STEM teachers' preferred instructional methods and challenges associated with implementing STEM education

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Abstract

A large body of research has investigated teachers' preferences for general teaching methodologies. However, relatively little research has been previously reported about the preferred instructional methods of STEM (Science, Technology, Engineering and Mathematics) teachers and their challenges in implementing STEM education at Bahir Dar STEM center, Ethiopia. This study examined preferences of 36 STEM teachers for three themes defining their instructional methods in this study: integration, engineering design and collaboration, and the challenges faced in implementing STEM education. The study used questionnaire and a semi-structured interview. The results showed that integration instructional method was marked by the teachers as the highest threshold instructional method. On the contrary, engineering design was the least preferred. A one way ANOVA results also revealed that the teachers showed considerable variation in their instructional preferences. The participants identified students' lack of motivation, poor laboratory facilities and lack of instructional materials as the top three challenges associated with implementing STEM subjects at the center. Drawn from the results, implications for further research and educational practices were proposed.

.**Key words***:* STEM education, instructional method, challenge, preference, science specific

INTRODUCTION

Effective instructional practices are crucial to equip students with the 21st century skills such as creativity, communication, collaboration and critical thinking skills. Accordingly, since the traditional science teaching could not yield significant change in the education system, there was an urgent need to reform the education system where an integrative STEM education has been proposed to address real-world situations through a design-based problem-solving process (Williams, 2011).In the face of an increasingly dynamic world, STEM is believed to make the difference in addressing societal problems and opportunities associated with globalization where there is a need to come up with an educational reform that can help nurture students with high thinking skills to bring up economic advancement and sustainable future (Roehring et al, 2012).

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A variety of STEM instructional methods have recently been proposed by researchers in the field of educational sciences including teaching the core concepts of science, using cross-cutting ideas, and utilizing engineering and scientific practices (Krajcik&Delen 2017), design and usingtechnology (Hernandez et al., 2014), collaboration (Strimel& Grubbs, 2016) and inquiry-based learning (Kennedy & Odell, 2014). Teachers' engagement in collaborative instructional method enhances teaching effectiveness (Carroll, et al., 2021). Similarly, cooperative learninghas become the preferred instructional process at all stages of education, for it provides an opportunity to students to enhance communication, social, critical thinking and problem-solving skills (Alruwaili& Templin, 2021).Collaborative learning is a widely utilized instructional method in a classroom, for it helps to enhance the collaborative skillsof learners and synergize literacy development (Pospelova, 2021).

Two approaches of STEM education are highlighted in the literature. In an integrative approach, all subjects should be integrated in one single course (Ritz & Fan, 2015),whereasin the second approach, knowledge should be integrated from separate aims of STEM disciplines to link content from specific subjects into the multidisciplinary approach (Cevik, 2017). Other educators have also posited the possibility of implementing both approaches by simply incorporating strategies such as problem-based learning, project-based learning or inquiry-based learning (Ntemngwa, & Oliver, 2018; Psycharis 2016). However, these methods should be simultaneously conducted with collaboration, authentic problem-solving skills, design and technology, and higher order thinking skills (Asunda&Mativo 2016; Shernoff, et. al. 2017).In this approach, barriers associated with interdisciplinary teaching are avoided and STEM content areas are taught (Rees & Roth, 2019; Soldano&Arzarello).In spite of all these endeavors, there are still differing views on the instructional methods in implementing STEM education.

One possible explanation for the effectiveness of student learning outcome can be attributed to teachers' instructional practices (Stronge et. al., 2011). Particularly, effective student learning can be fully realized when teachers provide students with opportunities to engage in and apply science concepts. With this respect, engineering design-based science education helps to realize the integration of STEM education into the curriculum (Ayaz&Sarıkaya, 2019),and lack of practice with these methods when teaching the subject matter were identified as negative attitudes to the STEM practices of active teaching and learning methods(Forbes & Davis, 2010). The benefitting working habits, the teacher's knowledge of the pupils and their necessities, cooperative work were also identified as criticalindicators for student achievement (García-Carrillo, et al., 2021).

