

# Science Fairs and Students' Achievements in Government-Aided Secondary Schools in Lwengo District, Uganda

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## ABSTRACT

This study inspected the effect of science fairs on students' achievements in Uganda, Lwengo District, government-aided secondary schools. The research anticipated responding to the succeeding investigation specific goals; i) To examine the effect of science quizzes on students' achievements, ii) To examine the effect of project exhibitions on students' achievements, and iii) To examine the effect of practical experiments on students' achievements in government-aided secondary schools in Lwengo District, Uganda. The investigation was managed by a research technique for cross-section incorporated with a quantifiable strategy. The research was centered on 50 individuals sample size encompassing head teachers and teachers drawn from 2 designated academic institutions. Equally descriptive and linear regression approach methodologies were employed to analyze the quantifiable facts assembled. The investigation disclosed that science quizzes possessed a robust meaningful and statistical substantial effect on students' achievements in Uganda, Lwengo District, government-aided secondary institutions.

The research also revealed that project exhibitions possessed a strong meaningful and statistically substantial effect on students' achievements in Uganda, Lwengo District, government-aided secondary institutions. The research additionally revealed that practical experiments possessed a moderate meaningful and statistically substantial effect on students' achievements in Uganda, Lwengo District, government-aided secondary schools. The research deduces that science fairs such as science quizzes, project exhibitions, and practical experiments have a considerable impact on students' achievements across Lwengo District, government-aided secondary schools, Uganda whereby an enhancement in science fairs would significantly results towards an advancement across Lwengo District, students' achievements in government-aided secondary schools, Uganda.

This research commends that academic institutions must ensure that science fairs are focused on inquiry, not just competition emphasizing curiosity, problem-solving, and the scientific process rather than only winning, which would possess a substantial impact on students' achievements in Uganda, Lwengo District, government-aided secondary schools in.

**Keywords:** Science Fairs, Science Quizzes, Project Exhibitions, Practical Experiments, and Students' Achievements.

## INTRODUCTION

Globally and in Africa, science fairs and practical science activities are used to improve students' academic achievement, problem-solving skills, and interest in science through experiential learning and innovation (Schmidt & Kelter, 2017; Mbugua & Ngware, 2021). In Uganda, the government has promoted science exhibitions and competitions to enhance practical learning and improve students' performance in science disciplines (Ministry of Education and Sports, 2018). Consequently, a student's achievement in science subjects across Lwengo District, government-aided secondary institutions stays low despite these efforts (Lwengo District Local Government, 2023). Previous studies have focused on general science competitions, with limited attention to how specific science fair activities such as science quizzes, project exhibitions, and practical experiments influence students' achievement, creating a research gap that this study intends to fill. Thus, the study examines the effect of science fairs on students' achievements across Uganda, Lwengo District, government-aided secondary institutions.

### Historical Perspective

Worldwide, science fairs began emerging in the mid-20<sup>th</sup> century as a response to educational reform and a push for improved scientific literacy. Organizations like science Service helped organize early fairs and related clubs, leading to widespread science engagement across schools. Participating in fairs often helps students improve communication, research organization, problem-solving skills, and confidence, all factors that contribute to broader achievement in academic and professional contexts (Schmidt & Kelter, 2017). In recent years, Uganda has strengthened science competitions, including regional and national fairs organized by governmental and professional bodies. For example, the Uganda Science Education Programme (USEP) and the Science Innovation Projects Competitions by the Uganda Professional Science Teachers' Union (UPSTU) engage secondary school students in multi-stage fairs culminating in national showcases of student innovations. Students who participate in science fairs often report improvements in research skills, creativity, use of ICT, group collaboration, and problem-solving abilities, which support deeper engagement and mastery of scientific content beyond rote memorization, improving academic achievement (Ssimbwa & Mategeko, 2026).

