library@chuka.ac.ke; www.chuka.ac.ke

EPISTEMOLOGICAL BELIEF IN CONTROL OF KNOWLEDGE AND PERFORMANCE OF PHYSICS AMONG SECONDARY SCHOOLS STUDENTS IN THARAKA NITHI COUNTY, KENYA

John K. Mbaka[1]; Dr. Benjamin M. Kanga[2]; Dr. Ruth M. Mwanzia[3]; Dr. James M. Murungi [3].
1.2.3.4 Chuka University, Kenya.
jkaraurim@gmail.com, bkanga@chuka.ac.ke, jmwenda@chuka.ac.ke

Citation:
Mbaka, J. K., Kanga, B. M., Mwanzia, R. M., & Murungi, J. M. (2024). Epistemological belief in control of knowledge and performance of physics among secondary school students in Tharaka Nithi County, Kenya. In: Mutembei Henry, Nduru Gilbert, Munyiri Shelmith, Gathungu Geofrey, Kiboro Christopher, Otiso Wycliffe, Rithaa Jafford, Miriti Gilbert, Gichumbi Joel, Mwathi David, Gitonga Lucy, Nanua Jackin, Kahindi Roseline, Jonathan Kathenge & Muthui Zipporah (Eds.). *Proceedings of the Chuka University Tenth Annual International Research Conference held in Chuka University, Chuka, Kenya from 5th to 6th October, 2023. 42-46 pp.*

ABSTRACT
The study's aim was to investigate the extent to which students' epistemological beliefs in the dimension of control of knowledge acquisition relates to performance in the subject of physics. The study used a mixed-methods research approach that included philosophical analysis, a descriptive survey and correlational analysis. The research was steered by both the implicit intelligence philosophy, and the constructivist learning theory. The sample size comprised of 310 form two students, 60 physics teachers and 20 heads of science department. Quantitative data analysis techniques, including correlation and regression analysis, were used to examine the relationships between students' epistemological beliefs in control of knowledge and physics performance. The qualitative data from interviews provided deeper insights into how students' experiences and perceptions related to their beliefs about knowledge and physics performance. Data analysis was performed using tools in the SPSS version 26. The study revealed a positive correlation between sophisticated beliefs in control of knowledge acquisition and performance in physics. From the findings of the study, the researcher concluded that sophisticated beliefs in control of knowledge acquisition contributes towards better performance in physics. The study suggests the implementation of strategies aimed at fostering the development and adoption of sophisticated epistemological beliefs in control of knowledge acquisition among students in order to enhance their performance in physics. The outcome of this study can inform educational policymakers, curriculum developers, and teachers in Kenya to design interventions that promote the development of students' epistemological beliefs in control of knowledge to stimulate performance in physics.
Key Terms: epistemological belief, control of knowledge, physics performance, secondary schools.

INTRODUCTION
The immense efforts of improving performance in the sphere of science education is founded on its significance in solving the daily problems faced by humanity and development of nations. In the contemporary society, training of scientific literacy forms part basic of education in learning institutions. In USA and Europe Physics community for a long time has been focusing on ways of improving teaching, learning and consequently performance of physics (Meltzer & Otero, 2014). Academic physicists' in these developed countries of the world recommends student centered approaches as part of the strategies of improving performance of physics (Calmer, 2019). However, physics overall average points for students in remains below

500 center points for TIMSS advanced scale (Provasnik & Malley, 2019). This is in spite of the enormous resources allocation for the implementation of strategies and recommendations intended to improve the performance physics among the students. This being the case, it can be inferred that there exist other aspects that influence students' performance in physics even in the developed countries besides those already espoused by scientific studies. Developing countries like South Africa, Rwada and Tanzania have adopted constructivist and interactive instructional practices like inquiry-based learning and problem solving to enhance the caliber, attitude, and performance of physics (Tambwe, 2017: Benek & Akcay, 2019: Mbonyiryivuze, Yadav, & Amadalo, 2021). In spite of prospected benefits and projections of constructivist leaning in improving performance of science subjects, physics education in developing countries schools continue to attract low students enrolment, poor performance in addition to dismissive mindset by learners

In Kenya, the enrolment and performance physics at various levels of education is low (Murei, 2016). Students also hold a belief that Physics comprises of difficult tasks that are abstract and theoretical, the subject is boring and lacks employable opportunities (Muchai, 2016). This is in spite of publicizing the immense benefits of physics and robust studies based on the ideas of pragmatic epistemology and its ability to improve performance of physics. Studies in physics learning in Kenya have revealed that there is an increasing student's apathy towards sciences (Calmer, 2019; KICD, 2016). Students see physics as boring and uninspiring. This has resulted in continued deprived enrolment, inadequate scientific inquiry skills, negative attitude and poor academic performance in physics (MOEST-Kenya, 2015). For instant, the overall mean points of physics in KCSE from the year 2017-2020 was 34.73% out of the maximum score of 100%. Despite the fact that in the majority of schools, only high-achieving students choose to study physics as an elective subject for the KCSE, performance of physics remains poor. Within Tharaka-Nithi County, the overall performance of physics at KCSE is below that of National level. This is as shown by information in Table 1.

~~Year~~	~~Total KCSE Candidates~~	~~KCSE Physics~~ Candidates	KCSE Physics Average marks (%)
2018	15,980	3145 (19.68%)	26.80%
2019	16,899	3567 (21.10%)	23.11%
2020	17,603	3884 (22.06%)	24.43%
2021	18,999	4325 (22.76%)	25.50%
Overall	18,225	3,932 (21.49%)	25.71%

Table 18: Tharaka-Nithi County KCSE Physics Analysis from 2017 to 2021 Source: Tharaka-Nithi County Education Office (2021)

According to the data presented in Table 1, it can be observed that the collective academic performance and participation rate of students who study physics at KCSE stood at 21.49% and 25.71% respectively. The performance alongside the enrollment of Physics candidates in KCSE deviates significantly from the typical score of 50%. Low enrolment and the dismal performance of Physics in Tharaka-Nithi County essentially is below the national statistics. The dismal performance is despite the persistence use of strategies recommended by CEMESTEA (2014) such as laboratory scientific inquiry, experimentation and project work that are perceived to promote physics efficacy. This suggests that merely involving students in commonly employed scientific inquiry methods may not be enough to foster the growth of their learning and comprehension of physics concepts. Conceptualizing and interpreting epistemological concerns into realities can form a foundation for effective learning and improved academic performance. Therefore, the relation interactions amid epistemological perceptions of individual student and efficacy in physics were examined. Studies on the connections amid epistemological and gaining knowledge in sciences have not received much research attention within Tharaka-Nithi County

