

**Impact of Students' Learning Styles on their Performance in Chemistry in Iringa Municipal
Community Secondary Schools**

Itika Mwakilasa

Ruaha Catholic University

Email: itikamwakilasa@gmail.com

and

Kristofa Zulu Nyoni

Ruaha Catholic University

Email: mazulukris@gmail.com

Abstract

This article investigated the impact of students' learning styles on their performance in Chemistry in Iringa Municipal community secondary schools. A mixed method research approach was employed to 141 participants, of whom; there were 15 Chemistry teachers, 6 academic masters/mistresses, and 120 students. Data were gathered through interviews and questionnaires. Content analysis was used to analyse qualitative data, while Pearson Correlation was used to analyse quantitative data. The findings revealed that students frequently used verbal, visual, active, and sensitive learning styles while studying. The identified students' learning styles allow students to easily absorb content while also acquiring knowledge. The findings also revealed that there is no perfect student learning style because each learning style has its own set of strengths and weaknesses. Chemistry teachers are recommended to use a variety of teaching approaches during the teaching and learning process to ensure that each student acquires the necessary knowledge.

Keywords: *Chemistry Teachers, Community Secondary Schools, Performance, Students' Learning Styles*

1.0 Introduction

In her teaching profession, the researcher has witnessed this. With over fifteen years of experience, she has noticed that many students do not perform well in chemistry in form two national examinations. As a result, most students in form three and four did not study Chemistry.

However, Tanzania hopes to improve access to high-quality secondary education in general, and science education in particular. Several policy documents demonstrate this, including Education for Self-Reliance (ESR) 1967, Musoma Resolution 1974, Education and Training Policy (ETP) 1995, Education Sector Development Plan (ESDP) 1997, and Secondary Education Development Programme (SEDP I and II). Through SEDP, Tanzania wished to improve science teaching by upgrading school infrastructures, such as laboratories and classrooms.

Despite the optimistic desire to improve science teaching and learning in Tanzanian secondary schools have, empirical evidence indicates a state of poor performance in science subjects in

community secondary schools. There are several factors that contribute to such a bleak state of performance. Poorly resourced schools, large classes, a lack of laboratories, a shortage of qualified teachers, and inadequate teacher education programmes are examples of such factors. Teachers are also hesitant to use learner-centered teaching methods, with the majority of teachers being untrained in better learning strategies (Malima, 2018; Makoro, 2020; Michael, 2015). Mligo (2018) cites a lack of parental support for educational issues as a contributing factor to poor performance in community secondary schools. The majority of the preceding studies addressed what Ha (2021) refers to as objective factors (teacher competencies, school facilities, and peer influence) and control factors (gender, region, input, and financial conditions). However, the studies mentioned above are silent on subjective factors such as students' learning styles.

On the other hand, there is literature that supports the impact of learning styles on students' academic achievement (Ha, 2021; Zhang, 2017; Shamsul, Muhadizir & Kamsani, 2014; Kessy, 2019; Bhat, 2014 & Abuge, 2021). According to Anual et al. (2017), a number of studies have investigated the relationship between learning style and academic performance in various disciplines (Abuge, 2021; Bosman & Schulze, 2018; Ha, 2021; Jahanbakhsh, 2012). Such an array of studies demonstrating a strong relationship between students' learning styles and academic achievement clearly demonstrates how students' learning styles are the primary determinant factor for effective student learning. Because of this, learning style theory and practise have continued to gain traction among educators and the general public since the late twentieth century (Zhang, 2017).

Aside from the fact that the majority of available studies show a positive relationship between students' learning styles and academic performance, there are few studies that specifically focus on the influence of learning styles on academic performance of higher achieving students and lower achieving students in science subjects at large and Chemistry in secondary schools particularly (Kim, 2011; Ihrig, 2017; Fries-Britt, 2010; Green & Owo, 2021; Mubashira, Mumtaz & Mubashira et al. 2017).