The mounting evidence on the role of teacher practices has attracted considerable attention in the literature (Bruce-Davis, et. al., 2014; Kristin, 2013; Park et. al, 2016). In a similar vein, although governments have given considerable attention for STEM education, little is known on the practice and challenges and problems teachers faced to implement STEM education (Shin & Han, 2011). The details of STEM education perception among teachers, STEM implementation and criteria have remained obscure in many parts of the world (Park, et. al., 2016) and success experiences of the United States (Bruce-Davis, et. al. 2014). Accordingly, widespread practices among STEM teachers across the globe emerged (Roehrig et. al., 2012).

An extensive review of research on effective teaching has generally produced findings that consistently indicated the highest correlates of effective teaching practices with learning outcomes (Matthews & Sammons, 2005; Ritter &Shuls, 2012; Van der Zanden, et al., 2021).

Considerable empirical support has been documented for the strong link between teaching practices and student learning outcomes provided that the teacher applies student-centered activities in their classrooms and supports students' needs (Hernández, et. al, 2020; Ljubin-Golub, Rijavec, &Olčar, 2020).To better understandeffective STEM curricular activities, it is, therefore, necessary to first identify the complex teaching practices of the STEM education (Assefa&Rorissa, 2013) because the practices of teachers towards STEM education will surely affect STEM lesson delivery (Bell, 2016).

Teaching effectiveness is not only determined by teachers' practices, it is also attributed to various factors related to students, classrooms and schools. Accordingly, apart from understanding teachers' preferences for instructional methods, this study was also specifically conducted to examine barriers that could hamper effective STEM education. Regarding this, research has also identified difficulties associated with teachers' of expertise on STEM education (Lim & Oh, 2015; Shin, 2013), time constraints to prepare STEM lessons, limited instructional resources (Nwanekezi et al., 2010), a predominantly focus on making students manipulate physical objects and equipment (Abrahams & Millar, 2008). Poor inspiration of students, lack of support from the school system, poor condition of laboratory facilities and instructional media, lack of hands-on training for students were also reported as major challenges that hampered implementing STEM education (Aydin, 2020; McDonald, 2016).

CONTEXT AND REVIEW OF LITERATURE

This research was guided bythe conceptual framework of integrated STEM education for secondary education (Kelley & Knowles, 2016). The basic tenets of this theory underlines the essence of active learning methods such as scientific inquiry, situated learning, engineering design, technological literacy, and mathematical thinking that reinforce implementation of STEM education. Scientific inquiry places emphasis on the role of instructional strategies and various procedures and practices to investigate scientific concepts through problem solving. Situated learning involves the practical implementation of STEM knowledge and skills in the real social contexts. While the concept of mathematical thinking relies on analyzing mathematical problems and linking them to other STEM disciplines, technological literacy refers to applying skills, knowledge and experiences to embed technology in STEM Education. The other aspect of this theory-engineering design-based science education helps to realize the integration of STEM education into the curriculum (Ayaz&Sarıkaya, 2019).

Three most common instructional strategies: integration, engineering designing and collaboration were identified in light of the literature where a questionnaire was developed from 20 learning methods associated with these strategies. The instructional methods that are reiterated in the literature include problem based learning, project-based learning and inquiry based learning (Ntemngwa, & Oliver, 2018; Psycharis 2016). Therefore, the conceptual framework of integrated STEM education for secondary education fits the purpose of this study as supports the essence of the strategies listed above and the various active learning methods identified for this study.

