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Role of Learner-Centered Approach Employed by Physics Teachers in Inspiring Students to Pursue Physics Subject in Public Secondary Schools in Hanang District Tanzania

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Abstract: The study investigated the role of learner-centered approach employed by Physics teachers in inspiring students to pursue Physics Subject in Public Secondary Schools in Hanang District, Tanzania. The study was anchored in the Expectancy-Value Theory of Motivation and adopted a convergent design within a mixed-methods research approach. The target population consisted of 38 heads of schools, 38 academic teachers, 46 physics teachers and 2,497 students. Stratified random sampling technique was used to select 298 students and criterion purposive sampling technique was used to sample 6 physics teachers, 6 academic teachers and 6 heads of schools. Quantitative data were collected through questionnaires while qualitative data were collected through interview guide and observation guide. Validity of instruments was ensured by 3 MWECAU experts in the field of Educational Planning and Administration. Reliability for Likert type item were established using Cronbach's alpha technique, whereby Alpha coefficient was 0.745. The trustworthiness for qualitative data collection instruments was ensured through triangulation and peer debriefing. Quantitative data was analyzed by using descriptive and inferential statistics while qualitative data was analyzed thematically. The researcher adhered to ethical issues including informed consent, permission from MWECAU, confidentiality, anonymity and acknowledgement of sources. The study found that learner-centered approach comprising inquiry-based learning, real-world applications, simulation and hands-on experiments employed by physics teachers to a moderate extent enhances students' engagement and interest towards physics subject, however its role was constrained by limited time for physics practical, inadequate teaching and learning resources, extensive physics content for form three and the existence of two complex topics in form two syllabus. The study concluded that, learner-centered approach to a moderate extent inspires students to pursue physics subject in public secondary schools. The study recommended that, physics teachers should adopt learner-centered approach by integrating hands-on activities and ICT tools as prescribed in the syllabus. Heads of schools and the government should allocate time for practical sessions and ensure the availability of teaching and learning resources. The Ministry of Education, Science and Technology should continue to review and improve the physics curriculum to align with learners' level of understanding and manipulation.

Keywords: *Learner-Centered Approach, Role, Simulation, Career Aspiration, Hands-on Experiments.*

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I. INTRODUCTION

Education is globally recognized by UNESCO and International Human Rights Frameworks not merely as a basic moral entitlement, but as an active, transformative vehicle for developing human dignity, agency and the higher-order 21"-Century skills demanded by a modern, scientifically driven world. In the 21st century, education is no longer just about memorizing facts, it is the ultimate engine for developing critical survival skills like adaptability, media literacy and complex problem-solving. As automation and artificial intelligence reshape the global economy, the modern classroom bridges the gap between traditional knowledge and real-world application by teaching students how to think critically, communicate across diverse digital platforms and collaborate globally (Abbas et. al., 2024).

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In response to the escalating global demand for highly skilled experts, developing nations have increasingly acknowledged the essential role of science in strengthening national competitiveness and cultivating a knowledge-based society capable of addressing complex global challenges, including climate change, environmental degradation and energy shortages (Techera & Mlay, 2024), Within this context, physics stands out as a fundamental discipline that underlies technological advancement and drives innovation across diverse sectors such as engineering, healthcare, transportation and communication. The widespread applications of physics highlight its critical importance in meeting the growing need for professionals equipped with advanced technical and analytical competencies worldwide. Consequently, the extent to which physics knowledge is integrated into educational and industrial systems significantly influences economic development and technological progress (Jho, 2023). As a result, physics serves as a crucial gateway to high-demand professional fields, including medical sciences, education and engineering, where its principles are applied in medical diagnostics, teaching and the design of modern infrastructure and technological systems, thereby reinforcing its global relevance in addressing the increasing need for scientific expertise (Gambo & Shehu, 2024; Prayogi & Verawati, 2024)

Despite the importance of physics subject, recent global trends indicate a significant and persistent decline in student's enrollment in physics at the secondary school level (Gourlay & Mujtaba, 2025). This challenge persists even in countries that have invested heavily in laboratory facilities and instructional resources. In Indonesia, data from Pendidikan Mandalika University revealed a steady decline in enrollment in physics-related programs, where student intake has decreased from 20 students in 2020 to only 9 in 2025 while in America, statistics indicates that 106 of the 745 students (14%) expressed interest in physics and persisted to graduate in American Institute of Physics (Pangga et al., 2025 & Porter et al., 2024). Similar patterns have been observed in several African countries, in Ghana, research shows low student interest in physics (Yuoni et al., 2025), while in Mauritius, a persistent reduction in the number of students selecting physics has been reported (Ramsurrun et al., 2025). In East Africa, Kenya has also documented declining participation in physics at the secondary level (Kibiwott & Njoroge, 2024). According to Kyaruzi (2025), the situation in Tanzania is that about 70% and nearly 75% of the students in secondary schools are not interested in pursuing physics and chemistry subjects. In addition, statistics from the National Examinations Council of Tanzania (NECTA) reveal a decline in the proportion of students registering for physics at the Certificate of Secondary Education Examination (CSEE). Table shows the statistics of students sat for National examination from 2022 to 2025 in Tanzania compared to other science subjects including Biology and chemistry as science subjects further confirming that the problem is widespread and not confined to a single context.