Salam et al. (2020) conducted research on learning styles and English language achievement. Ihrig (2017) conducted research in economically disadvantaged rural schools as part of a STEM (Science, Technology, Engineering, and Mathematics) project. Fries-Britt (2010) examined Physics lessons from high-achieving students. Godwin and Bassey (2013) investigated the effect of learning styles (active/reflective, sensing/intuitive, visual/verbal, and sequential/global) and teaching strategies (guided inquiry, demonstration, and lecture) on students' achievement in Biology in another study conducted in Nigeria. Schulze and Bosman (2018) investigated the interrelationships between mathematics achievement and learning styles of high and low achievers in secondary school in South Africa.

Few studies on learning styles have been conducted in Tanzania, for example, Kessy (2019) and Mbalamula (2017). Such studies focused on university students' learning styles; for example,

Mbalamula (2017) investigated undergraduate students' learning styles and the extent to which lecture pedagogy complemented students' learning in inclusive lecture rooms. Kessy (2019) evaluated the effectiveness of various types of multimedia-enhanced instructional materials among students with varying learning styles and abilities. All of the above critically reviewed empirical sources show that there are numerous sources on the relationship between students' learning styles and academic achievement in various subjects at various levels of education. However, this is not done exhaustively in Tanzania, particularly in community secondary schools with a focus on science subjects, specifically Chemistry.

Despite the fact that secondary schools in Tanzania face challenges that impede students' performance in science subjects, it has been observed that some secondary school students perform well in science subjects, overcoming the effects of objective factors. What remained unknown, and what prompted the current study, is how students' learning styles influence their academic performance. What is unclear is whether or not students' learning styles have a significant impact on their academic performance in Chemistry.

The study sought to investigate the impact of students' learning styles on differences in Chemistry performance at secondary schools. The preceding goal was met by responding to the following two specific questions:

- i. What are the common learning styles used by students in learning Chemistry?
- ii. What impact do students' Learning Styles have on their performance in Chemistry?

2.0. Materials and Methods

The pragmatic paradigm was used in the study for its ability to incorporate elements from both the post-positivism and constructivism paradigms. This study used a descriptive correlational research design, which allowed the researcher to explain the relationship between two or more variables without focusing on causal relationships or variable manipulation, instead collecting and analysing data to determine whether or not there is a link between them (Creswell, 2012).

The study used a mixed method research approach to collect numerical data as well as detailed information from respondents about the impact of students' learning on their performance total of 15 Chemistry teachers, 6 academic masters/mistresses, and 120 students participated in the study. The researcher decided to include the mentioned sample because they have constant interaction in the school context and are interested in learning more about this study. Purposive sampling was used to obtain Chemistry subject teachers, and stratified random sampling was used to select community schools and students from selected secondary schools in Iringa municipality.

Interviews and questionnaires were used to collect data. Teachers' data was gathered through interviews, while students' data was gathered through questionnaires. Felder and Silverman's Index

of Learning Styles (ILS) questionnaire was used in the study. In terms of data analysis, qualitative data were examined using content analysis, whereas quantitative data were examined descriptively.

3.0 Results and Discussion

This section presents the study's findings, which were guided by two questions: What are the common learning styles used by students in learning Chemistry? What impact do students' Learning Styles have on their performance in Chemistry?

The study used the Index of Learning Styles (ILS) questionnaire developed by Felder and Silverman to determine the learning styles used by Chemistry students in Iringa Community Secondary Schools. With this index, students were asked to indicate their preferred learning style when studying Chemistry. The rated items were further classified and presented according to the Felder-Silverman model's learning styles, which are verbal, visual, sensitive, intuitive, active, and global learning styles. The results are presented hereunder.