### Theoretical Perspective

The investigation was managed by the Constructivist Philosophy by Piaget and Vygotsky. The theory highlights that learners construct knowledge actively rather than passively absorbing information. In the context of science fairs, science fairs provide a platform for experiential learning, allowing students to design experiments, test hypotheses, and reflect on results (Milner-Bolotin & Timperley, 2018). According to Mbugua and Ngware (2021) learning is maximized when a student goes through a cycle of active experimentation, abstract conceptualization, reflective observation, and tangible experience. Science fairs inherently follow this cycle, enhancing comprehension and retention. The authors assert that students who engage actively with content through science fairs often demonstrate higher mastery of scientific concepts and problem-solving skills, directly linked to an improvement in students' achievements (Mbugua & Ngware, 2021). As a result, this hypothesis applied to this investigation as it provides a rationale on science fairs and students' success.

### Contextual Perspective

This research was taken from designated Uganda, Lwengo District, government aided secondary schools examining the effect of science fairs on students' achievements. This was considered as a result of the inadequate investigations performed within the district relative to science fairs and students' achievements. Furthermore, Lwengo District was put into consideration due to the low and sparse students' achievements in government-aided secondary institutions in exhibited by lower educational performance in national examinations especially in science subjects, difficulty in mastering academic content, and limited engagement in some class activities or subjects (Lwengo District Local Government, 2023).

## Conceptual Perspective

Science fairs are organized educational events where students, typically at the primary, secondary, or pre-college level, present independent or group research initiatives in science, technology, engineering, or mathematics (STEM) disciplines. Participants investigate a scientific question or problem, conduct experiments or design prototypes, and communicate their findings through displays, presentations, or demonstrations, often competing for awards or recognition (Schmidt & Kelter, 2017). Students' achievements refer to the knowledge, skills, competencies, and accomplishments that learners attain as a result of their educational experiences. This encompasses development of cognitive and practical capabilities, subject content mastery, academic performance, attainment of learning objectives, and sometimes recognition through awards or examinations (Budiarti & Solehudin, 2024). In this study, science fairs were conceptualized in terms of science quizzes, project exhibitions, and practical experiments, while students' achievements were formulated relating towards the cognitive skills development, academic efficiency, subject content mastery, and practical skills acquisition among others.

## Statement of the problem

Science fairs are anticipated to enhance students' achievement in science subjects by promoting practical learning, experimentation, innovation, and application of classroom knowledge to real-life situations (Schmidt & Kelter, 2017; Miller et al., 2018). Education policies in Uganda, including the National Science, Technology and Innovation Policy, encourage schools to organize science fairs, exhibitions, and innovation projects to advance a student's interest, participation, and academic efficiency in science subjects (Ministry of Education and Sports, 2018). When effectively implemented, science fairs can improve students' academic performance, problem-solving skills, creativity, and mastery of scientific concepts (Schmidt & Kelter, 2017; Miller et al., 2018).

However, despite these policy intentions, students' achievement in science subjects in many government-aided secondary institutions in Lwengo District remains low. This is reflected in poor performance in national examinations, low mastery of science content, and limited student participation in practical science activities in some schools (Lwengo District Local Government, 2023). In some government-aided secondary schools, science fairs are not regularly organized, and where they are organized, student participation in activities such as science quizzes, project exhibitions, and practical experiments is still limited due to inadequate resources, limited support, and low emphasis on practical science activities. Evidence from the Lwengo District Education Performance Report (2023) indicates that the failure rate in science subjects in UCE examinations was 62.3% in 2022 in government-aided secondary schools, which indicates low students' achievement in science subjects.

More so, most previous studies have focused on general science competitions and STEM participation without specifically examining how specific science fair components influence students' achievement in the local context of Lwengo District (Lwengo District Local Government, 2023). This creates a clear empirical research gap. If this gap is not addressed, low students' achievement in science subjects may continue, which may result in low transition to higher education, reduced interest in science-related careers, and limited development of scientific and technological skills among students in Lwengo District, government-aided secondary schools. Consequently, it is based on this verdict that this particular investigation inspected the effect of science fairs on students' achievements across Lwengo District, government-aided secondary institutions, Uganda.

