description general objective, and the courses outline of the college science and mathematics subjects. In doing so, first we presented and discuss the data gathered from all secondary sources and then, substantiated by the primary sources of data.

We critically investigate the current Education and Training policy document regarding the place of IKs in it and the results are discussed as follow: Subarticle 3.6.7 it states "traditional education will be improved and developed by being integrated with modern education" and sub-article 2.2.8 states it is important "to make education a supportive tool for developing traditional technology, and for utilizing for technology". Moreover, sub-article 3.1.3 states "ensuring the curriculum developed and textbook prepared at the central and regional levels are based on sound pedagogical and psychological principles and are up to international standards, giving due to attention to concrete local conditions and gender issues", and sub-article 3.5.1 reads "cognizant of the pedagogical advantage of the child in learning in mother tongue and the rights of nationalities to promote the use of their languages, primary education will be given in nationality languages" (Ministry of Education, 1994:10-26).

From the above provisions of the existing Education and Training Policy (1994), we can understand that there is an effort to include Ethiopian IKs in the curriculum, of Ethiopia. This is in line with Teshome (2017) who argue that there is an attempt to include IKs in the school curriculum in Ethiopia though there is problem of implementation. Furthermore, the new general education curriculum framework of Ethiopia, EGECF, (2020) revealed that "the existing general education curriculum framework was not able to give appropriate space for the teaching and learning of indigenous knowledge and emerging and nationally pressing issues (Ministry of Education, 2020a:8). Here we focused to investigate the EGECF, because the college of teachers' education curriculum in Ethiopia is designed based on general education curriculum framework. "In order to ensure the successful implementation of the general education curriculum, the framework basically envisages the alignment of the teacher education curriculum in both its preservice and

in-service modalities with the dictates of general education curriculum framework" (Ministry of Education, 2020a:3).

To get data regarding the inclusion of IKs in the colleges' science and mathematics subjects, we have collected data from mathematics and science (Biology, Chemistry, and Physics) subjects' curriculum framework focusing on the courses description, the general objective/s of each course and the course outlines. The findings are:

According to the Ethiopian ministry of education revised curriculum for Biology major students in the linear program (2007), would-be teachers are expected to take a total of fourteen (14) biology courses as major courses. The extent to which IKs are included into the BIOLOGY courses are analyzed thematically (content analysis) and discussed as follow:

In Biology 113, Introduction to Algae and Fungi course, the course description states that 'practical activities such as identification of some algae and fungi in their locality'. This implies the course allow students to appreciate and use some economically important groups of algae and fungi found in their localities. However, it is difficult to get components of IKs in all the course's objectives. Therefore, since the existing education in Ethiopia is categorized under objective based education system, we argued that IKs lack appropriate place in this course.

In Biology 221, Introduction Invertebrate Zoology, there is only one course objective related to IKs which reads as 'at the end of the course students are able to identify the importance of invertebrates to man, his crops and domestic animals'. Implies, the course helps students to be familiar with their day-to-day life activities.

In Biology 204, Ecology and Conservation, the course description states the following: field trips to appropriate ecosystems in the country to enhance students understanding on the ecosystems of Ethiopia and introduction to the area of conservation biology. It also includes an examination of the historical and ethical background underpinning the current conservation movement, the values of biodiversity and ecosystem services, and threats to biodiversity due to the impact of human use.

Furthermore, it includes ecological concepts that are utilized in conservation management practices, the role of national policy and institutions in implementing conservations.

And also, in Subject Area Methods II, TECM 242, course, there are concepts related to IKs like preparation and improvisation of instructional media, preparing appropriate teaching aids from locally available materials and develop better social skills.

From the above, it is clearly understood that the colleges' Biology subject curriculum framework try to includes some IKs components, such as identification of some algae and fungi in their locality, identifying the importance of invertebrates to man, his crops and domestic animals, practical knowledge on Ethiopian ecosystems, national policy and institutions in implementing conservation and the future directions of conservation, and preparation and improvisation of teaching aids from locally available materials and develop better social skills.