The CSEE statistics indicate that students' participation in Physics remained considerably lower than in other science subjects between 2022 and 2025. The percentage of students who sat for Physics was 20% in 2022, 22.5% in 2023, 21.9% in 2024, and 21.1% in 2025. In comparison, participation in Chemistry was 28%, 30%, 29.6%, and 29%, respectively. Biology recorded 92% in 2022, 95% in 2023, 91.9% in 2024, and 97.3% in 2025, while Mathematics recorded 92%, 97.3%, 97.4%, and 96.7%, respectively. These statistics demonstrate that Physics consistently had the lowest proportion of candidates among the science subjects considered, suggesting a persistent challenge in attracting students to pursue Physics at the secondary school level. Evidence from the Manyara Region further illustrates the extent of the problem. Statistics from five districts show variations in the proportion of students who opted for Physics between 2022 and 2024. In Babati District, the proportion increased from 21.2% in 2022 to 26.8% in 2023 and 29.8% in 2024. In Hanang District, the proportion declined from 23.5% in 2022 to 20.4% in 2023, before increasing slightly to 21.3% in 2024. Kiteto District recorded 22.7% in 2022, 20.7% in 2023, and 23.7% in2024. In Mbulu District, the proportion increased substantially from 20.3% in 2022 to 35.0% in 2023, before declining to 24.4% in 2024. Similarly, Simanjiro District recorded 23.8% in 2022, 21.5% in 2023 and 22.1% in 2024. Overall, these statistics indicate that the proportion of students studying Physics remained relatively low and fluctuated across the five districts, providing evidence of a continuing challenge in attracting students to pursue Physics in Manyara Region. Therefore, it was necessary to investigate the role of learner-centered approach employed by Physics teachers in inspiring students to pursue physics subject in public secondary schools in Hanang District Tanzania.

II. STATEMENT OF THE PROBLEM

The number of students studying physics subject in secondary schools in Hanang District, Tanzania is highly declining, a trend that threatens the availability of experts in the labor market specifically in physics-related fields. Studies and reports show high shortage of experts in physics-related fields including health, agriculture, radiology, education and engineering sectors. (Bundalla & Edward, 2025; URT, 2023; Mremi, 2023; Wekwe et al., 2024; Bodenstorfer, 2024; Silungwe, 2024 & Toroka and Kafanano 2024). This deficit undermines sustainable development, a situation partly attributed to students' declining interest in pursuing physics subject. Much of the existing research has concentrated on predictors of student participation and subject selection in physics, mathematics, and other sciences, with a particular emphasis on female students in Tanzania context (Kyaruzi, 2025; Otieno et al., 2023; Samiji et al., 2023). The existing research have not exactly linked the aspects learner-centered approach with the students' decision to pursue physics subject. The current study, therefore, filled the gap by investigating the role of learner-centered approach employed by Physics teachers in inspiring students to pursue Physics Subject in Public Secondary Schools in Hanang District, Tanzania.

- *Research Question*

To what extent does the learner-centered approach inspire students to pursue physics subject in public secondary schools in Hanang District?

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➢ *Research Hypothesis*

H_i: There is a statistically significant difference in mean score ratings between form two and form three students regarding the extent to which learner-centered approach inspires students to pursue physics subject in public secondary schools in Hanang District, Tanzania.

➢ *Significance of the Study*

The findings of this study are expected to have practical implication to all stakeholders including students, teachers, heads of schools and the Government to get ideas on learner-centered approach as it inspires students to pursue physics subject. Additionally, the study aims to informs Tanzania Educational Policy of 2014, version 2023 to design targeted interventions by offering additional support and training for physics teachers in promoting active and experiential learning that reflect student's subject choice. According to Creswell and Creswell (2023) conducting research in education field is important as it uncovers new facts and provides suggestions for improving phenomena. In this regard, the study findings contribute to the theory that relates the use of learner-centered approach by physics teachers and their influence on students' inspiration towards physics. Moreover, findings contributed knowledge to the field of research in education context in secondary schools on the extent learner-centered approach employed by physics teachers inspire students to pursue in secondary schools.

➢ *Theoretical Framework*

This study was guided by Expectancy-Value Theory developed by Eccles and Wigfield (1983), which explains that students' motivation to learn is determined by their expectations of success and the value they attach to a subject. According to the theory, learners are more likely to engage in and persist with Physics when they believe they can succeed and perceive it as useful, important and relevant to their future goals (Naz et al., 2025). Expectancy-Value Theory conceptualizes motivation as an interaction between expectancy (confidence in success) and task value, which includes intrinsic enjoyment, attainment importance, utility value and perceived cost. Expectancy-Value Theory directly links instructional methods to two measurable psychological constructs, expectancy (confidence of success) and task value (usefulness, importance, enjoyment) which map well onto how learner-centered approach such as inquiry-based learning, laboratory experiments, real-world applications, group discussions, and problem solving are hypothesized to work, they raise confidence and perceived value thereby increasing motivation and persistence (Edwards & Dai 2023). The approach strengthen expectancy for success, increase intrinsic and utility values, and reduce perceived cost by minimizing anxiety. However, the theory places little attention to external factors such as school resources, teacher competence, class size and cultural influences, which also affect students' interest in Physics (Hebibi et al., 2025). Despite the limitations, Expectancy-Value Theory provides a strong framework for examining how instructional practices influence students' motivation, interest and aspirations to pursue Physics and career pathway.