Epistemology, as a philosophical field, delves into inquiries regarding characteristics of knowledge, knowledge backgrounds or sources, knowledge acquiring workflow, structure and boundaries of knowledge, and related philosophical questions (Hofer, 2004; Barzilai & Zohar, 2014). Epistemological beliefs are personal ideas or assumptions that people have concerning epistemologies of learning (Hofer & Pintrich, 1997; Velasquez, 2005). These beliefs encompass the perspectives held by individuals regarding the characteristics of knowledge, the system of acquiring knowledge, and the reasoning behind knowledge justification. According to Kumar and Sumanta (2018) epistemological belief is a psycho-philosophical theory related to learner's conviction about acquiring knowledge. Within the field of education, epistemological beliefs pertain to

the ways in which students acquire knowledge, the philosophies and principles they embrace regarding knowledge acquisition, and the ways in which these epistemological principles shape an individual's intellectual development (Barzilai & Zohar, 2014). According to Ahluwalia and Sharma (2013) epistemological beliefs evokes questions such as how one come to know, how new knowledge is created, how inferences are drawn and how one makes sense as pertaining knowledge. Epistemological beliefs could rationally be described as application of epistemology on an individual level. Scientific epistemological outlook might be perceived to be perceptions held concerning scientific awareness characteristics and preogression of acquiring scientific knowledge. As stated by Yenice (2015) the epistemological belief concerning features and foundations of scientific acquaintance is connected on individuals' personal philosophical perspectives in context of scientific expedition.

Aspects of knowledge control presents a system of belief that ranges from a belief that learning capacity is a set of established talent at birth to learning is accomplished through experiences (Arlindo, 2006). Under this dimension, individuals with naive views believe learning is an innate skill that remains consistent with time (Florian et al., 2017). Those who possess advanced beliefs about control of acquiring knowledge consider that ability to learn is acquired from the learning environment and it can be improved and refined with time and experience (Kumar & Sumanta, 2018). Researchers have analyzed the connection between the convictions held by students and academic performance (Arlindo, 2006; Arslan et al., 2015; Barger et al., 2018). In accordance with Hofer (2010) individuals who hold position knowledge is predetermined and unwavering, most likely approach education in a very different way than someone who views knowledge as uncertain, developing, and built by the learner. Yusuf (2017) posited when an individual holds the belief that they do not possess an inherent capacity for learning, could experience a sense of despair when confronted with challenging academic assignments. Conversely, whereas students' holds notion that their learning capacity is something that can be improved, they tend to exert additional effort, experiment with various study techniques, and adopt a resolute attitude to overcome challenging learning tasks.

An inquiry conducted by Barger et al. (2018) surveyed concepts of constructivism alongside the growth of personal epistemology among college-level students in the United States. The results of their investigation unveiled that individual perspectives on how knowledge is acquired have a crucial part to play in an educational setting that promotes constructivist learning and performance in chemistry. The results of their research also suggested that there is a difficulty of changing student's epistemological beliefs over single-semester classroom intervention. Students whose epistemological beliefs matched instructional context were found to perform better in their final exam. Andrea, Maria and Mikael (2021) conducted a study on students' ideologies about cognition and training in Sweden and Germany, and explored the relationship between these beliefs and their classroom environments. The comparison of multiple groups' unveiled variations in the students' convictions regarding control of how knowledge is acquired, as well as the characteristics of their classrooms. In addition, regression analysis revealed that classroom characteristics significantly predicted epistemic beliefs of students on justification for knowledge and progress pattern differed amongst nations. Sharma et al. (2013) explored students' epistemological beliefs, their expectations, and their physics learning in India. The observations of the scrutiny unveiled that there existed need to put in place strategies that take into account the influence of learners' opinions, perspectives, and expectations. upon entering the classroom to enhance their performance. In addition, the study revealed that epistemological beliefs might influence students' motivation and performance in physics. However, studies by Andrea et al. (2021) and Sharma et al. (2013) did not factor in the association amid control of acquisition of knowledge and performance in physics. The current study investigated relationship between control of acquisition of knowledge and physics performance amid secondary school's students in Tharaka-Nithi County, Kenya.

In another study, Bodin and Winberg (2012) examined how beliefs and emotions influences the strategies of solving numerical problems in the realm of studying physics in Sweden. Their study's results indicated a limited connection between students' beliefs about knowledge and their objectives for achievement. The exploration also divulged that naive cognitive beliefs about knowing negatively affected students' performance. The study findings also uncovered the significance of epistemological beliefs in determining students' prowess to familiarize oneself with pragmatic solution-seeking situation. However, the study did not feature the aspects of epistemological beliefs and performance of physics among secondary school's students. The present research explored the correlation between students' beliefs regarding their control over knowledge acquisition and their physics performance. In Turkey, Ozlem (2015) conducted a study examining the epistemological beliefs, learning conceptions and personal effectiveness in relation to science education. Study's findings showed a correlation between students' epistemological views and their performance in biology that was satisfactory. The study further revealed that

epistemological beliefs about justification positively related to the students' belief in their own ability to learn biology. In another study, Sen et al. (2014) investigated relations between students' performance, motivation and the connections between educational approaches and fundamental beliefs about knowledge acquisition in Turkey. The study established there was an indomitable link between individual's performance and the belief that learning relies on effort. However, the studies in Tu rkey investigated in general epistemological beliefs under unspecified learning context. The current study examined relationship intermediary to epistemological beliefs within control of acquisition of knowledge and performance of physics amongst secondary school students.

Exploratory study in South Africa by Rudolf (2017) revealed that students have unique individual epistemological beliefs in the method used in erudition of physics principles. The studies on epistemological convictions carried on learning of physics might be an essential resource that can be used to appraise impacts of epistemological beliefs on the performance of physics. In a preliminary investigation with Mozambican high school students, Arlindo (2006) noted that epistemological beliefs did not directly influence students' academic performance in sciences. Paradoxically, less sophisticated beliefs appeared to exhibit an optimistic learning outcome amongst the Mozambican learners. This contradicts the theory that, holding naive beliefs about knowledge can result in poor performance, as these beliefs may encourage proactive approach to learning. Philosophy of science highlights that learning of physics is an active and interactive mechanism that requires efforts to nurture meaningful learning and a profound conceptual understanding (Shin, 2015). The control of knowledge dimension acknowledges that learning is flexible and evolving, challenging the notion that learning is fixed and inherent from birth (Basturk, 2016). Studies in various dimensions addressing the attitudes and epistemic convictions of beginners and experts have received a lot of attention by Physics education researchers (Bay, Vural, Demir and Bagceci, 2015). Investigations have also been carried out to reveal the possible link between the study habits of students and their epistemological convictions (Sapna et al., 2013; Dehui & Zwickl, 2018). However, the concept of relationship between epistemological belief in control of attaining knowledge and performance of physics has not received attention by physics education researchers. In this study, the researcher investigated the relationship between beliefs in control of acquiring knowledge and performance in physics. According to Blazer (2011) students who maintain the conviction that the capacity to acquire knowledge is experiential significantly outperform their counterparts who hold that learning ability is predetermined and innate.