## OBJECTIVES OF THE STUDY

### General Objective

To examine the effect of science fairs on students' achievements in government-aided secondary schools in Lwengo District, Uganda.

## Specific Objectives

The research engrossed on addressing the succeeding investigation distinct goals;

- To examine the effect of science quizzes on students' achievements in government-aided secondary schools in Lwengo District, Uganda.
- To examine the effect of project exhibitions on students' achievements in government-aided secondary schools in Lwengo District, Uganda.
- To examine the effect of practical experiments on students' achievements in government-aided secondary schools in Lwengo District, Uganda.

## Study Hypotheses

The succeeding null hypotheses guided the distinct goals;

**H<sub>01</sub>:** There is no significant effect of science quizzes on students' achievements in government-aided secondary schools in Lwengo District, Uganda.

**H<sub>02</sub>:** There is no significant effect of project exhibitions on students' achievements in government-aided secondary schools in Lwengo District, Uganda.

**H<sub>03</sub>:** There is no significant effect of practical experiments on students' achievements in government-aided secondary schools in Lwengo District, Uganda.

## CONCEPTUAL FRAMEWORK

The conceptual model on the association amidst Science Fairs and Students' Achievements.

### Independent Variable

#### SCIENCE FAIRS

##### Science Quizzes

- Oral science questions
- Mental work in mathematics
- Science puzzles

##### Project Exhibitions

- Creative inventions
- Science based products like medical devices, mobile apps

##### Practical Experiments

- Laboratory tests



### Dependent Variable

#### STUDENTS' ACHIEVEMENTS

- Creativity
- Confidence
- Academic performance
- Mastery of subject content
- Social-emotional development
- Cognitive skills development
- Practical skills acquisition

**Source: Adopted from Mbugua and Ngware (2021)**

The conceptual framework indicates an association between science fairs and students' achievement. Science fairs were conceptualized in terms of science quizzes, project exhibitions, and practical experiments, while students' achievements were directed relating towards the cognitive skills development, subject content mastery, academic efficiency, and practical skills acquisition among others. Consequently, the above conceptual model was grounded upon the presupposition that science fairs influence advancement in learners' achievement.

## LITERATURE REVIEW

### Science Fairs and Students' Achievements

Science fairs influence students' achievement through multiple educational, cognitive, and motivational mechanisms. Science fairs require students to investigate real-world problems, conduct experiments, and analyze data, which deepens understanding of scientific concepts beyond what is often achieved through traditional classroom instruction. Students who participate in science fairs demonstrate higher mastery of scientific principles and improved comprehension of complex topics (Koomen, Hedenstrom & Moran, 2021). According to Grinnell, Dalley and Reisch (2025) designing a project, testing hypotheses, and troubleshooting experiments promotes higher-order thinking skills such as analysis, evaluation, and synthesis. This skill development is closely linked to academic achievement, as students are better equipped to apply knowledge in tests and problem-based assessments (Grinnell et al., 2025).

Science fairs often require students to present findings to judges and peers, promoting clarity in scientific communication. Working in teams on projects fosters collaboration, negotiation, and leadership skills that support achievement in both academic and co-curricular domains. Also, exposure to research and problem-solving activities encourages learner to seek additional studies and professions in science and engineering, creating a feedback loop where engagement leads to higher achievement (Schmidt & Kelter, 2017). The authors assert that students participating in science fairs report renewed focus in STEM disciplines, which often translates to better performance in school science subjects (Schmidt & Kelter, 2017).