III. REVIEW OF EMPIRICAL STUDIES

This section contains review of empirical literature on the extent to which learner-centered approach employed by physics teachers inspires students to pursue physics subject.

Trevissoi, (2024) conducted a study in Italy to investigate examined the Development of an innovative" Hands on Physics" methodology for teaching Physics at high school level in Italy. Utilizing a case study design, the study comprised of students, 2 laboratory technician and 3 teachers. Sampling techniques for students, teachers and laboratory technician were not specified. Data collection relied exclusively on questionnaires, and the analysis involved the use of descriptive statistics. The findings revealed that hands-on physics methodology for teaching Physics improves students' attitudes toward Physics and STEM disciplines. These findings offered important perspectives that informed the present study that, active student participation in their own learning process enhances their motivation and deeper understanding. However, the study provides inadequate clarification regarding the research approach and sampling techniques. This state of affairs might raise methodological questions about the trustworthiness of research findings. This study complemented the findings by using a convergent design under mixed methods approach whereby, both probability and non-probability sampling techniques were used to ensure the credibility of the findings.

The study conducted by Win & Yi (2025) based in the United States, examined the the Effectiveness of Hands-On and Minds-on Activities in Physics Learning. The study employed experimental research design involving both qualitative and quantitative research approach. The sample of the study comprised of 60 students obtained through purposive sampling technique. Data collection relied achievement test and observation checklist, and the analysis involved the use of descriptive statistics. The study found that hands-on and minds-on teaching enhances students' interest in physics and increase in academic achievement. The study provided key insights that informed the current study on the role of hands-on and minds-on activities in arousing students' interest in learning physics. Moreover, drawing on Cohen et al. (2018), the use of a descriptive research design under a quantitative approach did not resonate well with the purposive sampling procedure. Consequently, findings related to qualitative data and responses from students only were questionable. This study complemented the findings by using a convergent design whereby probability and non-probability sampling techniques were used to ensure the credibility of the findings. Additionally, the study used a variety of instruments as a means to triangulate the information and validate the findings.

Ateko et al. (2025) performed a study by exploring effective approach to teaching thermal physics in Ghana. The study adopted quasi-experimental design within a quantitative approach and involved 191 students obtained through multistage sampling. Data were collected through achievement test and statistical method for data analysis was one-way ANCOVA. Findings revealed that, differentiated

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instruction including learner-centered with flexible teaching strategies increases students' readiness, interest and motivation towards learning physics subject. These findings offered important perspectives that informed the present study on how key elements of differentiated instruction are applied in the classroom according to the students' characteristics which are readiness, interest and learning stylesin physics lessons. However, the study focused its findings on effective content delivery and learning outcomes in a specific topic instructional effectiveness in physics. The use of students as the only source of data and relied solely on achievement test, might raise questions on the validity and reliability of findings. This study, therefore, used a variety of instruments such as questionnaires, interview and observation guide as a means to triangulate the information and hence validated the findings.

Musengimana et al. (2025) investigated the influence of systematic problem-solving strategies on teaching practices, classroom dynamics and student engagement in physics classrooms in Rwanda. Using a quasi-experimental design under a quantitative approach, the study involved 160 students purposively selected and employed observation protocol to collect data. Descriptive statistics was used to analyze data. Findings revealed that integrating problem-solving strategies with instructional practices improves teaching process, classroom culture and students' engagement. It is worth noting that the reviewed study informed the current study on the degree to which systematic problem-solving strategies influences student engagement in physics. Moreover, the study provides inadequate information on participant sampling and its reliance on the students' responses. However, drawing on Cohen et al. (2018), the use of a descriptive research design under a quantitative approach did not resonate well with the purposive sampling procedure. Therefore, the current study adopted a convergent research design that incorporates multiple data collection instruments alongside clearly defined sampling procedures. Additionally, it involves diverse participants to facilitate a more in-depth understanding of the topic.

Toto et al. (2024) examined teaching methods for motivating girls to learn science subjects in community secondary schools in Tanzania. The study adopted a phenomenological design under a qualitative approach, involving 40 participants, 16 science teachers and 24 students selected through purposive sampling. Data were gathered using classroom observation, interviews and focus group discussions, and analysis was done thematically. Findings indicate that learner-centered approach such as discussion, question and answer, experiments, hands-on activities, demonstration and field trips help learners to gain confidence, arouse interest, create positive attitude towards a lesson. The study provided useful information to this study on the role of teaching methods by teachers in motivating learners to learn Science, Technology, Engineering and Mathematics (STEM) subjects. The present study addresses the gaps by adopting a convergent mixed-methods approach, incorporating quantitative and qualitative data from students, teachers, academic teachers and heads of schools to enhance validity of results.