In a study conducted by Dehui and Zwickl (2018), students engaged in traditional cookbook-guided laboratory instruction demonstrated a naive belief that the workflow of acquiring knowledge is dependent on innate ability. However, previous studies on epistemological beliefs mostly focus on student behavior within a learning context or rely on surveys and interviews conducted separately from actual learning situations. Furthermore, there is a lack of widespread utilization of inferential statistics to give a thorough analysis about correlation amidst epistemological notions and physics in performance. This study aimed to gather authentic insights from secondary school students about their beliefs concerning the interdependence of control of knowledge acquisition and performance in physics. The analysis used surveys and correlations to gather data and employed inferential statistics to understand the correlation between beliefs about knowledge acquisition control and physics performance among secondary school students.

Studies have accumulated evidences supporting the ideas of the roles played by students' epistemological beliefs in their learning (Florian, Katharina, & Janes, 2017; Yuan-Hsuan, 2018). Research dwelling on how epistemological perspectives dictate learning in the context of science education are becoming more popular. Within a particular domain like physics, students' epistemological beliefs can be associated with both their choice to participate in physics education and the ultimate outcome of their learning. Students in Tharaka-Nithi County's secondary schools consistently demonstrate poor performance in physics. This could partially be attributed to the epistemological viewpoints held by the students regarding physics knowledge. The current investigation examined relationship between beliefs in the control of knowledge acquisition and performance of physics amongst secondary schools' students in Tharaka Nithi County, Kenya.

METHODOLOGY

This study used a mixed-methods research approach that included descriptive survey and correlational analysis. The choice of a descriptive survey methodology was adequate for this study due to its suitability in enabling collection of quantitative data from closed ended items for descriptive analysis. Correlational research design was employed to assess the level of association between epistemological beliefs and physics performance. The sample size determination followed the formula proposed by Israel (2013).

$$n = \frac{N}{1 + N(e)2} = \frac{15413}{1 + 15413(0.05)2} = 390$$

The schools were categorized into national, extra-county, county, and sub-county classifications from where samples were to be taken. A proportionate sample was used to get 20 public secondary schools and 310 students in each of the school categories. Purposive sampling was used to select 60 physics teachers and 20 heads of science department. The investigator adopted drop-pick method as a means of distributing and collecting questionnaires from the participants. Heads of science departments of sampled schools were interviewed. Eight students in each school participated in the focus group discussion. The coded data was fed into a computer for analysis utilizing Statistical Package for Social Sciences (SPSS) version 26. The qualitative data collected from the interview schedule and students' focus group interviews was analyzed using thematic approach. Measures of central trends, such as mean, standard deviation, and coefficient of variation, were used in descriptive statistics to examine quantitative data. Spearman's rho correlation (r) was employed to determine the magnitude and direction of the relationship between the variables examined in the study.

RESULTS Students Responses on Naive Beliefs in Control of Knowledge

The participants were tasked with specifying their depth of consensus with several affirmations, which measured naive principles regarding control of knowledge acquisition and its connection to physics performance. The findings are displayed in Table 2.

Table 19: Descriptive of Students' Naive Beliefs in Control of Knowledge

Statement	N	M	S.E	S.D
I believe that only certain students get good grades in physics exam	304	3.52	0.071	1.243
I think that some students are just good in physics experiments	304	3.95	0.058	1.012
I am sure that there are some students who just understand physics while others do not	304	4.08	0.052	0.901
I feel that how well you do in physics depends on how clever you are	304	3.65	0.066	1.150
I think that some students are just good in solving physics problems	304	3.86	0.058	1.017
Overall Mean Score	304	3.81	0.061	1.065

Information in Table 2 show that respondents agreed that only certain students get good grades in physics examinations (M=3.25, S.D= 1.243). Probing during the focus group discussion, generated the following themes on the item that only certain students can get good grades in physics.Certain students get better grades in physics exams because of their natural ability to grasp scientific concepts quickly. While effort and study play a role, some individuals have a natural liking and abilities for the subject that makes it easier for them to understand and excel in the subject.

Respondents strongly agreed (M=4.08, S.D= 0.901) that that there are some students who just understand physics while others do not. These findings present that the majority of participants believed that students who are perceived to be brilliant in physics were likely to pass physics examinations. Respondents also agreed that some students are just good doing in physics experiments (M=3.95, S.D= 1.012). They agreed on the suggestion that some students are just good in solving physics problems (3.86, S.D= 1.017) and that how well you do in physics depends on how clever one is (3.65, S.D= 1.150). These findings imply that most of the respondent belief that there is a cream of students with some sort of natural ability to learn and comprehend physics. Probing of students in focus group discussions on beliefs that some students were better in solving problems as well as carrying out physics experiments, the following themes emerged:

Some students believe that certain individuals possess a natural aptitude for physics problem solving and experimentation. They perceive these students as having an inherent ability to understand and apply concepts more effectively resulting in better performance in problem solving tasks and experiments.

According to the research results presented in Table 2, it is noticeable that the intermediate score for five specific measures of uninformed beliefs related to controlling the acquisition of knowledge was 3.81, with a standard deviance of 1.243. This suggests that vast of students hold naive beliefs of control of knowledge acquisition in relation to performance of physics that performance of physics was pegged on innate ability of individual student rather than experience.

Students Responses on Sophisticated Belief in Control of Knowledge

Information was sought on sophisticated epistemological beliefs in control of knowledge acquisition. Analysis of the respondents' opinion on sophisticated beliefs in control of knowledge acquisition is presented using Mean, standard deviations and standard errors on Table 3.