According to Ssimbwa and Mategeko (2026) science quizzes conducted in science fairs require students to recall factual information and apply conceptual knowledge, which strengthens memory and understanding of scientific topics. Frequent testing, such as through quizzes, has been shown to enhance long-term retention of information, a phenomenon known as the testing effect. Quizzes motivate students to study, prepare, and engage actively with the material before and during science fairs. This preparation fosters deeper cognitive processing, which correlates with higher performance in exams and class assessments. Additionally, the authors assert that well-designed science quizzes often include application and analysis questions, requiring students to solve problems and reason scientifically rather than just memorize facts. This practice supports higher-order thinking skills that are strongly associated with improved academic achievement among students (Ssimbwa & Mategeko, 2026).

Science fairs include project exhibitions which significantly influence students' achievements by providing hands-on, practical learning experiences that complement classroom instruction. Exhibiting a project requires students to apply theoretical knowledge to practical problems, integrating concepts from physics, biology, chemistry, or engineering. This process helps students deeply understand scientific principles and improves retention and performance in science subjects (Milner-Bolotin & Timperley, 2018). Consequently, the writer postulates that students must identify a problem, design experiments, collect data, and interpret results, which develops higher-order thinking skills. Such skills directly relate to academic achievement as students become better at analyzing and solving complex questions in exams, which is directly linked to improved students' academic performance (Milner-Bolotin & Timperley, 2018). According to Kook, DeLisi, Fields and Levy (2020) project exhibitions foster ownership and autonomy, motivating students to conduct independent research and persevere through challenges. Increased engagement and motivation have been linked to improved academic performance and higher achievement scores.

Science fairs involve presenting projects in exhibitions to judges and peers which requires clarity, organization, and effective communication, which helps students articulate scientific knowledge. These communications skills reinforce learning and understanding, positively influencing assessment performance. Successful project exhibitions also boost self-efficacy, giving students confidence in their knowledge and abilities, which is associated with better academic outcomes. Confidence gained through project work can lead to improved participation in classroom discussions and assessments (Mbugua & Ngware, 2021). Additionally, Koomen et al. (2021) postulated that engaging in practical experiments in science fairs fosters autonomy, competence, and interest, key elements of intrinsic motivation. Motivated students are more likely to invest time and effort into studying and practicing, which is linked to improved achievement.

Practical experiments in science fairs influence students' achievements by providing hands-on, experiential learning opportunities that reinforce theoretical knowledge and develop key science skills. Performing experiments allows students to apply classroom theories to real-world phenomena, making abstract concepts more concrete and understandable. This active engagement improves knowledge retention and comprehension, which translates into higher academic performance in science subjects (Miller, Sonnert & Sadler, 2018). The authors also assert that experiments require students to formulate hypotheses, design methods, collect and analyze data, and interpret results, which develop the ability to think critically and solve problems is crucial for being successful in assessments and examinations that require higher-order reasoning (Miller et al., 2018).

## METHODOLOGY

### Research Design

This research was directed by an investigation technique for cross-section incorporated with a quantifiable strategy. A research design for cross-section evaluates the frequency and association of particular factors within the demographic at a particular moment in time (Kassu, 2019). Therefore, this investigation strategy was crucial towards inspecting the effect of science fairs on learners' achievements in Lwengo District, government-aided secondary institutions, Uganda at a specific moment in time. The quantifiable strategy made it simpler to link, replicate, and assess results by allowing the investigator to measure and evaluate factors numerically.

### Target Population and Sample Size

The research's populace of interest comprised of 57 members from two designated Lwengo District, government-aided secondary institutions considered due to time constrictions. The Sloven's formula was employed to evaluate the size of the sample given as;

$$n = \frac{N}{1 + Ne^2}$$

Where, n = sample size, N = target population, and e = permissible error (0.05).

$$n = \frac{57}{1 + 57(0.05)^2}$$

$$n = 50 \text{ individuals}$$

The research was based on a sample of fifty people encompassing teachers besides head teachers to offer numerical facts that was employed in the investigation.