The reviewed literature, spanning America, Europe, Asia, Africa, and East Africa with particular reference to Tanzania, indicates that physics teachers employ various instructional strategies to inspire students to pursue Physics, with many studies focusing on learner-centered approaches or specific methods aimed at enhancing motivation, including among female students (Toto et al., 2024; Ateko et al., 2025; Musengimana et al., 2025; Trevissoi, 2024 & Win & Yi 2025). However, most studies were conducted outside Tanzania, with the exception of the study done by Toto et al. (2024), hence limiting contextual relevance due to differences in educational policy, economic, cultural and technological settings, thereby justifying the current study's focus on secondary schools in Hanang District. Additionally, methodological limitations were identified, including inconsistencies in research design and sampling, reliance on single research approaches (either quantitative or qualitative), use of single data sources, and limited participant groups, which constrained depth, generalizability and data validation (Ateko et al., 2025) & Trevissoi 2024). To address the gaps, the current study adopted a mixed-methods approach involving diverse participant groups of students, physics teachers, academic teachers, and heads of schools and multiple data collection instruments, including questionnaires, interviews, and lesson observations, to enable triangulation and enhance the reliability of findings on the extent to which learner-centered approach employed by Physics teachers inspires students to pursue physics subject in public secondary schools in Hanang District Tanzania.

IV. METHODOLOGY

This study employed a convergent design under mixed methods research approach. The target population was 2,619 individuals that comprised of 2,497 form two and three students, 46 physics teachers, 38 academic teachers and 38 heads of schools from 38 public secondary schools. Proportional stratified random sampling technique was used to select a sample of 298 students while criterion purposive sampling technique was used to select a sample of 6 physics teachers, 6 academic teachers and 6 heads of schools. Questionnaires, interview guide and observation guide were used to collect data from the respondents. Validity of instruments was ensured by 3 MWECAU experts in the field of Educational Planning and Administration. The reliability for the Likert scale items in a questionnaire for students was ensured using Cronbach's alpha technique whereby Alpha coefficient was 0.737. Moreover, the trustworthiness for qualitative data collection instruments was ensured through triangulation and peer debriefing. Quantitative data was analyzed through descriptive statistics using frequencies, percentages and mean scores with the aid of Statistical Package for Social Science (SPSS) version 27, while for inferential statistics, an independent samples t-test was used to test the hypothesis. Qualitative data was analyzed thematically by familiarizing, organizing, coding and presenting data in verbatim. The researcher adhered to ethical issues including informed consent, permission from

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MWECAU, confidentiality, anonymity and acknowledgement of sources.

V. FINDINGS AND DISCUSSIONS

The study investigated the extent to which learner-centered approach inspires students to pursue physics subject in public secondary schools. To answer the research question, questionnaires were used to capture the information from physics students which required them to rate the extent Likert scale with given statements. The interview guides were used to obtain information from heads of schools, academic teachers and physics teachers while observation guide was used to solicit information from physics teachers. Table 2 shows the responses of students on the extent to which learner-centered approach inspires students to pursue physics subject in public secondary schools in Hanang District, Tanzania.

The calculated values were in percentage, frequency and mean score, therefore the interpretation was based on scale as suggested by Celestin (2025) where the frequency and percentage distribution of responses were categorized as < 20=extreme minority; 21-49=minority; 50-59=moderate; 60-69=majority; 70-89=very high majority; 90-99=extremely majority; 100=overwhelming majority. A mean score of 1.00 – 1.79 represents to a very low extent, 1.80 – 2.59 represents to a low extent, 2.60 – 3.39 represents to a moderate extent, 3.40 – 4.19 represent to a high extent and 4.20 – 5.00 represents to a very high extent that learner-centered approach employed by physics teachers inspires students to pursue physics subject (Taufique et al., 2026).

Table 3 Students Responses on the Extent to Which Learner-Centered Approach Inspires Students to Pursue Physics Subject in Public Secondary Schools (n= 283)

S/N	Statement	VLE		LE		ME		HE		VHE		M
		f	%	f	%	f	%	f	%	f	%	
	Inquiry-based influences students to pursue physics.	17	6.0	68	24.0	126	44.5	65	23.0	7	2.5	**2.92**
	Hands-on experiments increase students' interest in physics	24	8.5	66	23.4	88	31.2	96	34.1	8	2.8	**2.99**
	Solving real-world problems encourages students to value physics	29	10.2	69	24.4	102	36.0	76	26.9	7	2.5	**2.87**
	Laboratory experiments make physics lessons more accessible	39	13.9	50	17.8	87	31.0	97	34.5	8	2.8	**2.95**
	Demonstration discourages students towards physics	124	44.6	111	39.9	24	8.6	16	5.8	3	1.1	**1.79**
	Real-world applications make physics relevant to students.	32	11.4	67	24.1	105	37.8	63	22.7	11	4.0	**2.83**
	Simulation enhances students to consider physics careers.	36	12.7	70	24.7	89	31.4	72	25.4	16	5.8	**2.87**
	Role-play helps students appreciate the usefulness of physics.	33	11.8	76	27.1	101	36.1	67	23.9	3	1.1	**2.75**
	Project connect physics subject with career aspiration	18	6.5	76	27.2	101	36.2	78	28.0	6	2.1	**2.92**
	Discussion decreases students' engagement towards physics.	159	56.6	87	31.0	16	5.7	15	5.3	4	1.4	**1.64**
	Grand Mean											**2.65**