Table 1: Students' Use of Different Learning Styles in Studying Chemistry

Statements	N	Agree	Neutral	Disagree	Ran k	Mean
<i>A. Students' use of Verbal learning style</i>						
Learning something new through talking	120	70(58.3%)	15(12.5%)	34(28.2%)	1	2.90
Through written directions and verbal communications	119	71(59.7%)	32(26.9%)	16(13.4%)	2	2.88
Written directive to direct to new place	120	47(39.2%)	41(34.2%)	32(26.6%)	3	2.81
Focus on written text in a book with pictures and charts	118	82(69.4%)	17(14.4%)	19(16.1%)	4	2.80
Direction through maps in a new place	114	89(78.3%)	17(14.8%)	8(6.9%)	5	2.78
Average		60.98%	20.56%	18.24%		2.83
<i>B. Students' use of Visual Learning Style</i>						
Preferring data through chats or graphs	120	76(63.3%)	25(20.8%)	19(15.9%)	1	3.19
Getting information in pictures, diagram and maps	120	75(62.5%)	22(18.3%)	23(19.2%)	2	2.34
Remembering when I see	120	83(69.1%)	20(16.7%)	17(14.1%)	3	2.26
Diagrams on the board	114	89(78.3%)	17(14.8%)	8(6.9%)	4	2.14

Average		68.3%	17.7%	14.03%		2.48
<i>C. Students' use of Sensitive Learning Style</i>						
Being listener in a group discussion	120	58(48.3%)	9(7.5%)	53(44.2%)	1	3.97
It easier to learn from facts	118	69(58.5%)	29(24.5%)	20(17%)	2	3.19
Work my way to the solution one step at a time when solving math problems	118	68(58.4%)	19(15.8%)	31(25.8%)	3	2.78
Learn better when material is presented in a clear sequence order	120	70(58.3%)	36(30%)	14(11.7%)	4	2.43
Learn better when having overall picture of materials related with another subject	120	76(60.9%)	28(23.3%)	16(15.6%)	5	2.41
Average		56.88%	20.22%	22.86%		2.97
<i>E. Students' use of Intuitive Learning Style</i>						
Knowing how the part fits in after understanding the whole thing	119	62(52.1%)	27(22.7%)	30(25.2%)	2	2.77
Prefer to study alone	120	45(37.5%)	42(35%)	33(27.2%)	1	3.11
Creativity to work	119	79(66.4%)	30(25.2%)	10(8.4%)	4	2.25
Preferring courses that emphasize abstract materials	115	40(34.8%)	34(29.6%)	41(35.7%)	3	2.73
Average		47.7%	28.13%	24.13%		2.72
<i>F. Students' use of Active Learning Style</i>						
Contributing ideas in group discussion	118	79(66.95%)	8(6.7%)	31(26.27%)	1	2.34
Prefer to make connection between new subject with related subject	120	72(65%)	37(30.8%)	11(9.2%)	2	2.08
Average		65.98%	18.75%	17.74%		2.21
<i>G. Students' use of Global Learning Style</i>						
Understanding all parts, understand the whole thing	118	48(40.6%)	25(21.2%)	45(38.1%)	2.88	
Average		40.6%	21.2%	38.1%	2.88	

Findings presented in Table 1 indicate that almost all learning styles proposed by Felder and Silverman are used by students studying Chemistry in community secondary schools. Furthermore, findings reveal that amongst eight learning styles proposed, only six were found to be used by

students to varying degrees of usage, with the majority of them (4) more commonly used as most students indicated agreement on the statement related to such styles of learning. These were: Visual Learning Style, Active Learning Style, Verbal Learning Style, and Sensitive Learning Style, with agreed responses of 68.3%, 65.98%, 60.98%, and 56.88%, respectively. However, the remaining two learning styles, Intuitive Learning and Global Learning, were not widely used by students, with less than half of students agreeing to use them in community secondary schools when studying Chemistry. The two had 47.7% and 40.6% agreement, respectively. This finding, in which the number of students using these learning styles was insignificant, was further supported by the majority support of students 38.1% disagreeing on statements related to the use of the style.

Aside from student responses, the study sought to learn about teachers' perspectives on students' learning styles when studying Chemistry. This was accomplished by interviewing 15 Chemistry teachers from the six schools studied. Teachers were asked in interviews to identify common learning styles used by students while studying Chemistry. Teachers' findings were as follows: Twelve of the fifteen teachers, or 80%, stated that students prefer to use different learning styles when studying Chemistry; the most common styles are verbal, sensitive, active, and visual learning styles.

