

Investigating learners' experiences and attitudes towards astronomy in the curriculum of Uganda: A case study of Kabale Municipality

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Abstract

Astronomy is the first natural science that is magnificently rich in concept. It is embedded in the various fields of modern 21st century; Science, Technology, Engineering and Mathematics (STEM). Slightly before the onset of Covid-19 pandemic (February 2020) in Uganda, the government rolled out the new lower secondary education curriculum (LSC). The aim of LSC was to equip learners with an enhancement skills training as opposed to the old curriculum, which was designed on colonial system. Interestingly, concepts on astronomy for beginners were included in the New LSC, but do learners have any experience in the content and how interested are they towards it. That is why this study investigated the learners' experience and attitudes towards Astronomy concepts. A total of 160 students from six secondary schools in Kabale Municipality (St. Marys' College-Rushoroza, Ndorwa Secondary School, Trinity College, Kabale Brainstorm High School, Rock High School, and Kigezi College-Butobere) were randomly sampled. A questionnaire-with carefully chosen set of questions was administered. Majority of the learners (67%) were found to have heard basic knowledge on astronomy, with 33% not conversant with astronomical concepts when first introduced in class. 81% of them were highly interested in Astronomy. Additionally, learners stated that they heard about astronomy from various sources like T.V programs, YouTube videos, among others; so to develop learners' astronomical knowledge, school takes the lead. Thus thorough facilitation in teaching of Astronomy and Astrophysics is required. We recommend Physics teachers to be given refresher courses and the scope of astronomy and astrophysics expanded.

Keywords: Astronomy; Attitude; Curriculum; Experiences; STEM

1. Introduction

Astronomy, over decades has had a significant impact on science in general and it is the first natural science that is magnificently rich in concept. It is deeply embedded in the various fields of modern 21st century; Science, Technology, Engineering and Mathematics (STEM). Its inclusion in a curriculum helps in acquisition of scientific knowledge through student participation and integration [1].

In most countries, astronomy content at secondary school level is basically the solar system. Salimpour [2] stated that topics in astronomy are found in the Earth and Space Science section with a few applicable standards in the physical science section in the USA National Science Education Standards, NSES [3]. Early secondary school (Ages 11-14) students build upon the skills they developed in elementary school. Consequently, this age group can use models to explain patterns of motion of the Sun, Moon, and stars. In addition, they view the Sun in the solar system as one of the billions of stars within the Milky Way galaxy. According to [4], astronomy concepts that are abstract in nature are taught at the upper secondary levels (Ages 15-18) as they require higher-level thinking. These students are to learn about the electromagnetic energy spectra and brightness of stars as it determines the composition of stars, their movements, and measurement of their distance from Earth.

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In Uganda, the new lower secondary curriculum was implemented in 2022 with reasonable content on astronomy and astrophysics. The astronomy content in the New LSC, begins from the analysis of earth formation stretching back to the Big Bang has some contents included. The content is found at senior two (S.2) and three (S.3) under the theme of "Earth and Space Science". This is broken into topics of: The Solar System at S.2 third term, Stars and Galaxies, Satellites and Communication at S.3 third term. However, there has always been a challenge of low attitudes towards astronomy and Space Science and science in general [5].

In the last 20 years, many authors were interested in studies about learners' attitudes towards science/ astronomy content [6], [7], [8]. For example, [8], stated that the main concern for conducting much of the research related to science attitudes was to find out possible answers for the decreasing number of students that prefer to study science. This decrease clearly indicates that over that period, students had developed negative attitudes towards science [9]. This means that if learners are to develop positive attitudes towards science, then it means to guide learners should be put in place earlier as concepts are introduced. It is for this reason that this study intended to analyze the learners attitude towards the newly introduced content on astronomy, astrophysics and space science in the new LSC.

2. Methods

This study is a survey model, which aimed at gaining understanding of opinions, motivation or attitudes of learners towards Astronomy. Consequently, in this study, majorly quantitative approach or technique (a type of survey research designs) was used in data collection. This provided deep insights into the problem and helped in developing ideas for potential quantitative research.