Source: Field data (2026) Key: 1 = (VLE) Very low extent, 2=(LE) Low extent, 3=(ME) Moderate extent, 4=(HE) High extent, 5 = (VHE) Very high extent

Data in Table 3 indicate that a minority (36.9%) of the students rated to a high extent and very high extent that performing hands-on experiments frequently in physics lessons increases students' interest in pursuing physics, while a minority (31.9%) of the students rated a low and very low extent. Similarly, a minority (31.2%) rated as moderate extent that performing hands-on experiments frequently in physics lessons increases students' interest in pursuing physics. The students' mean score was 2.99, indicating that hands-on experiments in physics lessons moderately enhance students' interest in pursuing the subject. The moderate mean score suggest that many physics teachers conduct practical activities in laboratories, which tend to engage learners actively hence decision to pursue the subject. In order to triangulate the information, an interview was held with Physics Teacher (PHT_2) who commented that: "*I use available laboratory equipment for hands-on experiments, demonstrations and practical based on electricity, light and mechanics to arouse students' interest in physics. I prefer using hands-on activities using available material because it makes physics lesson practical, engaging and reliable"* (PHT_2 Personal communication, February 17, 2026).

In the same vein Academic Teacher (SAM_4) had these to say, "*Teaching physics through questioning, experiments and problem-solving as part of learner-centered instruction*

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in physics, allow students to observe physical phenomena directly and promote students' decision toward the subject" (SAM_4 Personal communication, February 23, 2026).

The interview findings collectively suggest that the use of hands-on and inquiry-based activities are key strategies for enhancing students' engagement and conceptual understanding. As a result, such practices positively influence students' interest and decision to pursue physics as a subject. The contradiction between students' ratings and teachers' interview findings centers on the difference between perceived role and actual classroom experience of hands-on experiments. The inconsistency was explained by structural challenges including inadequate laboratory equipment and limited instructional resources. The findings of the study were in agreement with those by Trevissoi, (2024) which revealed that hands-on physics methodology for teaching Physics improves students' attitudes toward Physics and STEM disciplines in general. The findings of the study also align with the Constructivist Learning Theory by Vygotsky which posits that Physics being conceptual and experimental subject, aligns best by doing, experimenting, questioning and reflecting.

Data in Table 3 indicate that the minority (37.3%) of the students rated to a large extent and very large extent that frequently use of laboratory experiments makes physics lessons more accessible, while a minority (31.7%) of the students rated low and very low extent. Similarly, the minority number (31%) rated moderate extent that frequently use of laboratory experiments makes physics lessons more accessible. The students' mean score was 2.95, indicating that the frequent use of laboratory experiments has moderate effect on making physics lessons more accessible. This suggests that students perceive laboratory work as having a moderate role in increasing their interest in physics. In order to triangulate the information, an interview was conducted with Physics Teacher (PHT_1) who shared the views that:

I conduct experiments including practical experiments on electricity, light and mechanics. The approach improves students' interest to continue studying physics. Through laboratory experiment, students believe to become specialist in some talent when they are going to further studies (PHT_1 Personal communication, February 16, 2026).

- *In the Same Vein, the Head of School (HoS_4) Gave His View that:*

"In my school, Physics teachers attempt to inspire students through different ways. They link classroom activities with real-life applications, including laboratory experiments. This process helps students to observe the relevance of physics, which increases their motivation toward the subject" (HoS_4 Personal communication, February 23, 2026).

Information from interviewed respondents implies that frequent use of laboratory experiments in a well-equipped laboratory room makes physics lessons more accessible and enjoyable. This approach contributes to a better understanding of students' interest and aspiration in physics subject, ultimately assisting them in making decision to pursue physics subject in their education and career paths in physics-related fields. The findings concurred with a study by Win & Yi (2025) based in the United States of America who revealed that hands-on and minds-on teaching enhances students' interest in physics and increase in academic achievement. The findings of the study also align with the constructivism theory which posits that learners actively construct knowledge and meaning through experience, reflection and interaction that increases students' interest in physics. According to Vygotsky; social interaction, scaffolding and mentorship helps students see the practical relevance of physics and connecting classroom learning to real-world applications and future career paths.

To triangulate these data, the researcher made a classroom observation in one of the schools on 27th February, 2026 to confirm whether teachers were integrating learner-centered approach and guide students in developing interest towards physics. The researcher observed physics teachers actively engaged students in performing hands-on experiments.