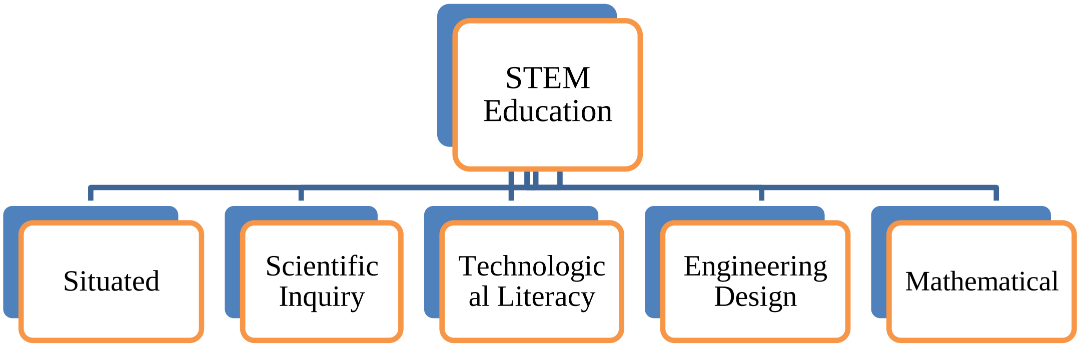

Figure 1: Theoretical Framework of the Study (Kelley & Knowles, 2016)

The goal of STEM education in Ethiopia is to produce engineers and scientists who are capable of transforming and speeding up economic competition in the global economy (MOE, 2020). STEM Education starts from the first level of secondary schools and is taught from grades 9-12. After the students successfully completed grade 8 regional exams, they face stiff competition due to limited STEM access in the region to attain admission to STEM education. Given the potential of STEM education to prepare students to the ever changing landscape of the scientific world, considerable attention for STEM access is vital.

Bahir Dar STEM center is located in Bahir Dar, the capital of Amhara Regional State, Ethiopia. It was established to prepare secondary school students for college and graduate study in the fields of science, technology, engineering, and mathematics (Bahir Dar University, 2014). There were currently 201 high school students in the center .They are selected on competitive basis from all public and private secondary schools. These students were provided with trainings related to STEM laboratory practices, life skills, teamwork, field exercises, games with funny approaches of science, site visits related to STEM like Bahir Dar Maritime Academy and College of Agriculture and Environmental Sciences of Bahir Dar University. In addition to instilling students to have inquisitive mind, fostering their critical skills and collaboration skills, the STEM center also provides different laboratory and project works for grades 9-12 students and summer our-reach training programs for talented students and math camp program (BDU, 2020).

Further, although the need for interdisciplinary collaboration with teachers in integrating STEM subjects is reiterated in the literature (Margot &Kettler, 2019), the national curriculum for STEM education in Ethiopia has been executed in a similar educational pattern to the national curriculum of secondary school science education. To illustrate, it was uncommon for the researcher as an English teacher, for example, to identify cross cutting skills and incorporate them in the classroom to enable students communicate with the scientific community.

Rationale for the study

There are three intertwined justifications for this study. Interdisciplinary philosophy, deep conceptual understanding and skills could be developed through STEM education (Biasutti& El-Deghaidy, 2014). Therefore, the value and impact of STEM education can be fully realized if we first recognize teacher related complex patterns of STEM education as the way in which teachers perceive and implement STEM education in their classes will surely affect STEM delivery (Bell, 2016). Equally important is the necessity of identifying and reducing the depth and breadth of barriers that could hamper the successful implementation of STEM education (Ejiwale, 2013).

While teacher preference for general teaching methods is well-documented,the current corpus of literature on STEM education reveals perplexing misconceptions indicating that there is a paucity of research regarding teacher instructional practices.Thus, constructs emerged from the review of successful STEM practices in the literature reviewed for this study can help educators to systematically conceptualize robust ideas and develop the capabilities of teachers in Ethiopia. So as to effectively implement STEM education in secondary schools, it is also necessary to understand the teachers’ preferred instructional methods and challenges associated with implementing STEM education.This will consolidate our understanding with regard to preparing effective STEM teachers who should be qualified to adapt to an ever changing landscape of teaching sciences in the 21st century.