However, the findings from the FGDs with the colleges' teacher educator reveal that the extent to which IKs are included and implemented in biology courses at almost negligible; Participant BL1 highlighted the inclusion of IKs in the colleges' biology courses saying: "I have more than 15 years' experience as biology lecturer in the colleges, still now; I didn't get a single concept related with IKs both in content and methodology part". Participant HOL1 shared his views on the extent to which IKs are included in the college Biology courses and he narrated that: "Although I believed in the importance of inculcating IKs in the college curricula not only in Biology courses but also in all the courses provided as

the college level, I can assure that, there are no IKs components in the existing college biology courses". However, participant HAL1 dis-agreed with the above responses and he said that: "It will be difficult to reach on such conclusion without researching the issues, in my opinion there are some components of IKs in the colleges' Biology courses like beekeeping, natural resource conservation, I am afraid of their inclusion and implementation in the actual classes by lecturers".

Similarly, the course breaks down for diploma Chemistry major linear program would-be teachers are expected to take a total of sixteen (16) major Chemistry courses. The extents to which IKs are included in each of these courses are examined critically and discussed as follow:

In general Chemistry I, Chem 101, one of the general objectives for the course reads as 'After completing this course, the student will be able to explain the role of chemistry in the society' and practical Organic Chemistry, Che 243, one the general objective for the course states 'after completing this course, the student will be able to prepare ordinary soap and examine its properties'. The, course description for applied chemistry, chem 351, states the following:

> "The course involves the study of energy resources and consumption, chemical industries and production of some important chemicals (acids, bases, salts, fertilizers, petroleum, detergents, plastics, textiles, leather, food, and drugs), local chemical factors, agricultural (fertilizers, pesticides) chemistry environmental Chemistry (soil, water, atmosphere), environment, impact of anthropogenic chemicals on the environment" (2007:65).

Moreover, two of the general objectives of the course stated as 'At the end of the course students will be able to explain environmental impacts of local industries and suggest possible ways of safe use of natural resources.

In Methods of Teaching chemistry, TeCh 242, general objectives of the course read as "At the end of the course students will be able to show implications of the objectives of education and training policy of the country and prepare instructional materials for teaching chemistry from local sources".

The finding shows there are some components of IKs in the colleges' chemistry courses like, chemistry in industry, agriculture, health, food and environment sectors indicating some efforts so far done to include IKs. This is in line with participant HAL2 views' read as: "Even if there are some component of IKs in the colleges' Chemistry courses such as in practical general chemistry, solution and solubility, in practical organic chemistry, distillation of "local Araki", in chem 245, extraction of local "Dataa", coffee leaf and how it is extracted, I cannot say IKs have appropriate place in the college chemistry courses".

This is further strengthen by participant HOL2 by saying, "There are a lot of IKs in our locality which can easily incorporate in the colleges' chemistry courses, unfortunately, the course doesn't allow and motivate us to include, it is coped from some Western realities, [silent...] we Ethiopian have so many rational herbal medicines like 'ginger, garlic, 'Tenaadam', 'Feto'....but they lack attention to include in our education".

The investigation on the Physics courses confirmed that in all the thirteen (13) courses would-be are expected to take, it is hardly found word, phrases, and concepts related to IKs neither in the course's description nor in the general objectives of each courses. This is supported with the result of FGDs with teacher educators and their response for the open-ended questions of the questionnaire. Participant HOL3 mentioned his views' as: "I have more than 15 years' experience as physics lecturer in the colleges, still now; I didn't get a single concept related with IKs both in content and methodology part".

Furthermore, HAL3 and BL2 agreed with the above response and they anchor the ideas by saying: "The college physics courses didn't include concepts related to IKs though there are contents like Simple machine, energy and renewable energy sources which could easily include IKs".

Therefore, from the result of content analysis and teacher educators' views, I strongly argued that the college of teacher education physics curricula strongly ignored the IKs though there are practical and related to the communities' day to day life activities.

Finally, the result of content analysis of the all the ten (10) Mathematics courses would be teachers enrolled in mathematics department are expected to take confirms that it is hard to find words, concepts, and phrases about IKs in all courses. This is in line with the result of the FGDs with teacher educators. Participant BL3 explained that: "During my experience as college mathematics lecture, I did not find IKs in the colleges' mathematics courses both in the content and methodological aspects, and I haven't applied the concept of IKs in my classes. Though, I believe that it is possible to include IKs in the college mathematics courses like, in unit of measurements, geometry, measurement, functions, and arithmetic and geometric progression".