Furthermore, they stated various methods teachers use in identifying their students' learning styles, with approximately 80% stating that they normally identify their students' learning styles through observation, asking individual students on the learning styles they prefer the most. The majority support for the aforementioned learning styles is clearly indicated by the following Chemistry teachers' opinions. For example, three teachers from different schools said on different occasions: *Most of my students prefer to learn better through noting down important information from whatever they hear or any written information. I find these students as verbal learners* (Interview with Teacher₃, School D: 12/07/2023).

Another Chemistry teacher from a different school had the following to say about students' learning styles when studying Chemistry:

Some students learn best by doing, you always find them actively in hands-on activities including practical, and they also actively engage in discussions or explaining things to others (Interview with Teacher₁, School B: 06/07/2023).

Not only that, another Chemistry teacher had this to say based on styles used by students in studying Chemistry:

My students prefer learning by performing a given task practically or by using their hands like performing an experiment in the laboratory (Interview with Teacher₂, School C: 10/07/2023).

In addition, one Chemistry teacher during the interview had this to say regarding visual learning:

Some visual learners learn easily when the lesson involves some diagrams, charts and pictures but they face difficult in learning when the lesson involves only text and speech.

(Interview with Teacher₂, School A: 06/07/2023).

In general, the findings from both students and teachers regarding the learning styles used by students in Chemistry study revealed that visual, active, verbal, and sensitive learning styles are the most preferred learning styles used by students in studying Chemistry in Community Secondary schools. These findings were supported by Dunn and Dunn (1979), who investigated learning styles/teaching and discovered that visual learners prefer to organise information and learn better by visualising objects in their minds.

Furthermore, the Felder-Silverman learning style model/theory (1988) supported these findings by stating that people differ in the way they learn and their learning-style preferences, and such preferences differ significantly from individual to individual. As a result, students have always adopted various learning styles such as active, sensitive, intuitive, visual, verbal, and global.

However, the above findings, in which the majority of respondents (both teachers and students) identified verbal, visual, sensitive, and active learning styles as the most commonly used by students in community secondary schools, contradict with the findings of Godwin and Bassey (2013). While the current study found a low percentage of students using intuitive learning styles, Godwin and Bassey (2013) discovered that students preferred intuitive learning to learn abstract learning material such as theories and their underlying meanings.

Bosman and Schulze (2018) discovered that secondary school students used a variety of learning styles, including competitive, collaborative, independent, avoidant, and participant, but these learning styles differ from what was discovered in the current study. Based on the findings, Chemistry students in community secondary schools use a variety of learning styles including visual, verbal, sensitive, and active global learning styles. As a result, it is the role of Chemistry teachers to embrace teaching approaches that accommodate learners with diverse learning styles in their instruction. This is due to differences in how students receive and process information.

3.1 The Impact of Students' Learning Style on Students' Differences in Performing Chemistry Subject at Secondary schools

The second question sought to determine the impact of such learning styles on students' academic performance in the chemistry subject after realising the forms of students' learning styles used by students in studying Chemistry in community secondary schools in Iringa. To accomplish this, Chemistry teachers were interviewed and asked to indicate what they thought the impacts of students' learning styles were on students' academic performance in Chemistry. Teachers' responses revealed that different learning styles have an impact on students' learning and performance in the

Chemistry subject in both positive and negative ways. Some interviewed teachers, for example, had the following to say about the significance of learning styles:

Students prefer group discussion, because it helps them to understand Chemistry subject better as they tend to share ideas, experience and enable students to eliminate some ambiguities that might rise in their private studies. Some students rely on discussion with other students without arranging their private time for studying. Such students are advised to arrange well their timetable for private studying so as to have enough time to grasp what have been acquired during group discussion (Interview with Teacher₂, School E: 13/07/2023).

This response implies that the students prefer an active learning style. Another respondent had this to say about the impact of students' learning styles on their Chemistry performance.

Some students prefer studying alone, because it helps them to focus more on what they have learnt from the class or what they have been discussing with their fellow students. (Interview with Teacher₃, School F: 14/07/2023).