### Sampling Procedure

To designate the investigation participants, the investigator utilized convenience sampling as well as basic random selection. Convenience sampling, which was used to choose head teachers, entails choosing people who are available, present, and prepared to take part in the study. To select instructors from the diverse schools to partake in this investigation, simple random sampling was employed which was based on the sampling frame containing all teachers' names at the various schools involved in the study and this was obtained from the school administration. The entire population possessed an equivalent likelihood to be chosen for the sample with simple random sampling, and the selection process is completely random (Elfil & Negida, 2017).

### Data Collection Methods

#### Questionnaire Survey Method

A systematic series of transcribed questions is used by the investigator to assemble data from a cluster of

participants using an inquiry survey approach (Mathiyazhagan, 2018). By employing closed-ended questions in the inquiry survey approach, the instigator was able to gather data that could be substantially examined to detect trends, relationships, and patterns. As a result, in the short amount of time available, this approach permitted the investigator to attain organized, trustworthy, and quantifiable facts from those taking part regarding the investigation's components.

## Data Collection Instruments

### Structured Questionnaire

A technique for gathering data from people that uses closed-ended questions to ensure consistency in answers, making data comparison and analysis simpler is described as a structured questionnaire (Acheung, 2019). The study employed standardized questionnaires with closed-end queries and predefined responses that were provided to those participating at the different schools in order to gather statistical numeric facts from teachers and head teachers. In order to ensure consistency in responses throughout the study, standardized questionnaires were employed, which improved the organization and quantifiability of data collection and facilitated comparison and analysis.

### Validity and Reliability

The validity of instruments was addressed through the assistance of investigation professionals' expert judgment. Validity of instruments was assessed using a Content Validity Index (CVI) where;

$$CVI = \frac{\text{no of items declared valid}}{\text{total no of items}}$$

A .7 CVI and more shows the contents of the tools are valid to be utilized for assembling data in this study (Amin, 2005).

$$CVI = \frac{20}{25}$$

$$CVI = 0.8$$

The research questionnaires were regarded as legitimate for assembling facts as the 0.8 CVI was beyond 0.7 as advised by Amin (2005). More so, a Cronbach Alpha coefficient was measured to address the instruments reliability basing on facts collected from a pilot study that was conducted in one Lwengo District, government-aided secondary institution. As stated by Amin (2005) a 0.7 coefficient of Cronbach Alpha's and above shows that the questions used in the instruments are reliable for data collection.

**Table 3.1: Reliability Statistics**

| Cronbach's Alpha | No. of Items |
|------------------|--------------|
| .790             | 20           |

**Source: Field Data (2026)**

The research questionnaires were considered reliable for data assembling since 0.790 Cronbach's Alpha coefficient was more than 0.7 as advised by Amin (2005).

## Data Analysis

Equally linear and descriptive regression analytic strategies were used in the research to analyze the quantifiable facts assembled. The variances, overall pattern, and trends in the demographic information of the

individuals were examined utilizing descriptive analysis. The data was displayed in an intelligible format utilizing percentage and frequency in order to give a well-organized and comprehensible summary. To inspect the effect of science fairs on students' achievements, linear regression evaluation was utilized to determine the magnitude and direction of the effect amidst a pair of variables besides to assesses the substantial affiliation. Linear regression analysis was the best method for assessing the strength of affiliation amidst more two variables (Maulud & Abdulazeez, 2020).

## Ethical Consideration

Prior beginning the investigation, the investigator secured an introduction letter from the university in order to obtain permission from the various schools' administrations to conduct the survey there.

Participants were allowed to leave the study at any moment, and the investigator ensured that participation was entirely voluntary and free from coercion or inappropriate influence.

Participants were also properly informed by those investigating about the aim and importance of this investigation. Furthermore, the investigator protects people's private information by ensuring anonymity and confidentiality.

## Study Findings

Findings pertaining to the goals of the study are presented in this subsection.