Moreover, to get data regarding the place of IKs in the courses (in the unit, objectives, examples, activities, exercise, projects) and the curriculum framework, course outline, syllabi of the courses' science and mathematics teacher educators are currently teaching and the extent to IKs are included and implemented into their teaching-learning strategies, assessment techniques, and practical activities, I have collected quantitative data from them using a five point rating scales. The results are summarized into three categories, Disagree (DA), Undecided (UN) and Agree (AG) in Table 3 and the findings are discussed in percentage and mean.

Table 3: Teacher educators' views on the extent IKs contents are included into the college science and mathematics courses

S/No	Statements	DA	UD	AG	Mean
1	The course you are currently teaching contains elements of indigenous knowledge (units, objectives, examples, exercise)	30	5	22	2.70
	%	51.7	8.6	38.0	
2	The syllabi, curriculum framework, and courses in Science and Math's subjects in colleges allow you to teach indigenous knowledge concept in your classes	33	9	15	2.51
	%	56.9	15.5	25.8	
3	Assessment techniques and project works practiced in your college Math's and Science curricula include IKs content	34	11	11	2.43
	%	58.6	19.0	18.9	
4	I believe practical examination in Science and Mathematics is based on modern science/academic scenario of learning.	11	6	40	3.72
	%	19.0	10.3	69.0	
5	The practical activities of Math's and Science subjects have incorporated indigenous knowledge and they promote to use locally available materials to perform the activities	26	10	20	2.88
	%	44.8	17.2	34.5	
6	The content of Math's and Science subjects and teaching methodologies is western curricula dominated with no/little local IK contents and methodologies	9	7	41	3.80
	%	15.5	12.1	70.7	

Source: Field survey, 2021

As show in Table 3 above, the college science and mathematics teacher educators were asked to express their views on the extent to which the course they are currently teaching

contain IKs in the units, objectives, examples, exercises, projects and their responses are as follow: The majority 30 (51.7%) replied IKs have no place in the colleges' mathematics and science curricula, 22(38.0%) said IKs have place, and 5 (8.6%) of the respondents were unable to decide whether IKs included or not. Furthermore, as shown from the table the mean for the item (2.70) indicate that the respondents were disagreed on the issue; the courses they are teaching have components of IKs in the units, unit objectives, examples, and exercise.

As indicated in the table in item 2, they were also asked to express their views on the colleges' science and mathematics courses curriculum framework and syllabi allow them to teach IKs concept for learners, and their responses are: The majority 33(56.9%) of the respondents dis-agreed, 15(25.8%) agreed, and 9(15.5%) said it is difficult for them to response the question. The mean value for the item (2.51) tells us the respondents dis-agreed with the discourse the current colleges' science and mathematics courses curriculum framework and syllabi allow teacher educators to teach IKs concept for learners.

Teacher educators were asked to express their view on the current assessment techniques they are practicing in their teaching and learning include IKs contents and their responses are as follow; the majority of them 34 (58.6%) replied the assessment techniques they are practicing in their college do not consider IKs contents, 11 (18.9%) stated the assessment techniques consider IKs, and the remaining 11 (19.0%) were not able to decide on the issue raised. And also the mean value for the item (2.43) indicate that teacher educators disagreed with the notion the assessment techniques currently practiced by college teacher educators considered IKs contents.

As item 4 indicate in Table 3 above, teacher educators were asked to express their views on practical examinations in science and mathematics are based on modern science/academic scenario of learning. The majority 40 (69.0%) of the respondents agreed that the practical examination in the colleges' science and mathematics courses are based on the modern/Western style of learning, 11(19%) dis-agreed, and 6(10.3%) were kept silent. Moreover; the mean value for the item (3.72) shows they agreed on the practical activities/examination in science and mathematics courses are based on Western knowledge production systems.

Item 5, about the inclusion of IKs in the practical sessions and can perform using locally available teaching-learning materials, their responses are the majority 26 (44.8%) disagree, 20 (34.5%) agree, and 10 (17.2%) were unable to response. The mean value for the item (2.88) tells us teacher educators are disagreed with the discourse that the practical activities found in the colleges' science and mathematics courses includes IKs and can be performed using locally available resources.

In the last item 6, teacher educators were asked about the domination of the Western knowledge at the expense of IKs in the colleges' science and mathematics courses both in subject matter and methodology, the majority of the respondents 41(70.7%) agreed that the curriculum is western dominated and it does not give space for IKs, on the other hand, 9 (15.5%) dis-agree with the domination of Western knowledge in the colleges' science and mathematics curricula, and 7(12.1%) of the respondents were not able to decide whether there is domination of Western knowledge or not. The mean value for the item (3.80) clearly indicates teacher educators agreed that in the colleges' science and mathematics courses there is a domination of Western knowledge at the expense of IKs.