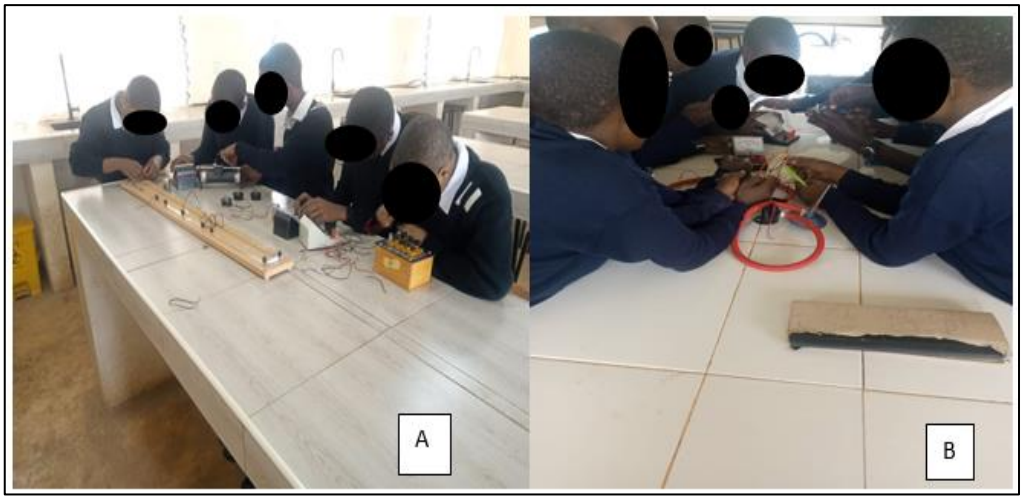

Fig 1 Observational Evidence on the Application of Learner-Centered Approach
Source: Field Data, (2026)

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Figure 1 images A and B, show students performing an experiment on electric current flow to measure the amount of current and voltmeter instead of reading from books and drawings only. Physics teacher (PHT_6) guided students by providing the instructions and electric apparatus regarding the content and asked students to follow the procedures in collecting data. The observation confirms that some physics teachers perform laboratory experiments with students. Despite the use of active learning strategies, the researcher observed that laboratory experiments were conducted using a limited number of apparatuses shared among large groups of five to seven students. Classroom observation revealed that the component of laboratory experiments was found to have moderate input in inspiring students to pursue physics subject. This was attributed by inadequate laboratory equipment in few visited schools in Hanang district.

Data in Table 3 indicate that the minority number (37.5%) rated moderate extent that frequently use of simulation enhances students to consider physics-related careers, while the minority (37.4%) of the students rated to a low extent and very low extent. Likewise, a minority (31.2%) of the students rated a high and very high extent that frequently use of simulation enhances students to consider physics-related careers. The mean score was 2.87 for students suggesting that frequent use of simulation enhanced students to consider physics-related careers to a moderate extent. This suggests that students believe that the use of simulation in learning process increases their interest in physics. The challenge was attributed by little access to smartphones and inadequate number of computers for animations and insufficient technical skills among physics teachers. In order to triangulate the information and to gain an insight into the matter, an interview was conducted with Physics Teacher (PHT_4) who commented that:

I use my smartphone for simulation; learners explore physical phenomena that are difficult to demonstrate in a real laboratory. The approach encourages students to develop confidence in their scientific abilities so as to increases students' motivation to learn physics. The challenge arises from a limited access to digital-based experiments and shortage of computers (PHT_4 Personal communication, February 23, 2026).

- *Similarly, the Head of School (HOS_3) Emphasized that:*

"Through digital tools, physics concepts are more visible and understandable through simulations and videos. Simulation improves learning by allowing students to manipulate variables, observe real-life outcomes and engage actively with phenomena that would otherwise be difficult to demonstrate." (HOS_3 Personal communication, February 19, 2026).

The interviews collectively imply that the use of simulation through digital tools create interactive and engaging learning environments where students actively manipulate variables and observe phenomena that were otherwise difficult to demonstrate in real life. Integration of digital tools enables learners to manipulate variables, explore abstract phenomena and develop problem-solving skills, thereby increasing their confidence and motivation toward physics. The contradiction between students' ratings and teachers' interview findings suggests that although simulations are viewed by teachers as highly effective instructional tools, many students do not consistently experience their benefits in ways that strongly shape their career considerations. The disparity was due to practical constraints including limited access to smartphones and insufficient computers which reduces students' interest in pursuing physics. The findings of the study were supported the study by Ateko et al. (2025) in Ghana, who revealed that differentiated instruction including learner-centered with flexible teaching strategies increases students' readiness, interest and motivation towards learning physics subject.

The findings concurred with the Expectancy-Value Theory which posits that students' motivation were influenced by their expectations of success and the value they attach to a subject. According to Eccles and Wigfield (1983), simulations in physics increase students' expectancy for success by making complex concepts in physics easier to understand, relevant and connected to real-world applications. The researcher made classroom observation in one of the schools and observed teachers actively engaging students in demonstrating visual-aids in classrooms situation using personal computers. Classroom observation revealed that the simulation through digital tools creates an interactive learning environment in which students actively engage with content by manipulating variables and observing phenomena that are difficult to replicate in real-life laboratory settings.

Data in Table 3 indicate that a minority number (37.5%) rated to a moderate extent that the use real-world applications in class often makes physics lessons more relevant to students, while a minority (35.5%) of the students rated to a low and very low extent. Correspondingly, minority (26.7%) of the students rated a high and very high extent that real-world applications in class often make physics lessons more relevant to students. The mean score was 2.83 for students. The data implies that the real-world applications in class moderately make physics lessons more relevant to students. This suggested that students perceived real-world applications as encouraging factor towards physics. The challenge arises from a little exposure to physics-related fields. In order to triangulate the information and to gain an insight into the matter, an interview was conducted with Physics Teacher (PHT_3) who shared the views that:

"I expose students to real-world applications through laboratory experiments and projects related to real-application of physics. When students see how physics applies to their real-life situation, they become interested in physics and feel more in control of it" (PHT_3 Personal communication, February 19, 2026).