Table 20: Descriptive of Students Responses on Sophisticated Beliefs in Control of Knowledge

Statement	N	Mean	S.D	S.E
I am sure that success in physics has no relationship to brightness of a student	304	2.41		0.077
I admit that any student can be good in doing physics experiment	304	2.65		0.075
I believe that any student has potential of getting good grades in physics	304	2.07		0.073
I am sure that it is possible to learn how to improve grades in physics exams	304	1.97		0.061
I am sure that it is possible to learn how to improve grades in physics exams	304	2.08		0.071
I believe that everyone has a potential of contributing ideas in a physics lesson	304	2.41		0.077
Overall Mean Score	**304**	**2.27**		**0.072**

The results presented in Table 3 demonstrate that the participants held a contrary opinion, expressing their disagreement that it was possible to learn how to improve grades in physics exams (Mean = 1.97, SD = 1.349, S.E = 0.077) and that any student has potential of getting good grades in physics Respondents disagreed (Mean = 1.97, SD = 1.349, S.E = 0.077). This implies that the respondents generally held a trust that good performance for only selected individuals who are deemed as bright and talented in physics. The respondents also disagreed that that success in physics has no relationship to brightness of a student (Mean = 2.41, S.D = 1.349, S.E = 0.077) and that any student can be good in doing physics experiment (Mean = 2.65, S.D = 1.309, S.E = .075). Upon probing students' reasons for their belief that not all other students possess the same level of ability carry out experiments and solve problems in physics generated the following themes.It is true that not all students are equally good at solving physics practical problems. Some students seem to have a natural ability for it, while others struggle.

Information on Table 3 indicate an overall mean score (Mean = 2.27, S.D = 1.263 S.E = 0.072) for the parameters used to measure the level of sophisticated believes in the control over knowledge procurement. The statements used to assess the students' agreement regarding their regulation of ideologies about regulation of knowledge accession were phrased in a negative manner. The overall mean scores imply that majority of respondents agreed that student's capacity to learn physics depends on individuals' natural ability.

Teachers Responses on Students Naive Beliefs in Control of Knowledge

A thorough examination was conducted to produce statistical data regarding the average, variability, and uncertainty of the teachers' feedback on students' misconceptions about controlling knowledge acquisition. The findings are presented in Table 4.

Table 21: Teachers Responses on Naive Beliefs in Control of Knowledge

Statement	N	M	S.D	S.E
Students admit that only certain students can get good grades in physics exams	60	3.28	1.263	0.163
Students think that some students are just good in physics	60	3.75	1.083	0.140
Students are sure that some students who just understand physics while others do not	60	4.05	1.064	0.137
Students feel that how well a students' performs in physics	60	3.45	1.171	0.151

depends on their natural ability	1			
Students admit that some of their classmates are just good in solving problems in physics	60	4.02	1.017	0.13
Overall Mean Score	**60**	**3.71**	**1.120**	**0.14**

4

The ramifications presented in Table 4 advance that participants acknowledged, only specific students are capable of achieving high grades in physics exams (mean = 3.28, standard deviation = 1.263, standard error = 0.163). The respondents also agreed strongly agreed (M= 4.05, S.D = 1.064, S.E = 0.137) that students are sure that there are some students who just understand physics while others do not. These findings imply that that preponderance of students opined that good performance of physics was a preserve of few individuals who were perceived to possess special academic talents and gifts that are inborn. Information in Tale 4 convey that the participants agreed that students believe that only some of their classmates are just good in solving problems in physics (M= 4.02, S.D = 1.017, S.E = 0.131). This finding implies that students' teachers find that during problem solving, majority of the students believe that perfection in solving problems in physics requires some natural endowment that are inborn. These findings illustrate that students held a naive believe that problem solving skills in physics depends individual innate ability.

In conformity with the data presented in Table 4, the average tally of the chosen statements assessing students' naive epistemological beliefs regarding control of knowledge acquisition was found to be 3.71. The standard deviation of the scores was 1.120, and standard error was 0.144. This implies that the participants agreed that students in Tharaka Nithi County had a simplistic belief regarding their ability to control the acquisition of knowledge, specifically in relation to their performance in physics. This data suggests that bulk of students thought their ability to perform in physics was a fixed gift given from birth.

Teachers Responses on Sophisticated Beliefs in Control of Knowledge

Information on students' naive epistemological assumptions regarding control over knowledge acquisition was obtained from the teachers in this study. Their response frequency is depicted in Table 5.

Table 22: Teachers Opinions on Sophisticated Beliefs in Control of Knowledge

Statement	N	Mean	S.D	S.E
Students admit that any student can be good in doing physics experiment	60	2.62	1.379	0.178
Student belief that any student has potential of learning physics	60	2.73	1.351	0.174
Students are sure that success in physics has no relationship to student's special talent	60	2.25	1.348	0.174
Students are certain that it is possible to learn how to improve grades in physics exams	60	2.17	1.167	0.151
Students are confident that everyone has a potential of contributing ideas in a physics lesson	60	2.17	1.342	0.173
Overall Mean Score	60	2.39	1.317	0.170

The analysis highlighted in Table 5 illustrate that those who were surveyed were neutral that students admit that any student can be good in doing physics experiment (M = 2.62, SD = 1.379, S.E = 0.178). During interviews with the HODs on whether students believed that 'any student can be good in doing physics experiment' the following responses:I am neutral on whether students' belief that anyone of them can be good at doing physics experiments because I believe it depends on various factors. Some students' exhibit a notion that if they get proper guidance and practice, they can improve their skills in physics experiments.

The respondents disagreed that students were sure that success in physics has no relationship to student's special talent (Mean = 2.25, S.D = 1.348, S.E = 0.174) and that students were certain that it is possible to learn how to improve grades in physics exams (Mean = 2.17, S.D = 1.167, S.E = 0.151). During interviews with the HODs on whether students believed that 'any student can be good in doing physics experiment' the following responses:I think most of the students' belief that there is a

strong connection between inborn cognitive aptitudes and their performance in physics. Majority of students' hold believe that some individuals naturally possess the ability to think abstractly and make connection between theoretical concepts. The findings showcased in Table 5 illustrate average mark of the phrases utilized to assess the level of advanced beliefs in controlling knowledge acquisition and physics achievement among high school students in Tharaka-Nithi County. The average score was 2.39, with a standard deviation of 1.317 and standard error = 0.170. The average scores in general illustrate that the bulk of the physics teachers fathomed believed that students did not possess advanced beliefs regarding control of the process of acquiring knowledge in relation to their performance in physics. Additionally, the research conducted interviews with Heads of Science Departments (HODs) to gather their perspective on students' perceptions regarding the connection between physics performance and inherent special talents. Most of the HODs argued that students generally believe that some students are born with special competencies and talents that was directly related to success in physics.

Correlation of Control of Knowledge and Performance of Physics

The motive of this study was to analyze how beliefs of secondary school students in Tharaka-Nithi County regarding their control over knowledge acquisition affected their performance in physics. The researchers used Spearman's correlation to explore the connections between naive beliefs, sophisticated beliefs, and physics performance. The specific correlation outcomes can be found in Table 6.