Understanding instructional methods from the STEM education perspective help educators to design and implement STEM instructional methods appropriate to the educational demands of students and hence strengthen STEM programs.Guided by the following research questions, this study has sought to address the gap in existing literature by examining STEM teachers’ preferred instructional methods and challenges that could hinder the effective implementation of STEM education at Bahir Dar STEM center, Ethiopia.

1. What are the teachers' preferences regarding STEM specific instructional methods?
2. Is there any statistically significant difference among teachers regarding their instructional preferences when they were grouped by their fields?
3. What are the self-reported challenges of STEM teachers?

METHODS

Research Design

This study was conducted to examine the perceived practices and challenges of implementing STEM education at Bahir Dar STEM Incubation center. This study follows an explanatory sequential mixed-method approach. A questionnaire was used to obtain information about the teachers' instructional preferences and challenges of STEM education, and interview was also used to reinforce the data from the questionnaire.

The population and Sample

The population for this study consisted of all STEM teachers at Bahir Dar STEM Incubation Center as listed in the 2021/22 academic year. A total of 36 instructors made up the population. 36instructors who have been assigned to teach STEM classes within their respective subjects: Biology, Chemistry, Mathematics and Physics were taken as the sample for the quantitative part of the study. Furthermore, purposive sample was used to select interviewees for the qualitative part. To illustrate, to obtain data from the survey questionnaire, all STEM instructors who were assigned to teach at the STEM incubation center were invited to participate in this study. Six participants for the interview were purposefully selected to provide additional insights and triangulate the quantitative data (Creswell, 2014).

Research Setting

STEM education system was launched in various regions of the country where students are allowed to join the centers on competitive basis. The students are taught by university instructors. This study was conducted in the context of Ethiopia where STEM education in secondary schools is still immature particularly in the Amhara region where the Bahir Dar STEM Incubation center is located. Biology, Chemistry, Physics and Mathematics were included. With the exception of its location, which is separated from the other secondary schools, no difference was observed as each subject teacher prepared lesson plans and delivered lessons in STEM classrooms individually rather than identifying cross cutting topics and integrating their lessons in collaboration with other STEM educators.

Research Procedures

Informed consent was obtained from candidates to participate in the study. Then, they were asked to freely explain their actual teaching practices.The teachers' survey was sent to a total of 36 STEM teachers who were assigned to teach their respective subjects in eight sections at Bahir Dar STEM Incubation center, which is located in the town of Bahir Dar. Interviews with six participants who were selected purposively from each subject teacher were conducted. Participants were notified about the purpose of the study and the confidentiality of the data. Respondents were asked to complete filling in the survey questionnaire and return it to the researcher within two weeks. Ten days after the follow-up procedure, a telephone call was made every three days as a reminder to ensure the highest possible response rate.

Instruments

The survey questionnaire that was developed by the researcher in light of the related literature reviewed for this study. The questionnaire consists of a- five-point Likert scale asking participants to rate their degree of agreement (from 1 which means strongly disagree to 5 strongly agree). The questionnaire was first pilot tested in one of the STEM centers, which was not included in the main study. Items number 1-20 were developed to examine the preferred instructional methods of teachers, whereas items number 21-27 were constructed to explore the potential challenges that hampered the effective implementation of STEM education in the study site.Instructional methods refer to the general procedures used to implement the teaching plan or strategy to accomplish learning objectives. Upon completion of the quantitative data, the researcher conducted the semi-structured interview to understand the reasons why the teachers rated as the most or least preferred instructional methods and the challenges they faced in implementing STEM education, and hence to provide some additional insight into this study

Data Analysis

This study aimed to understand the current status of STEM education and challenges in implementing STEM education. The data was analyzed through the Statistical Package for the Social Sciences (SPSS). To address these objectives, descriptive statistical methods were used to organize, tabulate, and interpret the questionnaire data.ANOVA was employed to examine if instructional methods varied across subjects. The interview data was transcribed, coded and thematically analyzed to reinforce the quantitative data.