2.1. Population and Sample

Here, the target population of this study was the students and teachers in the Lower secondary from South-Western Uganda. The accessible population in this study was the Lower Secondary level learners from senior one and senior two to be specific, since the curriculum has been running for two years (from 2020, to the time of this study).

A sample space of 160 students was selected from six schools. This required that at least 28 students were chosen from each of the six schools purposely selected (for different reasons) within Kabale Municipality. The chosen schools were: St. Marys' College-Rushoroza, Ndorwa Secondary School, Trinity College Kabale, Kabale Brainstorm High School, Rock High School, and Kigezi College-Butobere. To be gender sensitive, 14 boys and 14 girls were sampled in the research process from every school from both senior one and senior two. In a particular class, participants were selected by grouping students into two main groups, that is the group of Boys and that of Girls, then seven (7) participants were picked from each of the two groups to make 14 participants. In other cases, an alternative approach was used where participants were randomly selected from a given class in a particular school.

2.2. Data collection Instruments and data analysis

2.2.1. Questionnaire

In order to study students' attitudes towards astronomy as a content of Physics in the New LSC, our questionnaire consisted of nine (9) questions, categorized into two (noting that the name for each category does not necessarily define the beliefs contained within the categories);

The first category of the two was, "*Experience*", which consisted of five (5) statements to assess students' experience in Astronomy so far.

The second category was, "*Interest*" which consisted of four (4) statements assessing the learners' interest in astronomy, which greatly influence their success and involvement at the Advanced level of their education.

2.2.2. Data Analysis

The data was analyzed using Statistical Package for Social Sciences, SPSS, also known as IBM SPSS Statistics, which greatly helped in analyzing the data statistically. The responses (answers) were presented on an *alternative scale*: The positive attitude was indicated by a "yes", "true", and "agree" while the negative answers were indicated by a "no", "false", and "disagree". Further, any positive response as was done by Bektaşlı Behzat [8] were coded positive response as "1" while negative response coded as "0", for instance, if the response was either a yes (true) or a no (false), then it was coded as "1" for yes (true) and "0" for no (false).

3. Results and Discussion

In this section we present the findings from students and teachers on astronomy education. The average ages of the respondents (students) were found to be 15 years. This is a rightful stage for students to make further choices in career. The schools were coded as “P” for St. Marys' College-Rushoroza, “Q” for Ndorwa Secondary School, “R” for Trinity College Kabale, “S” for Brainstorm High School, “T” for Rock High School, and “U” for Kigezi College-Butobere. The overall results were summarized in **Error! Reference source not found.**

Table 1 Learners' attitudes towards astronomy, by analyzing their experience and interest towards astronomy; statistics results for all the six schools sampled

	Number (%) of students' responses	
	Positive response	Negative response
Experience on Astronomy		
It is not my first time to hear about Astronomy	107 (66.9)	53 (33.1)
I heard about Astronomy: from my parents and friends	32 (20.0)	128 (80.0)
Seminar organized by the school	15 (9.4)	145 (90.6)
From a T.V program	75 (46.9)	85 (53.1)
From YouTube videos	37 (23.1)	123 (76.9)
From a website I visited one time	17 (10.6)	143 (89.4)
From a cultural gathering	09 (5.6)	151 (94.4)
I have ever observed the night sky using a telescope	09 (5.6)	151 (94.4)
I think the study of Astronomy is necessary to me as a young growing scientist	150 (93.8)	10 (6.2)
My school have ever organized a seminar in Astronomy	07 (4.4)	153 (95.6)
Interest towards astronomy		
I am highly interested in Astronomy	160 (100)	00 (00)
I would like to be taught Astronomy as a subject itself	98 (61.3)	62 (38.8)
Astronomy should have separate specialized teachers at Secondary Level	130 (81.2)	30 (18.8)
Astronomy should be examined separately by UNEB	106 (66.3)	54 (33.8)

3.1. Learners' experience in astronomy

The statistics of those students who said it was their first time to hear about astronomy (ref **Error! Reference source not found.**) were found to be approximately 70% of the 160 sampled students. It was interesting to find out that the 30% who knew about astronomy had used a variety of sources as indicated in the results. The analysis on the 160 sampled students basing on each of the different sources was plotted on a bar chart as in Figure 1.