Table 23: Correlation of Control of Knowledge and Performance of Physics

		Performance of physics	Naive Belief in Control of Knowledge	Sophisticated Belief of Control of Knowledge
Performance of Physics	Spearman's rho	1		
	Sig. (2-tailed)			
	N	304		
Naive Belief in Control of Knowledge	Spearman's rho	0.071	1	
	Sig. (2-tailed)	0.217		
	N	304	304	
Sophisticated Belief Control of Knowledge	Spearman's rho	0.246**	0.057	1
	Sig. (2-tailed)	0.000	0.318	
	N	304	304	304

** *Correlation is significant at the 0.01 level (2-tailed).*

The findings, displayed in Table 6, suggest that there exists minimal and inconclusive connection intermediary to measures of naive belief in control of knowledge acquisition and physics performance. The correlation observed is weakly positive (r = 0.071) but lacks statistical significance (p-value = 0.127 > 0.01). The implication of the weakly positive correlation (r = 0.071) that lacks statistical significance (p-value = 0.127 > 0.01) on the performance of physics is that there is a slight association between the two variables, but it is not strong enough to confidently conclude that the correlation is meaningful or significant. This demonstrates that an increase in naive belief in control of knowledge acquisition would result in a minimal or insignificant improvement in performance. Therefore, based on these results, it is not appropriate to conclude that there is a significant impact of naive belief in regulation of acquiring knowledge on performance of physics.

The findings in Table 6 also suggest that there is a modest yet statistically meaningful relationship between measures of sophisticated convictions of control of knowledge acquisition, and the performance in physics (r = 0.246, p-value = 0.000 < 0.01). The correlation coefficient (r) of 0.246 suggests a positive relationship between these factors, indicating that as the convictions of control of knowledge acquisition become more sophisticated, there tends to be an increase in physics performance. The low p-value of 0.000 (< 0.01) further supports the significance of this relationship. The results of a correlation analysis show that students who have sophisticated ideas about the factors influencing knowledge acquisition score

better in physics than their peers who have simplistic beliefs about how people learn new things, that is whether they learn through experience or not. The positive correlation between a sophisticated belief in control of knowledge acquisition and performance in physics implies that students who believe that knowledge of physics does not depend on inborn capability have control over their own learning process. These students are likely to perform well in physics than those who believe that only students born with unique skills could learn physics.

Regression Analysis and Hypothesis Testing

The objective of the study was to investigate association between beliefs in control of knowledge acquisition and the performance of physics. The study assessed whether collected data adhered to the assumptions of ordinal regression, by running a parallel lines assessment. Based on findings of Alexopoulos (2010) if the parallel lines test yielded non- remarkable results, it would manifest that the model satisfied the assumptions of ordinal regression, leading to acceptance of equality hypothesis. The null hypothesis postulated that location parameters for criterion and predictor variable were identical across response categories. The output of this analysis were presented in Table 7.

Table 24: Control of Knowledge Test of Parallel Lines

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	435.837			
General	429.481	6.355	6	0.385

Link function: Logit.

The data presented in Table 7 support the acceptance of the null hypothesis, as indicated by the p-value of 0.385 surpassing critical value of 0.05. This advances that likelihood of epistemological beliefs in control of knowledge acquisition falling into different performance categories in physics is equal across all response categories. It implies that the effects of these beliefs on performance levels in physics are consistent, making the data suitable for ordinal logistic analysis. For the tenacity of evaluating potency of relationship relationships between the variables under investigation, the subsequent hypothesis underwent examination.

There is no statistically significant relationship between beliefs in control of knowledge acquisition and performance of physics among secondary schools' students in Tharaka-Nithi County

A non-parametric nominal regression analysis was conducted to scrutinize the supposition due to the ordinal nature of the collected data, which did not follow a normal distribution. The nominal regression analysis was executed with a 95% confidence interval ($\alpha = 0.05$). The study examined the relationship between naive beliefs in the control of knowledge acquisition, sophisticated opinions in control of knowledge acquisition, and the performance of physics. Various measures were harnessed to gauge the inclusive significance and entity essence of regression modeling technique. They include model fitting information, goodness-of-fit, pseudo R-square, and parameter estimates. Goodness-of-fit information was examined to determine if the model adequately described the data obtained in the study. This information included the Deviance and Pearson Chi-Square tests, which are useful for evaluating the adequacy of the model. According to Vakhitova and Alston-Knox (2018), significant test outputs for the model fitting data indicate a well-matched integration of the model and the information provided. The statistics related to the model fitting information can be found in Table 8.

Table 25: Control of Knowledge Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	184.281			
Final	166.373	17.908	2	0.000

Link fuction: Logit.

Table 8 displays the values that correspond to the -2 log likelihood for two models: the null model, which only includes an intercept, and the final model, which includes all predictors. The outputs in Table 22 indicate a substantial augmenting the final model's coherence when compared to the null model [$\chi^2(2) = 17.908$, p-value = $0.000 < 0.05$]. This suggests that final

model provides a significantly better explanation or prediction compared to the null model. The chi-square test statistic of 17.908 with 2 degrees of freedom and a p-value of 0.000 affords formidable substantiation rebuff the null hypothesis. Thus, the ultimate model presents a markedly superior fit to the data than the null model

The investigation determined the alignment of the actual data with model that was created. This was done by conducting a test to evaluate the goodness of fit. The test involved using Pearson's chi-square statistic and the chi- square statistic based on the deviance. The statistics offer valuable insights in determining whether the acquired data is in line with the optimized model. The yield of the Goodness-of-Fit test for control of knowledge acquisition and performance of physics can be found in Table 9.

Table 26: Goodness-of-Fit for the Control of Knowledge Acquisition

Chi-Square	df	Sig.
Pearson	41.779	56	0.921
Deviance	42.023	56	0.917

Link function: Logit.

Table 9 presents valuable information regarding the Deviance and Pearson chi-square assessments, which are instrumental for assessing the adequacy of a model fit to the data. The findings in Table 30 indicate Pearson chi-square test [$\chi^2(56)= 41.779$, p-value = 0.921>0.05] and the deviance test [$\chi^2(56)= 42.023$, p-value = 0.917 > 0.05] did not reach statistical significance. The implication of Pearson chi-square assessments and the deviance test is non-existence of pronounced evidence to reject the null hypothesis. To clarify, the outcome suggests that the model being tested exhibits adequate appropriate alignment with data. The p-values, which are outstripping the predetermined level of significance of 0.05, display that the observed differences between predictable and detected standards are likely due to random chance rather than any systematic deviation. According to Field (2018) inconsequential assay outcomes are pointers that the model precisely captures the data. Therefore, the representation's conformity to the data affords the flexibility of being considered acceptable based on these assessments.

To examine how much of the disparity in physics performance can be vindicated by beliefs in control of knowledge (naive and sophisticated), a regression analysis was conducted. Kutty (2021) stated that in logistic regression models, pseudo-Rsquared statistics are used to fulfill a similar role as the coefficient of determination in linear regression. Pseudo R-Square values generated were presented in Table 10.