### Findings on the Participants' Demographic Characteristics

This research reviewed the demographic traits of participants across Lwengo District, government-aided secondary institutions, Uganda and Table 4.1 illustrates the results;

**Table 4.1: Participants' Demographic Characteristics**

| Category            | Items             | Frequency | Percentage   |
|---------------------|-------------------|-----------|--------------|
| <b>Gender</b>       | Male              | 31        | 62.0         |
|                     | Female            | 19        | 38.0         |
|                     | <b>Total</b>      | <b>50</b> | <b>100.0</b> |
| <b>Age Category</b> | 25-30 years       | 4         | 8.0          |
|                     | 31-35 years       | 8         | 16.0         |
|                     | 36-40 years       | 15        | 30.0         |
|                     | Above 40 years    | 23        | 46.0         |
|                     | <b>Total</b>      | <b>50</b> | <b>100.0</b> |
| <b>Education</b>    | Diploma           | 7         | 14.0         |
|                     | Bachelors' degree | 38        | 76.0         |
|                     | Masters' degree   | 5         | 10.0         |
|                     | <b>Total</b>      | <b>50</b> | <b>100.0</b> |

|                                  |                |           |              |
|----------------------------------|----------------|-----------|--------------|
| <b>Marital Status</b>            | Married        | 37        | 74.0         |
|                                  | Single         | 13        | 26.0         |
|                                  | <b>Total</b>   | <b>50</b> | <b>100.0</b> |
| <b>Time Worked at the School</b> | 1-5 years      | 8         | 16.0         |
|                                  | 6-10 years     | 31        | 62.0         |
|                                  | Above 10 years | 11        | 22.0         |
|                                  | <b>Total</b>   | <b>50</b> | <b>100.0</b> |

**Source: Field Data (2026)**

Findings under Table 4.1 specify that most of those participating 31 (62.0%) who took part in the study were male and 19 (38.0%) of the participants were female. The findings also indicate that most of the participants 23 (46.0%) were beyond the age of 40, 15 (30.0%) of the participants were 36-40 years, those amidst 31-35 years were 8 (16.0%) of the participants, and those amidst 25-30 years were 4 (8.0%) of the participants.

Consequently, the findings specify that most of those participating were 38 (76.0%) had obtained a bachelor's degree, 7 (14.0%) of the participants had acquired a diploma, and only 5 (10.0%) of the participants had acquired a masters' degree.

The findings also specify that most of those participating 37 (74.0%) were in marriages and 13 (26.0%) of the participants were not married. The findings furthermore indicate that most participants 31 (62.0%) had labored for 6-10 decades at the school, 11 (22.0%) of the participants had labored for over 10 decades at the school, and 8 (16.0%) participants had labored for 1-5 decades at the school.

**Findings on the Study Objectives**

**Effect of Science Quizzes on Students' Achievements in Government-Aided Secondary Schools in Lwengo District, Uganda**

The investigation inspected the effect of science quizzes on students' achievements in Uganda Lwengo District, government-aided secondary schools and Table 4.2 illustrates the results.

**Table 4.2: Regression on the Effect of Science Quizzes on Students' Achievements in Government-Aided Secondary Schools in Lwengo District, Uganda**

| Model Summary                              |                   |                             |            |                           |                            |      |
|--------------------------------------------|-------------------|-----------------------------|------------|---------------------------|----------------------------|------|
| Model                                      | R                 | R Square                    |            | Adjusted R Square         | Std. Error of the Estimate |      |
| 1                                          | .656 <sup>a</sup> | .430                        |            | .418                      | .54259                     |      |
| a. Predictors: (Constant), Science Quizzes |                   |                             |            |                           |                            |      |
| Coefficients <sup>a</sup>                  |                   |                             |            |                           |                            |      |
| Model                                      |                   | Unstandardized Coefficients |            | Standardized Coefficients | T                          | Sig. |
|                                            |                   | B                           | Std. Error | Beta                      |                            |      |

|                                               |                 |       |      |      |       |      |
|-----------------------------------------------|-----------------|-------|------|------|-------|------|
| 1                                             | (Constant)      | 1.104 | .448 |      | 2.465 | .000 |
|                                               | Science Quizzes | .694  | .115 | .656 | 6.020 | .000 |
| a. Dependent Variable: Students' Achievements |                 |       |      |      |       |      |