The findings above show that, though, the existing Ethiopian education and training policy, 1994, provides an opportunity for the inclusion of local or IKs, the above findings and discussions on the extent to which IKs are included into the existing colleges' science and mathematics curricula, clearly shows IKs are alienated. It is in the words of Breidlid (2013):97) "probably intentionally so vague and ambiguous that one wonders

what was to be included and excluded from the variety of values, worldviews and knowledge systems...". While on one hand, the national education and training policy is fairly considerate of the localization process, curriculum content on the other hand is not locally sensitive and thus not reflective of the indigenous policy decision. This is in line with (Kedir, 2007; Semela, 2017) who argue that the teacher training system is characterized by frequent reforms due to the global influences associated with lack of emphasis on local contexts and absence of genuine societal participation.

The domination of Western knowledge over IKs in sub-Saharan African countries is also supported with Shizha (2013) who states that in sub-Saharan Africa, curriculum, both in content and pedagogy continues to teach students a foreign culture and worldview in a foreign language that inhibit learning experiences of students. Shava (2016) also claims that the western education system denies learners space to bring into the educational processes knowledge from their own lived experiences. Instead, their experiences are considered inferior and their accumulated IK as valueless and insignificant. Therefore, curriculum content is still predominantly dominated by the western hegemonic epistemology at the expense of IKs (Dei, 2002; Shizha, 2010).

This is evidence that science and mathematics curricula still predominantly represent the Western Scientific paradigm at the expense of local knowledge. It confirms Ngugi's (1981) notion of "colonization of the mind". Despite considerable strides of inclusion of IKs especially at policy level, de-colonization of the education system has not quite come to realization and still carries signs that are demonstrative of a colonized curriculum.

Therefore, including and implementing IKs, in the colleges' science and mathematics curricula, means acknowledging the social identities of the learners and developing positive experience and the attitude of learners towards science and mathematics. It brings students' school experiences closer to their home lives and gives them the opportunity to develop their talents and abilities to full potential, gain confidence and self-esteem, use their initiative and creativity, gain life skills and make informed decisions, and to understand and experience pluralism and democratic coexistence (UNICEF, 2004). Thus, the current science and mathematics curricula of the college of teachers' education should need immediate attention to inculcate IKs and implement so as to encounter the Western hegemonic knowledge.

4.2 Perceptions of colleges' science and mathematics lecturers on IKs and its inclusion

In this sub-section we present, analyse and discuss the findings of the data obtained by questionnaires, FGDs, and interviews from the research participant perceptions on IKs and its inclusion into the colleges' science and mathematics curricula. Respondents were asked to define the notion 'IKs' in their own words and some of their definitions are summarized and discussed as follows:

IKs are traditional knowledge" this definition indicates IKs as 'tradition' which is an inherited or customary pattern of thought, action, or behavior. Traditions are just a component of IKS. IKs are knowledge that have been created by the locals out of their own experiences locally". (2018) doesn't necessary give a definition but describes how this knowledge is generated and brings the idea of local to the discussion.

IKs are knowledge to do with ancestors". This definition positions IKs in the past as something that ended historically.

"It's the knowledge that deals with the culture". Culture knowledge is more embracing because of its broad nature that imply the whole way of life of a given people which

may include, their language festivals, values, beliefs and traditions. Culture, includes all aspects of a people's way of life such as their sporting activities, music, dance, economic activities, education system, their legal and political system, the fundamental rights of a human being, spiritual, material, intellectual and emotional aspects of a human being.

They also define IKs by giving various examples of medicinal herbs, fishing and farming methods, methods of food preservation, traditional methods of conserving wild life, knowledge of trees and their uses, beer brewing, and weaving and handicraft.

Although, some of their definitions fit with the United Nations (2004) view that IKs as a body of knowledge that indigenous people of a historical and geographical locality have lived on for a prolonged period and have developed and transmitted to future generations. We argued that this perception could be problematic to multicultural communities such as Ethiopia in that it tends to exclude inhabitants of that particular area who may not be otherwise indigenous to the area and may not have used the IKs of the people of that area. Similarly, associating IKs to the long occupancy of a given people to a given place could be thought-provoking.