Table 27: Pseudo R-Square for Beliefs in Control of Knowledge

Parameter Measure	**Pseudo R-square**
Cox and Snell	0.363
Nagelkerke	0.364
McFadden	0.075

Link function: Logit.

The data presented in Table 10 displays the Pseudo R-square values for Cox and Snell method (0.363), Nagelkerke method (0.364), and McFadden method (0.075). These values indicate span of the alternation in outcome variable can be justified by the model. Based on Nagelkerke Method, the Pseudo R-square value of 0.364 indicates that about 36.4% of the inconsistency in physics performance is susceptible to convictions regarding control of knowledge acquisition using this method. Similar to the Cox and Snell method, the remaining variation is influenced by other factors. In contrast, the Pseudo R-square value of 0.075 obtained from the McFadden Method suggests that only 7.5% of diversity in physics performance can be rationalized by beliefs in the control of knowledge acquisition according to this method. Overall, these findings reflect that while beliefs in the control of knowledge acquisition have some explanatory power for physics performance, they only account for a relatively small portion of the total variation. Factors beyond the scope of the model exert a significant influence on determining physics performance.

The research strived to ascertain the weight and impact of specific variables in the mode by utilizing parameter estimates statistics. These estimates indicate the likelihood of a case falling into a specific category on the dependent variable, either above or below. The parameter estimates obtained were then displayed in Table 11.

Table 28: Parameter Estimates of Control of Knowledge

		B	SE	Wald	df	Sig.	Exp(B)
Threshold	[Performance = 1]	-1.288	0.616	4.372	1	0.037	0.276
	[Performance = 2]	0.703	-0.353	0.611	0.334	1	0.563
Location	Naive belief in control knowledge	0.854	-0.158	0.132	1.443	1	0.230
	Sophisticated belief in control knowledge	0.226	0.086	6.932	1	0.008	1.254

Link function: Logit.

According to data in Table 11, sophisticated epistemological views depicted substantial predictability of physics knowledge acquisition (B = 0.226, SE = 0.086, p-value = 0.008 < 0.05). As the level of sophisticated epistemological views increases, there is a predicted increase in knowledge acquisition. Additionally, the standard error (SE) of 0.086 provides an estimate of the precision of the coefficient, indicating the variability around the estimated effect size. Furthermore, the p-value of 0.008, suggests that interaction within sophisticated epistemological views and knowledge acquisition is statistically significant. In other words, likelihood of obtaining such a relationship due to random chance is very low. These findings suggest that sophisticated epistemological views significantly predict knowledge acquisition. Students with augmented sophisticated views are susceptible to demonstrate higher levels of knowledge acquisition compared to those with less sophisticated views.

The study did not find naive epistemological beliefs in the control of knowledge acquisition to be a significant positive antecedent to performance in physics (B = -0.158, SE = 0.132, p-value = 0.230 > 0.05). The parameter estimate (B) of -0.158 suggests that there is a negative relationship between naive epistemological beliefs in controlling knowledge acquisition and performance in physics. However, since the value is negative, it implies that an increase in naive beliefs is associated with a decrease in physics performance. The p-value of 0.230 is greater than the significance level of 0.05, which means that the relationship between naive epistemological beliefs and physics performance is not statistically significant. In other words, the observed association is likely to have occurred by chance. These findings suggest that naive epistemological beliefs in the control of knowledge acquisition do not have a significant positive impact on performance in physics. It implies that students with naive beliefs may not necessarily perform better in physics compared to those with different beliefs.

DISCUSSION

The finding of both quantitative and qualitative data present that students' disagreed that not any student can be able to solve and carry out physics experiment. These findings imply that students believed that innate ability was key to success in physics experiments and problem solving skills. Andrea (2021) found that believing innate ability is crucial in carrying out experiments and solving problems in physics might inculcate a fear of failure in students. This fear might limit student's readiness learn physics which can hinder their overall growth in knowledge and performance. The students may also avoid challenging physics problems or experimental tasks because they fear not measuring up to their peers who are perceived as naturally talented. This might lead to lack of inclusivity of all cadres of students in the events of learning physics that can be part of the reasons for poor performance. The aforementioned themes reflect the viewpoints of the cross-examined students who expressed their agreement with the assertion that some students are better in solving problems and carrying out physics experiments. These findings imply that the respondents held a belief that some students were naturally talented and therefore, they had superior capacities of learning physics compared to others. This finding can adversely influence the performance of physics because students who consider themselves lacking the inborn ability to understanding and solving physics related problem are likely to give up in learning the subject. Reddy (2020) noted that students who come into a physics course with a belief that only the gifted students are capable of problem solving were liable to perform poorer that their colleague who think that learning happens gradually.

Results of the study revealed that students had a belief that problem solving in physics depends on inherent capabilities. Problem solving in physics entails application of several methods of analyzing a problem and devise clarification. To accomplish objective of physics problem solving, students ought to perceive learning as process that takes place gradually, requires effort rather than innate potentiality. Believe than students who are gifted would perform better in physics problem solving is an indicator that there were deficiencies in problem solving skills among students. This finding agrees with that of Blazer (2011) indicated that students who maintain the conviction that learning ability is inherent performed poorly than their

counterparts who hold that ability was gradual and experiential. Oktay and Oktay (2021) observed that student's appreciation and understanding that problem solving was not reliant on individual student's innate ability had a prominent part in improving performance of physics. The belief that ability to solve physics problems depends on inborn mental capability could be part of motives for the unsuccessful performance of physics.

The findings from the focus group discussion are in line with the quantitative data on whether students believed that it is only some students who can get good grades in physics. Both the quantitative and qualitative data implies that the respondents held a belief that some students were naturally talented and therefore, they had superior capacities of getting good grades in physics compared to others. These results concur with findings by Oguzhan and Oktay (2021) that high school students' believed that inborn intelligence was essential in learning physics. In contrast, the study conducted by Arslantas (2016) revealed that students with belief that their acumen for learning was predetermined faced challenges in understanding physics texts and implementing effective self-regulated learning methods. This suggests that students who think that their capacity to grasp physics is solely based on innate abilities could experience lower academic performance in this particular subject. In Tharaka Nithi County, majority of the students believe that innate ability was essential component of learning physics. This could be part of what lead to the poor performance witnessed among the students.