RESULTS

Table 1: *Teachers' Overall Instructional Methods Preferences*

Instructional Methods	Mean	S.D	df	F	Sig
Integration	4.85	.837	3	2.963	.047
Engineering design	2.67	.858	3	1.983	.136
Collaboration	3.47	.567	3	4.405	.011
Total practice	3.67	.621	3	3.822	.019

* S.D: Standard Deviation
* df: Degree of freedom

The descriptive statistics indicated in Table 1 exhibits the overall pattern of instructional methods preferred by the teachers. As it was indicated in Table 1 above, participants exhibited high instructional use in their STEM classrooms (M=3.67). The most preferred instructional method as identified by participants was integration with the mean value of 4.85 and standard deviations of .837, whereas with mean of 2.67, the STEM instructional strategy related to engineering design was the least reported instructional method.

A close scrutiny of the results concerning the sub categories of integration also showed that with a mean value of 4.22, the teachers demonstrated interdisciplinary project-based learning to promote problem solving skills as their most preferred sub-categories.When comparing the STEM teachers' choices across their respective fields, the participants showed significant differences in their overall preferences for all instructional methods at $p<0.05$. The teachers also showed significant differences regarding their preferences for *integration and collaboration* instructional methods respectively at $p<0.05$.

The interview participants also consistently disclosed their favor for inquiry based learning as their most preferred instructional method. One participant stated:

> "*I placed a greater emphasis on inquiry based learning because it fosters students' communication and collaboration skills as it helps student to be exposed to variety of interactions.*"

Another participant stated:

> "*It is necessary to apply inquiry based learning, for I believe that it helps develop my students' creativity and critical skills.*"

Table 2: *Preferred Instructional methods across Discipline*

				95% Confidence Interval for Mean	
	N	Mean	S.D	Lower Bound	Upper Bound
Biology	9	3.71	.511	3.32	4.10
Chemistry	9	3.14	.477	2.77	3.51
Physics	9	3.89	.725	3.34	4.45
Mathematics	9	3.92	.479	3.55	4.29
Total	36	3.67	.621	3.45	3.88

∗ S.D: Standard Deviation

The above table shows STEM teachers' preferences for instructional methods) across subjects (Biology, Chemistry, Physics and Mathematics). Inferring from the data, it is evident that STEM teachers in mathematics with m=3.92; S.D= .479 obtained the highest mean values among the STEM teachers in this study. This can be interpreted that the teachers might have frequently applied the STEM instructional methods (Integration, Engineering design, collaboration) into their actual classrooms.

When the interview participants were asked to explain why they rated engineering design as the least (preferred) instructional method, they described the students' little motivation, affirming the need for student motivation to successfully implement STEM education, one teacher echoed:

> *"We know that engineering design improves students' higher order thinking skills, but I often found it difficult to apply this method as the design processes are too complex for the majority of our students who are demotivated to learn."*

The other emphasized the importance of applying engineering design, but asked that:

> *"How can I usually employ in the absence of instructional materials in the school where it lacks (there is lack of) the basic facilities to develop and implement the inquiry-based method?"*

Table 3 *ANOVA Results*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.563	3	1.1883.822	.019	
Within Groups	9.943	32	.311		
Total	13.506	35			

A one-way ANOVA statistics was carried out to examine if the teachers across discipline categories show statistically significant difference in their overall preference of instructional methods. In analyzing this, the level for significance was set at .05. Normality checks and Levene's test were conducted and the assumptions met. There was a significant difference in mean of instructional use [F (3, 32) =3.822, p = 0.019] among the teachers. This result suggests that teachers' preference for instructional methods significantly differed.