They were also asked what they understand from the concept Indigenous knowledge and some of the concepts stated are summarized as: tradition, orally passed on from generation to generation, knowledge created out of a sustained stay to a locality, local, ancestral, static knowledge, and cultural. While the key terms listed maybe somewhat accurate in their description of IKs, they are also problematic and posse a challenge when used in the context of the locals.

As Semali and Kincheloe (1999), describe the terms, local, traditional, ancestral, and orally passed on tend to reflect the Western perspective of the concept of IKs which is mainly associated with the ideas of primitive, static, inferior, wild and the natural. Furthermore, Odora Hoppers (2002) describes this as "inverted mirror of Western identity" (Odora Hoppers, 2002:8) which breaks negative connotation about IKs and significantly contributes to the deviation of IKs in science education. The West often seems to perceive indigenous practices as irrational, mythical, unscientific and superstitious and incapable of contributing to 'development'.

While the conception of IKs as a preserving national heritage came out prominently among respondents, the aspect of it being a national resource was missing. **odora2002indigenous<** sees IKs as a combination of knowledge systems encompassing technology, social, economic and philosophical learning, or education, legal and governance systems. Indigenous knowledges are dynamic, and enables people to live harmoniously with their environment and as Breidlid (2013) observes, many people and majority population groups in Africa still adhere to cultures, belief systems and epistemologies that differ from the hegemonic Western ones.

Furthermore, we have asked college of teacher educators to express their perceptions specifically focusing on IKs and colleges' science and mathematics curricula, IKs and students learning achievement, IKs and societies' need, IKs and nations', and development through four scale Likert scale questionnaire and their responses are presented, analyses and discussed as follow:

Table 4: Perceptions of teacher educators on IKs content and application

S/No	Statement	DA	UD	AG	Mean
1	I believe that there is a room to include IKs in the existing college science and mathematics subjects.	36	8	12	2.41
	%	62.1	13.8	20.7	
2	I have a positive perception that IKs enhance critical thinking and logical reasoning of learners if the contextualized in Science and Mathematics courses at college level	6	4	47	4.26
	%	10.4	6.9	81.0	
3	I believe integration of IKs and practices into Science and Mathematics teaching enhances students' understanding and improve learning achievement	2	1	54	4.47
	%	3.4	1.7	93.1	
4	I believe that if IKs are systemically and holistically included into school's curriculum contextually, students' achievement will be improved.	2	2	52	4.39
	%	3.4	3.4	89.7	
5	I believe IKs shall be considered to be an essential body of knowledge that can be integrated into the school curriculum to make teaching and learning contextual and meet the dynamic needs of the society.	2	4	51	4.37
	%	3.4	6.9	87.9	
6	I believe practical examination in Science and Mathematics should include IKs and connected to practical life of the societal problems.	2	1	54	4.49
	%	3.4	1.7	93.1	
7	I feel teacher educators are responsible to connect IKs in their actual classroom setting while teaching	1	3	53	4.26
	%	1.7	5.2	91.4	
8	Medium of instruction will play vital role for promoting and teaching IKs contents	4	7	46	4.18
	%	6.9	12.1	79.3	
9	I believe it is impossible to include IKs in the existing curricula.	47	5	6	2.01
	%	81.0	8.6	10.4	
10	Inculcating IKs in the curriculum helps for holistic development of a nation	3	2	52	4.4
	%	5.1	3.4	89.7	

Source: Field survey, 2021

From Table 4 above, Item 1, teacher educators were asked to express their beliefs on whether there is a room to include IKs in the current colleges' science and mathematics curricula or not, and, in this regards, the majority of the respondents 36 (62.1%) replied that the existing colleges' science and mathematics curricula have no place to include IKs, 12 (20.7%) replied that there is a room to include IKs in the current colleges' science and mathematics curricula, and 8(13.8%) replied that they cannot decided whether there is a space to include or not. From the mean value of item 1, (2.41) it is clearly understood that the respondent strongly dis-agreed with the discourse that teacher educators believed that there is a room to include IKs in the existing college science and mathematics subjects. Furthermore; Participant BL3 stated the following: "Science the current colleges' curricula are copied from other counties like America, Germany, and Great Britain and pasted. How can we talk about the space for IKs if all the colleges' teaching and learning materials are brought from Western counties?"