Further probing of HODs revealed that students held deterministic views that success in physics was based on what you are born with and no more. There was a notion that individual intelligence was not akin to a skill that could be refined by zeal. The respondent in addition strongly opposed the idea that students' view that success in physics has no relationship to student's special talent. This assertion display that HODs perceived that students held the belief that intelligence is prioritized over diligence when it comes to achieving success in the field of physics. The HODs also indicated that students do not consider it was possible for any other student to learn how to improve grades in physics exams and that everyone is capable of contributing ideas in a physics lesson. Sengul and Osman (2020) through an iterview also revealed that students believed that performance in sciences was more related to adopting the right study habits rather than innate abilities. If students believe that their natural talent is the sole factor determining success in physics, they might have reduced inspiration to entrust time and vigor in learning. They may feel that if they do not possess the innate ability, their efforts will be futile. As a result, they may not dedicate the necessary time and energy to fully understand and master physics concepts and skills.

The overall ascertainments gleaned from the study reveal that although there were many factors that affect performance of physics it was not possible to separate success in physics with the concept of natural ability. They argued that being smart is frequently associated with performance in physics. Believe that innate ability is superior in determining student performance in physics can undermine the importance of effort and deliberate practices of learning physics concepts. This could contribute to overall poor performance amongst the students. This finding concur with that of Ozlem (2015) which found that ingenuous believe in regulation of knowledge accession had negative relations with conceptions and learning of sciences. In addition, the results corresponded with a research conducted by Bodin and Winberg (2012) regarding the significance of beliefs in the process of solving numerical problems in physics. The study discovered that students' performance was adversely affected by their naive epistemological beliefs. Students who hold naive belief in control of knowledge acquisition may overlook the significance of consistent practice, perseverance, and seeking help when needed to overcome the challenges of their learning. This could mistakenly attribute success of leaning physics solely to talent rather than hard work and might lead to poor performance.

CONCLUSION

The objective of the study was to ascertain the relationship between beliefs in control of knowledge acquisition and performance of physics. The overall mean tally for naive beliefs in influence of acquisition knowledge indicated that respondents agreed with the parameters measuring naive beliefs in control of knowledge acquisition and performance of physics. The overall mean outcome for sophisticated beliefs in the in control of knowledge acquirement for the students and teachers revealed that the respondents disagreed with the selected statements assessing sophisticated beliefs in the in control of knowledge acquisition and performance of physics. Findings from the interviews and students focus group discussions revealed that the respondents had views that most of the students held believe that performance of physics was dependent of special abilities that some student possess at birth. The correlation between naive beliefs in control of knowledge acquisition and performance in physics was very weak and statistically insignificant, while the

relationship between sophisticated beliefs in control of knowledge acquisition and performance in physics was modestly positive and statistically significant. Ordinal regression analysis demonstrated that sophisticated beliefs in control knowledge acquisition significantly and positively predicted performance in physics, whereas naive beliefs in control knowledge acquisition manifested a detrimental and inconsequential correlation with performance in physics.

REFERENCES

Alexopoulos, E. (2010). Introduction to Multivariate Regression Analysis. *Hippokratia, 14*(1), 23–28.

Andrea, B., Maria, L., & Mikael, W. (2021). Students' Epistemic Beliefs in Sweden and Germany and Their Interrelations with Classroom Characteristics. *Scandinavian Journal of Educational Research, 65*(1), 54-70. doi:10.1080/ 00313831.2019.1651763

Arlindo, A. (2006). *Epistemological Beliefs and Perceptions of Education in Africa: An Exploratory Study with High School Students in Mozambique.* Unpublished PhD Thesis, University of Groningen.

Arslantas, H. (2016). Epistemological Beliefs and Academic Achievement. *Journal of Education and Training Studies, 4*(1), 215-220. doi:10.11114/jets.v4i1.1107

Ayaz, F., & Sekerci, H. (2015). The Effects of the Constructivist Learning Approach on Student's Academic Achievement: A Meta-Analysis Study. *The Turkish Online Journal of Educational Technology, 14*(4).

Barger, M., Perez, T., Canelas, D., & Linnenbrink-Garcia, L. (2018). Constructivism and Personal Epistemology Development in Undergraduate Chemistry Students. *Learning and Individual Differences, 63*(2018), 89-101. doi:10.1016/j.lindif.2018.03.006

Barzilai, S., & Zohar, A. (2014). Reconsidering Personal Epistemology as Metacognition: A multifaceted Approach to the Analysis of Epistemic Thinking. *Educational Psychologist, 49*(1), 13–35. doi:https://doi.org/10.1016/j.learninstruc.2012.11.003

Basturk, S. (2016). Primary Pre-service Teachers' Perspectives on Constructivism and its Implementation in the Schools. *Universal Journal of Educational Research*, 904-912. doi:10.13189/ujer.2016.040428

Bay, E., Vural, F., Demir, S., & Bagceci, B. (2015). An Analysis of the Candidate Teachers' Beliefs Related to Knowledge, Learning and Teaching. *International Education Studies, 8*(6), 75-89.

Benek, I., & Akcay , B. (2019). Development of STEM Attitude Scale for Secondary School Students: Validity and Reliability Study. *International Journal of Education in Mathematics, Science and Technology, 7*(1), 32-52.

Blazer, C. (2011). *How Students' Beliefs about Their Intelligence Influence their Academic Performance.* Miami: MiamiDade County Public Schools.

Bodin, M., & Winberg, M. (2012). Role of Beliefs and Emotions in Numerical Problem Solving in University Physics Education. *Phys. Rev. ST Phys. Educ. Res, 8*, 010108-1 - 010108-14. doi:10.1103/PhysRevSTPER.8.010108

Calmer, M. (2019). Teaching Physics within a Next Generation Science Standards Perspective. *Pedagogical Research, 4*(4), em0041. doi:https://doi.org/10.29333/pr/5868

Cano, F. (2005). Epistemological Beliefs and Approaches to Learning: Their Change through Secondary School and Their Influence in Academic Performance. *British Journal of Educational Psychology, 75*, 203-221. doi:10.1348/000709904X22683

CEMESTEA. (2014). *Secondary INSET: Fundermentals for Effective Teaching.* Nairobi.

Costa, A., & Faria, L. (2018). Implicit Theories of Intelligence and Academic Achievement: A Meta-Analytic Review. *Frontiers in Psychology, 9*(1), 1-16. doi:10.3389/fpsyg.2018. 00829

Dehui, H., & Zwickl, B. (2018). Examining Students' Views about Validity of Experiments: From Introductory To Ph.D. Students. *Physical Review Physics Education Research, 14*(1), 010121. doi:10.1103/PhysRevPhysEducRes. 14.010121

Dweck, C. (2007). The perils and promises of praise. *Educational Leadership, 65*(2), 31-39.