It was noted that a greater percentage of students both boys and girls mentioned that they heard about astronomy from a T.V program (46.9%), followed by YouTube videos (23.1%). This is contributed because most learners these days have access to the internet and some T.V programs at their homes showing modern science and technology of which astronomy is inclusive. The variation of results from senior one (S.1) and two (S.2) is attributed to because S.1 spend much of their times watching T.Vs when home. In addition, they still have other experiences from primary level of education where brief introductory concepts of astronomy are shared.

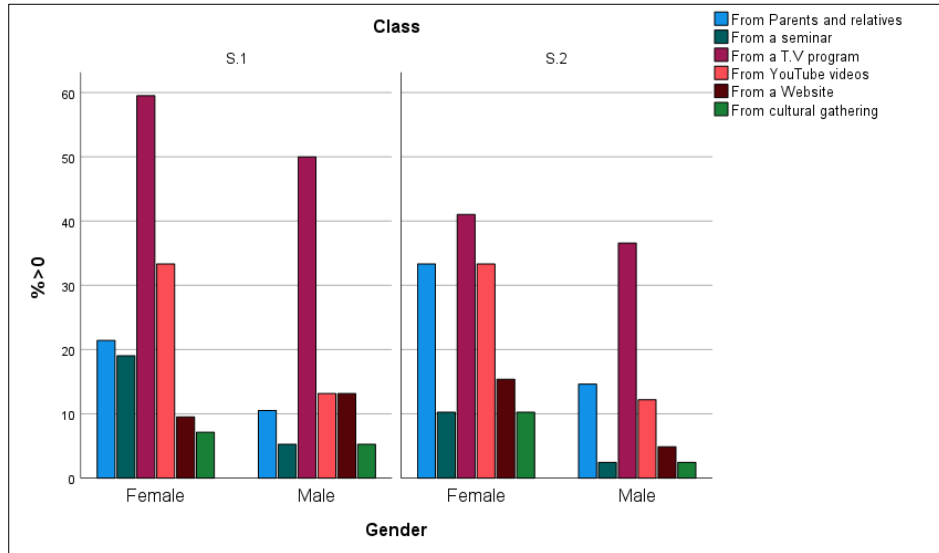


Figure 1 Other sources of astronomy information apart from school; results for S.1 and S.2 Male and Female: from parents and family (blue), seminar (dark green), T.V program (purple), YouTube videos (orange), website (indigo), and from a cultural gathering (green).

Further, from the graph, it was clearly identified that seminars (9.4%), websites (10.7%), and cultural gatherings (5.6%) contributed very low significance to learners' knowledge (experience) on astronomy. The results for seminar showed that most or almost all schools have never organized a seminar on astronomy for both students and teachers. This was proved when asked of whether their school have ever organized a seminar or not. Here, only 4.4% gave positive response and this clearly makes one conclude that no seminar has been held on astronomy in any of the sampled schools.

When asked whether they had ever observed the night sky using a telescope, very high percent (89.4%) of the sampled population gave negative response. The statistic bar in

Figure 2 showed that a cumulative (94.4%) percent; 46.4% and 47.9% for S.1 and S.2 respectively have never used a telescope in their school. This indicated that schools had no astronomy instruments/ equipment, and materials and thus the expertise to view the night sky.