Table 4: *Multiple Comparisons Results*

DISCIPLINE 95% Confidence Interval						
I	J	MD	SD	Sig	Lower Bound	Upper Bound
Biology	Chemistry	.569	.263	.155	-.14	1.28
	Physics	-.186	.263	.893	-.90	.53
	Mathematics	-.212	.263	.851	-.92	.50
Chemistry	Biology	-.569	.263	.155	-1.28	.14
	Physics	-.755*	.263	.034	-1.47	-.04
	Mathematics	-.781*	.263	.027	-1.49	-.07
Physics	Biology	.186	.263	.893	-.53	.90
	Chemistry	.755*	.263	.034	.04	1.47
	Mathematics	-.026	.263	1.000	-.74	.69
Mathematics	Biology	.212	.263	.851	-.50	.92
	Chemistry	.781*	.263	.027	.07	1.49
	Physics	.026	.263	1.000	-.69	.74

* MD: Mean Difference * SE: Standard Error
* *The mean difference is significant at the .05 level.*

So as to further examine which group makes this difference, Post hoc comparisons using the Tukey test was conducted(See the table above)**.**Tukey's HSD Test for multiple comparisons found that the mean value of teachers' preferred instructional methods was significantly different between the groups. Table 3 shows that considerable variability in teachers' preference for instructional methods was observed among teachers who teach different subjects in the STEM incubation center. As it is indicated in the table above, three significant differences were observed between the three pairs of the groups. This difference was attributed to Physics and Chemistry (p=0.034), 95% C.I. = (.04; 1.47) and Mathematics and Chemistry (p= 0.027), 95% C.I. = (.07; 1.49). This suggests that teachers who taught these subjects might have tended to use different instructional methods to meet student needs in their respective subjects.

Key Reported Challenges Facing STEM Education at Bahir Dar STEM Center

Table 5: *STEM Teachers' Reported Challenges*

Items	Frequency	Percent
Lack of motivation of students towards these subjects	32	89
Poor laboratory facilities to handle STEM education	27	75
Lack of instructional materials for the development of inquiry-based method	23	64
Lack of institutional support and collaboration among colleagues	16	44
Time Constraint due to an excessive extension of the curriculum	14	39
Inadequacy of teachers' knowledge for integrating all STEM subjects	11	31
Inadequacy of teachers' knowledge in applying active learning methods	9	25

This research was also designed to investigate challenges impeding the implementation of STEM education at the STEM center. The teachers were asked to select their three major challenges to implement STEM classes. The vast majority of the teachers 89% reported that overall, they faced the strongest challenge in implementing STEM education in relation to lack of motivation of students towards the STEM subjects. The teachers also rated the other top two challenges facing STEM in their center: poor laboratory facilities to handle STEM education (75%) and lack of instructional materials for the inquiry-based method (64%). In contrast, the least challenges described by the participants centered on inadequacy of teachers' knowledge in applying active learning methods in their STEM classrooms (25%).

Concerning key challenges associated with implementing STEM education, the interviewees consistently identified the top two challenges facing the STEM teachers as self-reported in the questionnaire. However, the participants differed in their response to the third major challenge. As one participant mentioned:

> "*Teaching the poorly prepared and motivated students coupled with inadequate facilities of laboratory hindered my facilitation of students' activities in the STEAM center."*

The other participant described:

The limited support from the school system such as internet connection and library hampered my effort to implement STEAM education in my classes.

DISCUSSION

The present research sought to understand the instructional practices of STEM teachers by examining which STEM specific instructional methods they favored most. The results of this study showed that teachers placed integration instructional method to the forefront in their STEM classrooms. The highest ratings of the teachers with respect to their overall preferences for this instructional method might be interpreted as indicating that the teachers were frequently incorporating this instructional method in implementing STEM education in their respective subjects. This result is consistent with recommendations proposed by researchers in the field (Ntemngwa, & Oliver, 2018; Psycharis 2016).

When the sub-categories of integration were further analyzed, the teachers exhibited interdisciplinary project-based and problem solving learning as the highest threshold subcategories of integration instructional method. This result was also reinforced by all the interview participants who specifically mentioned the two sub-categories of integration method as the most favored instructional methods. This view resonates well with the research assertion in that applying inquiry based learning could help students think, hypothesize and carry out scientific investigations (Kelley & Knowles, 2016), and STEM teachers used project-based and problem solving activities in the classroom (Ntemngwa, & Oliver, 2018). Given the role of interactive teaching methods such as inquiry-based learning and project based learning reported in the literature (Rees & Roth, 2019; Soldano&Arzarello), the teachers' considerable attention on these instructional methods seemed to be promising for the success of the STEM education.