Florian, B., Katharina, R., & Janes, B. (2017). Impact of Different Levels of Epistemic Beliefs on Learning Processes and Outcomes in Vocational Education and Training. *World Journal of Education, 7*(3), 103-114. doi:10.5430/wje.v7n3p103

Hofer, B. (2004). Exploring the Dimensions of Personal Epistemology in Differing Classroom Contexts: Student Interpretations During the First Year of College. *Contemporary Educational Psychology, 29*(2), 129–163. doi:https://doi.org/10.1016/j.cedpsych.2004.01. 002

Hofer, B. (2010). Personal Epistemology in Asia: Burgeoning Research and Future Directions. *The Asia-Pacific Education Researcher, 9,* 175-184.

Hofer, B., & Pintrich, P. (1997). The Development of Epistemological Theories: Beliefs about Knowledge and Knowing and Their Relation to Learning. *Review of Educational Research, 67*(1), 88–140. doi: Https://Doi.Org/10.3102/00346543067001088

KICD. (2016). *Kenya Institute of Curriculum Development Report on Needs Assessment for School Curriculum in Kenya.* Nairobi: Kenya Institute of Curriculum Development.

Kumar, A., & Sumanta, C. (2018). Epistemological Beliefs: Its Relationship with Learning Styles, Learning Approaches, and Achievement. *Asia Pacific Journal of Education, Arts and Sciences, 5*(1), 60-70.

Kutty, K. (2021). Users' Satisfaction on SC/ST Book Bank Scheme through Ordinal Users' Satisfaction on SC/ST Book Bank Scheme through Ordinal Logistic Regression Analysis. *Library Philosophy and Practice*, 1-23. Mbonyiryivuze, A., Yadav, L., & Amadalo, M. (2021). Students' Attitudes towards Physics in Nine Years Basic Education in Rwanda. *International Journal of Evaluation and Research in Education, 10*(2), 648-659. doi:10.11591/ijere.v10i2.21173

Meltzer, D., & Otero, V. (2014). A Brief History of Physics Education in the United States. *American Journal of Physic, 83*(5), 447-458. doi:http://dx.doi.org/10.1119/1.4902397

MOEST-Kenya. (2015). *Basic Education Programme Rationale and Approach.* Nairobi: Government Printer. Muchai, A. (2016). *Effects of Practical Work on Students' Achievements in Physics at Secondary School Level in Murang'a East Sub-County, Kenya.* Unpublished PhD Thesis.

Murei, G. (2016). Impacts of Low Enrolment in Secondary Schools Physics to Attainment of Kenyan Vision 2030. *Educational Research, 7*(3), 088-094. doi:http:/dx.doi.org/10.14303/ er.2016.134

Oguzhan, N., & Oktay, K. (2021). Gifted Students' Beliefs about Knowledge and Learning. *Journal of Science Learning, 4*(3), 275-287. doi:10.17509/jsl.v4i3.31995

Oktay, K., & Oktay, B. (2021). Improving 7th Grade Students' Epistemological Beliefs by Epistemologically Enriched Argumentation Model. *Pedagogical Research, 6*(3), 1-14. doi:10.29333/pr/10949

Ozlem, S. (2015). High School Students' Epistemological Beliefs, Conceptions of Learning and Self-efficacy for Learning Biology: A Study of Their Structural Models. *Eurasia Journal of Mathematics, Science & Technology Education, 11*(5), 1061-1079. doi:10.12973/eurasia.2015.1375a

Provasnik, S., & Malley, L. (2019). *U.S. Performance on the 2015 TIMSS Advanced Mathematics and Physics Assessments.* Washington, DC: National Center for Education Statistics. Retrieved from https://nces.ed.gov/pubsearch

Reddy, L. (2020). An Evaluation of Undergraduate South African Physics Students' Epistemological Beliefs When Solving Physics Problems. *EURASIA Journal of Mathematics, Science and Technology Education, 16*(5), 2- 11.

Republic of Rwanda. (2015). *Summary of Curriculum Frame-Work: Pre-primary to Upper Secondary.* Kigali: Ministry of Education.

Rudolf, T. (2017). Epistemological Beliefs, Academic Performance and Teaching Competence of Pre-Service Teachers. *Asia Pacific Journal of Multidisciplinary Research, 5*(2), 114-124. Retrieved from www.apjmr.com

Rwegasha, P. (2012). Teaching Science by Constructivist Approach as a Means of Reducing the Gap Between Secondary School students' Experiences and the Society Needs/demands in Tanzania. *The Constructivist, 21*(1), 106-130.

Sapna, S., Ahluwalia, P., & Sharma, S. (2013). Students' Epistemological Beliefs, Expectations, and Learning Physics: An International Comparison. *Physics Education Research, 9*(1), 010117. doi:10.1103/PhysRevSTPER.9.010117

Sapna, S., Ahluwalia, P., & Sharma, S. (2013). Students' Epistemological Beliefs, Expectations, and Learning Physics: An International Comparison. *Physics Education Research, 9*(1), 010117. doi:10.1103/PhysRevSTPER.9.010117

Sen, S., & Yurdugul, H. (2014). An Evaluation of the Pattern between Students' Motivation, Learning Strategies and Their Epistemological Beliefs: The Mediator Role of Motivation. *Science Education International, 24*(3), 312-331 Sengul, A. (2020). Using Concept Cartoons to Identify the Epistemological Beliefs of Middle School Students. *Journal of Science Learning, 3*(3), 165-173.

Sevda, Y., & Elby, A. (2016). Sophisticated Epistemologies of Physics Versus High-Stakes Tests: How Do Elite High School Students Respond to Competing Influences About How to Learn Physics? *Physical EPhysics Education Ressearch, 12*, 010118. doi:10.1103/ PhysRevPhysEducRes.12.010118

Shin, L. W. (2015). *Physics Instructional Context and Learners' Epistemological Beliefs.* PhD Thesis, Universiti Teknologi Malaysia , Faculty of Education.

Tambwe, M. (2017). Challenges facing implementation of Competency-Based Education and Training (CBET) system in Tanzanian Technical Institutions. *Education Research Journal, 7*(11), 277-283.

United Republic of Tanzania. (2021). *Candidates' Item Response Analysis Report for the Advanced Certificate of Secondary Education Examination (ACSEE) 2020.* Dar es Salaam, Tanzania: The National Examinations Council of Tanzania.

Velasquez, M. (2005). *Philosophy: A Text with Readings.* USA: Thomson Wadsworth.

Yenice, N. (2015). An Analysis of Science Student Teachers' Epistemological Beliefs and Metacognitive Perceptions about the Nature of Science. *Educational Sciences: Theory & Practice, 15*(6), 1623-1636. doi:10.12738/estp.2015.6.2613

Yuan-Hsuan, L. (2018). Internet-Based Epistemic Beliefs, Engagement in Online Activities, and Intention for Constructivist ICT Integration among Pre-Service Teachers. *Australasian Journal of Educational Technology, 34*(5), 120-134