Source: Field Data (2026)

Table 4.2 findings specify that science quizzes possessed a robust meaningful and statistical substantial effect on achievements of students across Lwengo District, government-aided secondary schools, Uganda ( $\beta=.656$ ,  $p<.05$ ). The regression findings stipulate that an increase of one unit in science quizzes significantly results towards .656 increase in achievements of students across Uganda, Lwengo District, government-aided secondary institutions. The results infer that in order to enhance students' achievements, there must be a direct advancement across Lwengo District, science quizzes across government-aided secondary institutions, Uganda. The coefficient of determination (Adjusted  $R^2 = 0.418$ ) suggests that roughly 41.8% variance in students' achievements is explained by science quizzes, while the remaining variation is accredited to other factors not accounted in the model across Uganda, Lwengo District, government-aided secondary institutions. This implies that improvement in science quizzes is directly consistent with the corresponding improvement in students' achievements across Uganda, Lwengo District, government-aided secondary institutions. Consequently, to advance the achievements of students, there must be a corresponding modification in science quizzes across Lwengo District, government-aided secondary institutions, Uganda.

### Effect of Project Exhibitions on Students' Achievements in Government-Aided Secondary Schools in Lwengo District, Uganda

The investigation inspected the effect of project exhibitions on achievements of students across Lwengo District, government-aided secondary schools, Uganda and Table 4.3 displays results given.

**Table 4.3: Regression on the Effect of Project Exhibitions on Students' Achievements in Government-Aided Secondary Schools in Lwengo District, Uganda**

| Model Summary                                  |                     |                             |            |                           |                   |                            |
|------------------------------------------------|---------------------|-----------------------------|------------|---------------------------|-------------------|----------------------------|
| Model                                          |                     | R                           | R Square   |                           | Adjusted R Square | Std. Error of the Estimate |
| 1                                              |                     | .529 <sup>a</sup>           | .279       |                           | .264              | .39210                     |
| a. Predictors: (Constant), Project Exhibitions |                     |                             |            |                           |                   |                            |
| Coefficients <sup>a</sup>                      |                     |                             |            |                           |                   |                            |
| Model                                          |                     | Unstandardized Coefficients |            | Standardized Coefficients | t                 | Sig.                       |
|                                                |                     | B                           | Std. Error | Beta                      |                   |                            |
| 1                                              | (Constant)          | 1.684                       | .531       |                           | 3.175             | .000                       |
|                                                | Project Exhibitions | .535                        | .124       | .529                      | 4.313             | .000                       |
| a. Dependent Variable: Students' Achievements  |                     |                             |            |                           |                   |                            |

Source: Field Data (2026)

Table 4.3 findings specify that project exhibitions possess a robust meaningful and statistical substantial effect on achievements of students across Lwengo District, government-aided secondary schools, Uganda ( $\beta=.529$ ,  $p<0.05$ ). The regression findings specify that an increase of one unit in project exhibitions significantly results towards a .529 increase in achievements of students across Uganda, Lwengo District, government-aided secondary schools. The findings imply that in order to enhance the achievements of students, there must be a direct improvement in project exhibitions across Lwengo District, government-aided secondary institutions, Uganda.