Item two in the table is about perceptions of teacher educators on the positive effects of IKs on enhancing the critical thinking and logical reasoning of learners' and their responses are analyzed and discussed: the majority 47 (81.0%) of replied that if IKs are included in the colleges' science and mathematics curricula in a contextualized way, learners' critical and logical reasoning power will enhanced. This is supported with UNESCO (2011) which states "Education programs that promotes indigenous knowledge sustainable lifestyle and sustainable development will further enhance critical thinking and problem-skills solving (UNESCO, 2011; 61)". On the other hand, 6(10.4%) of the respondents disagreed and 4 (6.9%) said they do not know. From the mean value for the item (4.26) it is understood that the respondents are strongly agreed that if IKs are included in the colleges' science and mathematics curricula in a contextualized way, learners' critical and logical reasoning power will increase.

Item three in the table is about teacher educators' perceptions on integrating IKs contents and practices into science and mathematics and its positive effect on students' understanding and learning achievement. Almost all 57(93.1%) of the participants agreed on if IKs contents and practice are included and implemented in the colleges' science and mathematics courses the students understanding and hence academic achievement will improve. On the other hand, 2(3.4%) of the respondent dis-agreed with the above discourse, and one respondent cannot decide the relation between IKs and students understanding and academic achievements. Moreover, the mean value for the item (4.47) indicates the respondents are strongly agreed on the strong positive relation between IKs and students' understanding and academic achievement. During the FGDs session with teacher educators, participant BL4 explained: "Including and implementing IKs in the colleges' science and mathematics subjects will enhance students' understanding on both factual and conceptual knowledge and hence will improve their academic achievement".

Furthermore, Participant BL5 strengthened the above statement by saying: "Including IKs in the colleges' curricula will make the teaching-learning process easy, students start their learning from what they know, that means it will promote a meaningful learning. Since it starts from the society's real problems, students' creativity and academic achievement will increase".

The above findings imply that if IKs and practices are included and implemented in the colleges' science and mathematics curricula, student's prerequisite knowledge, they have got from their environment and family will help them to foster understanding of the formal education, this will help to improve their academic achievement.

Item four in the table above is about teacher educators' perception on systematically, and holistically, and contextually inclusion of IKs and its positive effects on students' academic achievement. The majority of the respondent 52(89.7%) agreed, whereas only 2(3.4%) disagreed, and 2(3.4%) were unable to react to the item. The mean value for the item (4.39) tells us the respondents were strongly agreed on IKs should include in the existing curricula systematically, holistically and contextually so as to improve the learners' academic achievement. The finding is aligned with the existing literature of the holistic nature of IKs and proposed that native knowledge should contain the complex set of technologies improved and sustained by the indigenous community (Battiste, 2002: 2).

Item five in the table above is teacher educator perceptions on considering IKs as an essential body of knowledge and should be integrated into the school curriculum to meet the dynamic needs of the society. Their response are analyzed and discussed below as follow: The majority of the respondents 51 (87.9%) agreed, 2 (3.4%) dis-agreed and 4 (3.9%) they do not know. Moreover, the mean value of the item (4.37) indicated that the respondents were strongly agreed that IKs should be considered as an essential body of knowledge and should integrated in the curriculum so as to meet the dynamic needs of the society. This finding is alighted with the existing literature that highlights IKs are

essential knowledge and should be include in the curriculum so as to meet the dynamic needs of the society. Some of the solutions to problems that currently plague developing societies and communities must proceed from understanding the dynamics within the local context; such dynamics includes the role of indigenous knowledge and practices in the development processes. (Dei, 2002; Angioni, 2003).

Furthermore, the World Bank (2004) states that indigenous knowledge is a resource that can help to solve local problems, to prevent conflict, to build solidarity in communities, to manage local affairs, and thus contribute to global solutions. Similarly, Van Niekerk (2004) states that curricula have to be contextualized in order to address problems, topics and issues that face the dynamic society.

In item six, teacher educators were asked about their perceptions on the importance of including IKs in practical examinations of science and mathematics courses that are connected to the practical life of the societal problems. The majority of the respondents 54(93.1%) agreed, 2 (3.4%) disagreed, and only 1(1.7%) was not able to respond on the issues. The mean value (4.49) for the item indicate the respondents were strongly agreed on the inclusion of IKs in the practical examinations of the colleges' science and mathematics courses and the examination should connected to practical life of the societal problems.