- *Echoing this View, During the Interview, the Head of School "4" Stated that:*

Physics teachers attempt to inspire students through different ways including conducting practical experiments and relating physics concepts to everyday life. When students understand how physics is used in the fields such as

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engineering, medicine, communication, transportation and energy production, they become more interested in studying the subject (HoS_4) Personal communication, February 23, 2026).

- *The Data were Supported by Academic Teacher (SAM_1) Who Highlighted that:*

During meeting with heads of subject departments, we advise physics teachers to integrate real-world applications into physics subject make physics concepts more meaningful and engaging for students. By connecting physics to real-life situations, students develop deeper understanding of physics principles and gain valuable skills that can be applied in everyday situations. (SAM_1 Personal communication, February 16, 2026).

Collectively, the interviews suggest that learning through connecting concepts with real-life experiences, the use of practical examples and career links in real-life contexts enhances students' motivation and participation in the subject. The findings of the study align with the constructivism theory which posits that learners build knowledge through active problem-solving and the application of concepts in meaningful contexts. According to Vygotsky, students learn best when they connect new information to their existing knowledge and real-world problems provide a rich context for the process. Through practical applications, students see the relevance of physics in their lives. The findings of the study were consistent with those of Musengimana et al. (2025) in Rwanda which indicated that integrating problem-solving strategies with instructional practices fostered an optimal environment for physics learning by improving teaching process, classroom culture and students' engagement.

Data in Table 3 indicates that a greater majority (84.5%) of the students rated to a low extent and very low extent that the use of demonstration repeatedly discourages students towards physics subject, while the extreme minority (8.6%) rated a moderate extent. Conversely, an extreme minority (6.9%) of the students rated a high and very high extent that the use of demonstration repeatedly discourages students towards physics. The mean score was 1.79 for students. This implied that the repeated use of demonstration repeatedly encourages students towards physics subject. In order to triangulate the information and to gain an insight into the matter, an interview was conducted with Physics Teacher (PHT_4) who shared the views that:

I improve student confidence by gradually building their understanding from simple to complex concepts. Demonstration helps students understand complex concepts through direct observation. It makes abstract theories more concrete by showing how physical principles work in practice and increases students' interest, attention and participation during lessons (PHT_4 Personal communication, February 23, 2026).

- *Similarly, the Head of School (HoS_5) Emphasized that:*

"In our school, science teachers frequently use demonstrations because they help students understand abstract concepts by observing real experiments and practical applications. However, due to inadequate laboratory equipment, demonstration is sometimes constrained" (HoS_5 Personal communication, February 24, 2026).

The interviews collectively imply that the repeated use of demonstrations encourages students to develop an interest in physics. The approach enhances students' confidence, stimulate interest and promote positive attitudes toward physics. The findings of the study were consistent with those of Toto et al. (2024) who confirmed that learner-centered approach such as discussion, question and answer, experiments, hands-on activities, demonstration and field trips help learners to gain confidence, arouse interest, create positive attitude towards a lesson. Furthermore, the information provided by respondents aligns with the Social Learning Theory which posits that learning is primarily social and observational, students internalize behaviors, attitudes and skills by observing role models such as teachers or peers. According to Bandura's principle of reciprocal determinism, a positive classroom environment, interactive teaching strategies and supportive feedback strengthen learners' engagement with physics.

Furthermore, an independent samples t-test was tested at .05 significant level as per Akpan & Clark (2023) to determine whether there is a statistically significant difference in the mean scores on the extent to which learner-centered approach inspires students to pursue physics subject in both form two and form three classes. The researcher tested the null hypothesis which states that, "There is no statistically significant difference in mean score ratings between form two and form three students on the extent to which learner-centered approach inspires students to pursue physics subject in public secondary schools." Decision rule considered was that, if the p-value is less than or equal to 0.05 ($p \leq 0.05$), the null hypothesis will be rejected, and if the p-value is greater than 0.05 ($p > 0.05$), the null hypothesis will not be rejected, indicating that there was no statistically significant difference between the variables being tested.

The assumptions were tested before testing the hypothesis and found to comply with independent samples t-test. From the SPSS, the researcher obtained the summary of the mean scores of Form Two and Three students in public secondary schools.

Table 4 Group Statistics of the Mean Scores on the Extent to Which Learner-Centered Approach Inspires form Two and form Three Students in Public Secondary Schools (n=283)

	Class Level	N	Mean	Std. Deviation	Std. Error Mean
Mean Score on learner-centered approach	Form Two	10	2.62	.468	.148
	Form Three	10	2.68	.543	.172

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The data in table 3 show that the mean score for the learner-centered approach for Form Two was smaller (2.62) than that of Form Three students (2.68). To find out whether the observed difference in the mean score was significant, the hypothesis was further tested, and the results are summarized in Table 5.