The coefficient of determination (Adjusted  $R^2 = 0.264$ ) proposes that roughly 26.4% of the variations in students' achievements are explained by project exhibitions, while the remaining variations are accredited to other factors not accounted in the model across Uganda, Lwengo District, government-aided secondary institutions. This implies that improvement in project exhibitions is directly associated with the equivalent advancement in learners' achievements in Lwengo District, government-aided secondary schools, Uganda. Consequently, to enhance the students' achievements there must be the same tuning in project exhibitions in Uganda, Lwengo District, government-aided secondary institutions.

### Effect of Practical Experiments on Students' Achievements in Government-Aided Secondary Schools in Lwengo District, Uganda

The investigation inspected the effect of practical experiments on students' achievements in Lwengo District, government-aided secondary schools, Uganda and Table 4.4 displays the results.

**Table 4.4: Regression on the Effect of Practical Experiments on Students' Achievements in Government-Aided Secondary Schools in Lwengo District, Uganda**

| Model Summary                                    |                       |                   |                             |            |                           |                            |      |
|--------------------------------------------------|-----------------------|-------------------|-----------------------------|------------|---------------------------|----------------------------|------|
| Model                                            |                       | R                 | R Square                    |            | Adjusted R Square         | Std. Error of the Estimate |      |
| 1                                                |                       | .482 <sup>a</sup> | .232                        |            | .216                      | .40470                     |      |
| a. Predictors: (Constant), Practical Experiments |                       |                   |                             |            |                           |                            |      |
| Coefficients <sup>a</sup>                        |                       |                   |                             |            |                           |                            |      |
| Model                                            |                       |                   | Unstandardized Coefficients |            | Standardized Coefficients | t                          | Sig. |
|                                                  |                       |                   | B                           | Std. Error | Beta                      |                            |      |
| 1                                                | (Constant)            |                   | 2.796                       | .311       |                           | 8.993                      | .000 |
|                                                  | Practical Experiments |                   | .310                        | .081       | .482                      | 3.811                      | .000 |
| a. Dependent Variable: Students' Achievements    |                       |                   |                             |            |                           |                            |      |

**Source: Field Data (2026)**

Table 4.4 findings in specify that practical experiments possess a moderate meaningful and statistical substantial effect on the achievements of students' in Lwengo District, government-aided secondary schools, Uganda ( $\beta=.482$ ,  $p<0.05$ ). The regression findings demonstrate that an a rise of one unit in practical experiments significantly results towards a 0.482 increase in the achievements of learners across Lwengo District, government-aided secondary institutions, Uganda. The findings imply that in order to enhance the achievements of students, there must be a direct improvement in practical experiments in Lwengo District, government-aided secondary schools, Uganda.

The (Adjusted  $R^2 = 0.216$ ) coefficient of determination specifies that approximately 21.6% of the variations in students' achievements are explained by practical experiments, while the remaining variations is accredited to other factors not accounted in the model in Uganda, Lwengo District, government-aided secondary institutions. This implies that improvement in practical experiments is directly associated with resultant enhancement in students' achievements across Uganda, Lwengo District, government-aided secondary schools. Consequently, to enhance the students' achievements there must be a matching advancement in practical experiments in Uganda Lwengo District, government-aided secondary schools,.

## CONCLUSIONS

The investigation deduces that science fairs such as science quizzes, project exhibitions, and practical experiments have a considerable effect on the achievements of students across Lwengo District, government-aided secondary schools, Uganda whereby an enhancement in science fairs would significantly results towards an advancement in the achievements of students across Uganda, Lwengo District, government-aided secondary institutions.

## RECOMMENDATIONS

This investigation commends that schools must ensure that science fairs are focused on inquiry, not just competition emphasizing curiosity, problem-solving, and the scientific process rather than only winning, which would have a significant effect on students' achievements across Uganda, Lwengo District, government-aided secondary institutions.

The investigation also commends that schools must integrate science fairs into the curriculum instead of treating them as optional or extracurricular as they play a vital part towards influencing students' achievements in Uganda, Lwengo District, government-aided secondary institutions.

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