Item seven in the table above is about perceptions of teacher educators on the responsibilities of science and mathematics lecturers to connect IKs in their actual classroom setting and they replied as follow; 53(91.4%) of the respondent believed that science and mathematics lecturers have the responsibilities to connect IKs in their actual classes, 1 (1.7%) believed that it is not the responsibility of the educators, 3 (5.2%) of respondents were not decided on the issue at all. Furthermore, the mean value for the item (4.26) show that the majority of the respondents are strongly agreed on the concept that teacher educators have responsibilities' to include and implement IKs in their actual classrooms teaching-learning processes.

Moreover, During the FGDs participant HOL3 explained that: "Not only science and mathematics lecturers are responsible to include and teach IKs in their classes but also other course lecturers should be responsible. We, teachers, must see indigenization not only as a way of making science a reality in the lives of the learners but also as a way of improving our students' academic performance".

Item 8 is all about how teacher educators perceive the role of MOI in promoting and teaching IKs contents. The majority 46 (79.3%) of participants agreed that MOI will play a vital role in promoting and teaching IKs contents, 4 (6.9%) were dis-agreed on the importance of MOI, and 7(12.1%) were unable to respond the question. As we can see from the mean value for the item (4.18) the participants were agreed on MOI will play the vital role for promoting and teaching IKs contents.

Even if, this finding is aligned with the existing literature on the importance of incorporating indigenous languages into the science curriculum in helping students to understand scientific principles and to link Western science to indigenous ways of knowing (McKinley, 2005), studies on cultural beliefs and science in Africa conclude that the teaching and learning of science in school is not successful because the subject is not linked to everyday life experiences and the language of instruction alienates students (Clark and Ramahlape, 1999; Dlodlo, 1999; Dzama and Osborne, 1999; Shumba, 1999).

In item 9 above, teacher educators were asked to express their views on the possibilities of including IKs in the existing colleges' science and mathematics curricula and 47 (81.1%) replied that it is possible to include IKs in the existing college science and mathematics curricula, 6 (10.4%) replied it is impossible to include, and 5(8.6%) were not decided on

the issue at all. Moreover, the mean value for the item (2.02) indicates that the respondents dis-agree on the thought of impossibility to include IKs into the existing colleges' curricula. Furthermore, participant BL6 stated that: "It is possible to include mathematics IKs in the existing college curriculum; the problem is that lack of knowledge and skills on the inclusion of indigenous resources".

However, participant HAL4, replied for the open ended as follow: "It is not possible to include IKs in physics courses in all topics, in some topic there may be an opportunity to include IKs, I doubt, in social sciences, it may be possible. What I simply mean here is that certain topics and certain study areas can present these IKs to the learners. But it's not in every study area and certainly not in every subject".

The participant' argument is supported by Ernest stated that "to empower learners as individuals' citizens-in-society, by developing mathematical confidence... and to foster critical awareness and democratic citizenship via mathematics" (Ernest, 2007: 34). Research shows that how different indigenous groups have developed mathematical competence and practices, in particular "quantitative and qualitative practices as counting, weighing and measuring, comparing sorting and classifying" (D'Ambrosio, 1999:51).

Finally, in item 10, respondents were asked about their perception on the concept that if IKs are included and implemented in the colleges' curricula, it will contribute for the holistic development of the nation. The majority 52 (89.7%) of the respondents agreed, 3(5.1%) dis-agreed, and 2 (3.4%) were unable to react for the item. From the mean vale (4.40) it is understood that the participants are agreed that if IKs are included and implemented in the college curricula it will contribute for the holistic development of a nation. Their responses are supported by Asgedom (2005) and Woldeyes (2017) argument that modern education in Ethiopia does not play a meaningful role in the national development because it disregarded the IKs in Ethiopia. And also by Teshome (2019), 206) who argue that the "failure in investing in IKs and its integration into the school curriculum marginalizes the importance of indigenous knowledge to contribute to the national endeavor of the country in all aspects". Including and implementing IKs in the school curriculum will play a vital role for the holistic development of a nation.

5 Conclusions

Indigenous knowledge are now being considered to be an essential body of knowledge that can be integrated in the school curriculum to make teaching and learning contextual and meet dynamic needs of the society. Therefore, college of teachers' education Science and Mathematics curricula should include IKs contents which learners are familiar with, and then gradually move to the knowledge about regional, national and global environments. This essentially follows the philosophy of embarking on teaching and learning from the known to the unknown', which could be adopted if quality and relevancy of education is to be achieved.