Table 5 Independent Sample T-Test Output on Ratings between Form Two and Three Students Regarding Learner-Centered Approach

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Mean Score	Equal variances assumed	.111	.743	-.256	18	.801	-.058	.227	-.534	.418
	Equal variances not assumed			-.256	17.610	.801	-.058	.227	-.535	.419

Source: Field Data (2026)

The data in Table 5 give the summary of independent samples t-test: t(18) = 0.256, P= 0.801. The test for homogeneity indicates favorable results since the p-value (p = 0.801) was greater than significant level of 0.05 as shown in Table 5, therefore the samples being compared have equal variances**,** hence testing of hypothesis was allowed. Regarding the decision rule, the p-value is greater than the significance level of 0.05, leading to the non-rejection of the null-hypothesis. The results signify that the difference was not substantial and the researcher failed to reject the null hypothesis. Moreover, the null hypothesis states that, there is no statistically significant difference between the mean scores of Form Two and Form Three students regarding the extent to which learner-centered approach inspires students to pursue physics subject in public secondary schools. This lacks statistically significant variations implies a consistency in ratings of the strategy's moderate extent among students from different learning stages. The information of the hypothesis test suggests that implementing learner-centered approach greatly improves students' confidence, stimulate interest and promote positive attitudes toward physics.

To triangulate these findings, the researcher made a classroom observation in one of the schools and confirm that physics teachers are actively engaging students in performing hands-on experiments. Despite the use of active learning strategies, the researcher observed that laboratory experiments were conducted using a limited number of apparatuses shared among large groups of five to seven students.

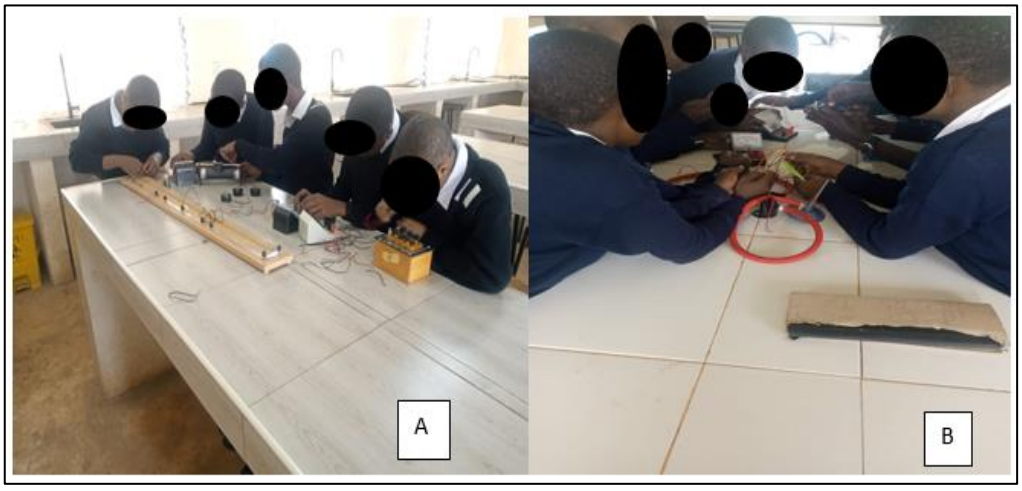

Fig 2 Observational Evidence on the Application of Learner-Centered Approach
Source: Field Data, (2026)

Figure 2 images A and B, show students performing an experiment on electric current flow to measure the amount of current and voltmeter instead of reading from books and drawings only. Physics teacher (PHT_6) guided students by providing the instructions and electric apparatus regarding the content and asked students to follow the procedures in collecting data. The observation confirms that physics teachers perform laboratory experiments with students. Classroom observation revealed that the component of laboratory experiments was found to have moderate input in inspiring students to pursue physics subject. This was

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attributed by inadequate laboratory equipment in few visited schools in Hanang district.

The study found that, learner-centered approach with the grand mean score of 2.65 for students was moderately implemented in Hanang District. The hypothesis-tested findings further revealed no significant difference between the form two and three students' views, confirming a shared view of the strategy's moderate inspiration. Qualitative evidence further shows that teachers implement learner-centered approach through practices such as hands-on activities, laboratory experiments, demonstration, real-world application and simulation. However, their role was constrained by limited time for conducting experiments, inadequate teaching and learning resources, extensive physics content. Generally, the findings show that when learner-centered approach is extensively implemented, it inspires more students to pursue physics subject.

VI. CONCLUSIONS

Based on the findings, the study concluded that, learner-centered approach to a moderate extent inspires students to pursue physics subject in public secondary schools in Hanang District. Thus, if the implementation of learner-centered approach will not be reinforced, the number of students pursuing physics subject will continue to decrease. This, in turn will result in serious consequences including persistent shortage of professionals in physics-dependent fields like engineering, information technology, medicine and education.

RECOMMENDATIONS

Based on the conclusions, heads of schools in collaboration with teachers, should strategically plan and allocate adequate financial resources for the acquisition and improvement of ICT facilities and learning materials through strengthening school-based income-generating activities, including agricultural projects, school shops, and catering services; establishing partnerships with school well-wishers, including alumni, private donors, and religious organizations.

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