On the other hand, this result raised serious questions about the popular instructional method reiterated in the literature as only few participants placed hands-on activities or learning activities as their most preferred instructional method indicating a little teacher support for students in linking observations and experiences to conceptual science ideas. This result was supplemented by the views of interview participants who mentioned the complexity of designing and applying engineering design in the face of demotivated students. Despite this, researchers have suggested engineering design to create opportunity for students and apply science knowledge and inquiry by providing an authentic context for learning mathematical reasoning for informed decisions during the design process(Kelley & Knowles, 2016).

A one-way ANOVA revealed that there was a statistically significant difference in the mean values of teachers' preferred instructional methods across discipline categories. The paired mean comparison results showed significant differences in two paired combinations, namely between Physics and Chemistry and between Mathematics and Chemistry ($p<0.05$) indicating that these teachers varied interdisciplinary practices across departments. This result might have been because although explicitly integrating large amounts of STEM content has been suggested in the literature (Pearson, 2017), teachers needed to support students in more effective ways based on the real context in their specific field and goals.

Participants self-reported the top three challenges associated with implementing STEM education. One of the major barriers that were self-reported by the participants was the lack of motivation of students towards the STEM subjects. However, this might be because students used to spend much of their time in learning the STEM sessions without utilizing appropriate active learning methods (Dare et al., 2018; Ejiwale, 2013; McDonald, 2016). The interview response for key challenges also exhibited complementary result with the self-reported results. Further, engineering design-based science education helps to realize the integration of STEM education into the curriculum (Ayaz&Sarıkaya, 2019). The fact that engaging students through hands on activities was the least instructional method reported by the participants might also contribute to students demotivation.

CONCLUSIONs

Based on the self-reported data of the questionnaire and the interview results of this study, the following conclusions were drawn. The most preferred instructional strategy employed by STEM teachers centered on integrative instruction and interdisciplinary project-based and problem solving learning methods. The participants rated engineering design as the least instructional method, and they scarcely demonstrated hands-on learning opportunities to augment the STEM instruction. There were significant statistical differences among the participant teachers regarding their instructional preferences when they were grouped by their fields.

The results of the present study shed light on the integrative view of STEM education in Ethiopia where the curriculum was primarily designed to prepare secondary school students for competent scientific knowledge in higher education. Therefore, it is possible to suggest that educators should create more opportunities for students to learn best from cross cutting issues by implementing interdisciplinary integration STEM Education. STEM education could improve students' engagement and motivation in science education. Various hands-on work and real world activities are considered the most effective strategies for engaging and motivating students in STEM education (Ejiwale, 2013). Thus, a concerted effort should be made to implement engineering design instructional methods using hands-on activities to enable students learn STEM education meaningfully in a real context.

The participants ranked lack of student motivation, poor laboratory facilities and lack of instructional materials as the top three challenges in the STEM center. The teachers' commitment to STEM integration can only be realized if facilities necessary for the successful implementation of STEM education are properly fulfilled. Unless remedies are made to cope with the existing laboratory problem, this barrier will continue to weaken STEM education implementation (Ejiwale, 2013). It was difficult to increase the curiosity and self-guided inquiries on the part of the learners due to the lack of resourcefulness (Nwanekezi et al., 2010).

Recognizing the underutilized resource of the STEM education, therefore, this study suggests that educational institutions should reinforce the capacity of laboratories with low-cost and easily available materials. They also should periodically supervise, evaluate and support the STEM education center by establishing a strong supervisory link with schools and teachers. This research was not a comprehensive study as it was delimited to examining STEM teachers' preferred instructional methods at one STEM center, and hence cannot be generalized in the context of other STEM centers in Ethiopia. Thus, due to its small sample size, future research should investigate the issue by including other research designs and data gathering tools.

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