Although, the current education and training policy, ETP, has some provisions which supports the inclusion and implementation of IKs in the curriculum, the college of teachers' education curricula was not able to give appropriate space for the teaching and learning of indigenous knowledge contents particularly in Science and Mathematics courses/subjects. Therefore, the inclusion and implementation of IKs contents in the colleges' curricula need adequate attention.

Furthermore, teacher educators lack basic philosophical and conceptual knowledge and skills of relevance of IKs to enhance critical thinking of learners and some teacher educators undervalued the effectiveness of indigenous knowledge in developing techno-

scientific skills applicable to scientific principles that can lead to sustainable use of indigenous resources.

However, indigenous knowledge are knowledge which encompassing technology, social, economic and philosophical learning, or education, legal and governance systems. And are dynamic, and enable people to live harmoniously with their environment. Thus, both the pre-service and in-service teacher training program curricula should revise in the light of IKs contents and to address both overt and hidden biases against indigenous knowledge in the college of teachers' education much needs to be done to change the attitudes of teacher educators toward indigenous knowledge.

Therefore, since integration of the IKs into the colleges' and school curriculum provides the necessary foundation for sustainable education which requires education programs that are locally relevant and culturally applicable and the most efficient way of strengthening indigenous knowledge is integrating the knowledge into school curricula, the current curriculum of Ethiopia should revise in the ways that it provides space for including the country's indigenous knowledge in the education system.

6 Recommendations

Based on the study key findings the following recommendations are forwarded.

1. The research finding shows that college of teachers' education science and mathematics curricula did not include IKs. Thus, failure in integration of IKs contents into the curriculum marginalizes the importance of IKs that contribute to the national endeavor of the country in all aspects. Therefore, revising the existing college curricula in light of IKs contents should be a top priority to policy makers and curriculum developers/experts.
2. Changes in the curriculum changes the knowledge discourse. Curriculum developers at all levels (national, regional, zonal) need equipped with the concepts and methodology on how to include IKs which are the essential attributes and skills required for the 21st century teaching profession. Therefore, the curriculum should be developed in a way that both Western and Indigenous knowledge systems coexisted which is important to realize sustainable education.
3. The integration of indigenous knowledge helps the production of knowledge and social relation that were ignored and marginalized by Western dominated knowledge. It also allows knowledge production to give space for indigenous knowledge. This requires ways of incorporating IKs into colleges' science and mathematics curricula. Therefore, there should be national institution working on surveying, selection, standardization, integration, implementation and feedback on including the various Ethiopian IKs in college's curricula.
4. In order to include and implement IKs contents in the curriculum, there should be a clear road map or guideline consisting of the strategies, clear set of principles or rules that define the actions that all implementer and stakeholders should take to achieve the desired goals.
5. Teacher educators' attitudes and perceptions are crucial and have implication for the inclusion of IKs contents and implementation in colleges' science mathematics courses. Therefore, a lot more work needs to be done in an effort to change attitudes, perceptions, institutions and communities, if inclusion is going be a success. To do these I recommend, Using continuous professional development (CPD) as an opportunity and ideal platform for giving a renewed hope and attention to the discourse of IKs.

6. It is necessary for teacher education programs to rethink ways in which to prepare teachers for effective integration of multiple forms of knowledge when designing and implementing the teacher education curriculum.
7. Even if the current political system of Ethiopia is decentralization, and hence it's education system, the real decentralization education system should be exercised by regions and training institutions to address the local needs and inclusion of IKs contents.
8. The study reveals that globalization has both negative and positive effects on IKs, Thus, indigenous value addition is key to the survival of IKs. People can only contribute and benefit from globalization if they are endowed with knowledge, skills, and values and with the capabilities and rights needed to pursue their basic likelihoods in IKs play a vital role.
9. The policy goals of INGOs, NGOs, and development partners are achieved through two different ways. The first one is powers of persuasion and the second one is conditionality attached to loans. Therefore, the government of Ethiopia in general and the education sector in particular should be very conscious and proactive to their hegemonic discourse on knowledge production and it should be counter balanced by including IKs contents in the curricula.
10. Revitalizing the value of indigenous knowledge through curriculum reforms are vital if communities are to engage in sustainable economic development that is oriented to their local needs. This becomes necessary to rethink the education framework in order to determine terms of development within the macro and micro levels.

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Data Availability

Data can be made available on the behavior of the request

Declaration of interests' statement

The author declare no competing interests.

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