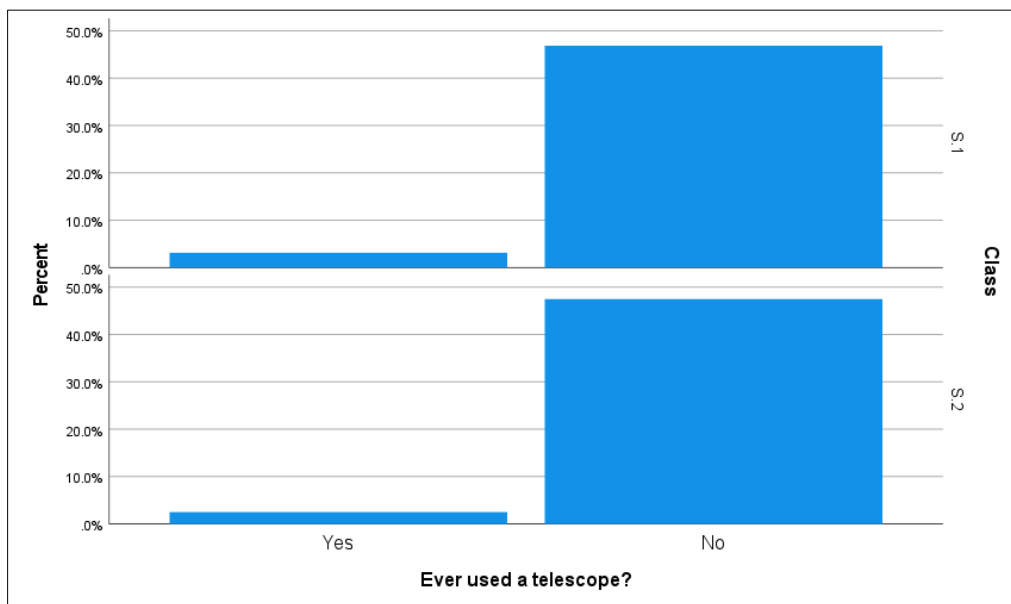


Figure 2 Students experience in the telescope usage: responses on whether students ever used a telescope in the classes sampled

Concerning the learners' view about astronomy, the statistics showed that most of the students (93.8%) stated that astronomy is a very good science to the young growing scientist in the 21st century. No significant change in responses was seen in the two different classes.

3.2. Learners' Interest in astronomy

This sub-section presents the result of learners' interest in astronomy. On trying to measure how they were interested, there was majorly three scale measure used, and these were; "Not interested", "Interested" and "Highly interested". The results were summarized on the chart in Figure 3. The percentage of those who stated that they were highly interested dominated the results. We can observe that almost every student is interested, though others were not highly interested.

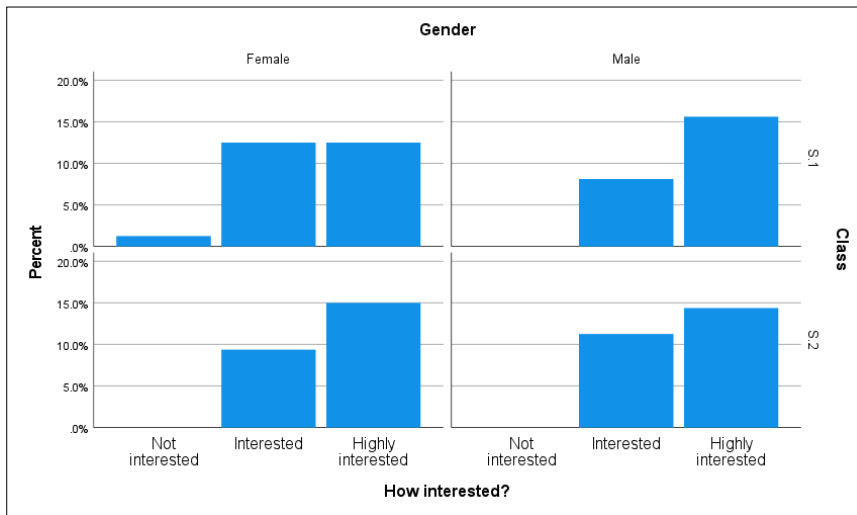


Figure 3 Learners' interest in astronomy for both male and female gender in senior one and two.

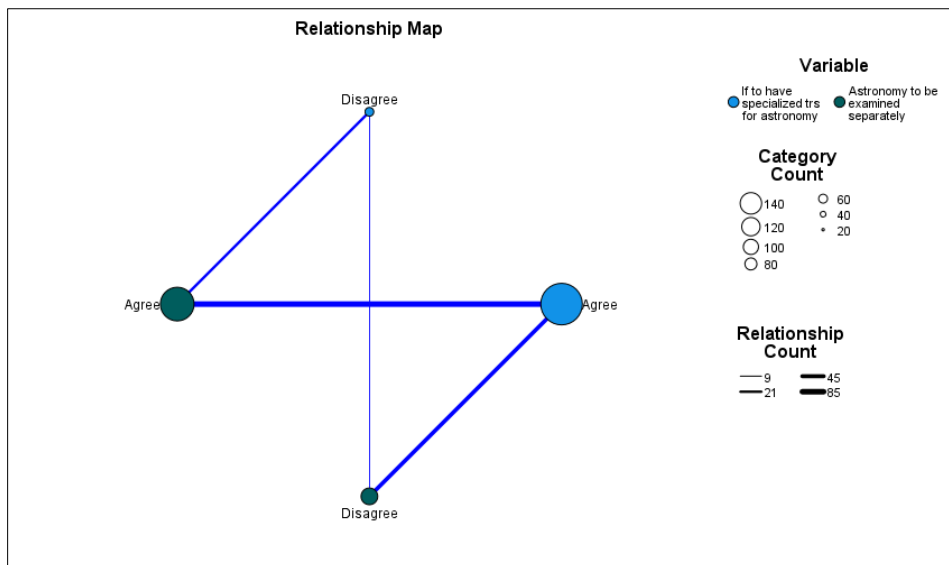


Figure 4 The relationship between learners' quest for specialized teachers in astronomy, and astronomy being examined separately by Uganda National Examination Board (UNEB).

When asked on how to be taught astronomy, the results showed that 61.3% of the sample students wanted astronomy to be taught as a subject itself. It also showed that 81.2% of learners wanted astronomy to have specialized teachers other than the Physics teachers in the service. The analysis of the relationship that exists between the learner's quest for specialized astronomy teachers and astronomy being examined separately by UNEB is shown in Figure 4. The Category count clearly shows that greater percentage of students "agreed" in both cases respectively, indicated by the big colored circles. In addition, the blue colored lines represented the Relationship Count. The highest count was seen between agreeing in both the two variables and the least count was seen between disagreeing in all the two cases. This result therefore shows that learners are highly interested in astronomy to the extent that they want it to have specialized teachers, and also to be examined separately by the examining body in Uganda, the Uganda National Examination Board (UNEB).

4. Discussion

Developing positive attitudes plays an important role on students' achievement [10]. Attitudes are hard to change, however the results of Bektasli's study showed that students' attitudes toward astronomy could change significantly even after a semester long astronomy class [8]. In the definition of attitude; Cognitive, affective, and behavioral components were presented by [11], [10], and [12], where the cognitive component is related to knowledge and beliefs. If students develop positive attitudes toward science, they might be more likely to prefer studying science in the future [8].

In this study, positive attitudes of learners towards astronomy were witnessed with a percentage of as high as 81%. Learners generally have high interest in this content though with little experience they have so far. This was in line with the findings of Osborne [6], and [8], where Bektasli for example, mentioned that if learners are to develop positive attitudes towards science, then it means learners' guidance should be adopted earlier as concepts are introduced.

5. Conclusions and Recommendation

In this study, we have analyzed learners' attitudes, experience and interest towards astronomy. Learners' experiences in Astronomy content greatly contribute to the level of interest a learner may have towards astronomy. Leaving school as an exception, different sources such as Televisions, YouTube videos, and websites, among others are major contributors to the learner's interest in astronomy. It was revealed that learners would like to be taught astronomy as a separate subject, with specific specialized teachers. We therefore recommend that in future, instructors (Physics teachers) be given refresher courses with a deep scope of astronomy and astrophysics. Organize workshops on astronomy by schools, providing wireless internet (Wi-Fi), computer laboratory to enhance research, facilitating teachers and students to carry out simple astronomy related research projects. This study can be carried out in different regions of the country, apart from South-Western Uganda- Kabale Municipality and in such a study a wider sample size should be considered.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

Authors declare the absence of conflict-of-interest statement.

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