Not only that but another interviewed Chemistry teacher had this to say about the impact of students' learning styles on their Chemistry performance:

Visual learners recall information easily when they see diagrams, colour or pictures, they easily make some references with what they see in different environments. This improves their understanding which results into better performance. However, when teachers fail to use visual aids, students fail to comprehend what is being taught and thus fail to perform better. Visual learning style can sometimes not work especially to some topics that do not allow the use of visual objects rather than making assumptions (Interview with Teacher₁, School B: 06/07/2023).

Apart from visual learning style, Chemistry teachers had comments about verbal leaning style as it contributes on performance of Chemistry subject:

Verbal learning style usually help learners to assimilate and retain information even in absence of texting, diagrams and teacher since it allows student to receive the taught information wherever they are, this also enable learners to recall easily because they sometimes use the vocabulary that that can be easily remembered by themselves. However, when teachers use other methods that do not allow students to take some notes on their own, verbal learners experience difficulties in learning since they to acquire the required knowledge which obviously lead to poor performance and the opposite is true (Interview with Teacher₁, School F: 14/07/2023).

With regard to the contribution of leaning styles on students' performance on Chemistry subject, another respondent had this to say about sensitive learning style:

Sensitive learning style enable learners to practice and make observations by using their naked eye, this helped them to recall the information easily since they eliminate the ambiguity that might arise in discussions or text. However, sensitive learners experience difficulty in learning when their learning process do not involve practical works although this learning style requires enough time, space and resources and they delay the completion of topics (Interview with Teacher₂, School B: 06/07/2023).

According to the presented quotations, students' learning styles influence their performance in various ways. Because students study in a variety of ways, they can easily understand the subject content. Not only does learning style help students participate actively in the lesson, which enhances their learning, but it also helps students develop a sense of belonging from what they have learned. Furthermore, the findings have revealed that students' learning styles help learners assimilate and retain information even when the teacher is not present, allowing for easy recall of what they have leaned.

Teaching and learning processes that result in improved performance in the mentioned subject. This indicates that learning style always has a contribution to student performance in Chemistry study because it depends on how much that student masters his or her learning style to the extent that he or she can implement it in all types of learning environments so that they are not affected in their process of studying.

The findings are supported by a study conducted in the Philippines by Magulod (2019), which examined the learning style preferences, study habits, and level of academic achievement of students enrolled in applied science courses at one of the higher learning institutions. The study also found that students who preferred visual, group, and kinesthetic learning styles performed well academically. Furthermore, Ha (2021) funded this research. A study was carried out in Vietnam to investigate the relationship between learning styles and academic achievement in Physics among high school students. The findings imply that different learning styles, in conjunction with a learning environment, can significantly contribute to students' academic achievement.

4.0 Conclusion and Recommendations

Based on the above findings, the following conclusions were made: Students in community secondary schools use a variety of learning styles, including visual, verbal, sensitive, and active global learning styles. Some learning styles, such as intuitive and global learning styles, have been found to be less preferred by students. As a result, it is the responsibility of Chemistry teachers to embrace teaching approaches that accommodate learners with diverse learning styles in their instruction. This is due to differences in how students receive and process information. On the other

hand, the findings suggest that different learning styles preferred by students have an impact on their overall learning and performance in particular. The following recommendations were made based on the research findings and conclusion.

First, teachers must consider their students' diverse learning styles, design instructional methods that accommodate those differences, and remain sensitive to such during the instructional process. Teachers should also assist their students in understanding their learning style preferences and using them to develop life-long learners. On the other hand, at the school level, students should be given the opportunity to provide their opinion on which learning style they believe is more beneficial to them in order to ensure that they are taught in a suitable learning style that will help them understand the lesson and perform better in the chemistry subject.

Second, the government should hire enough well-trained Chemistry teachers to have an impact on students' learning while taking into account students' learning styles. In contrast, schools will continue to have few teachers, making it difficult to consider each student's learning style in class. Tanzania's government should also take steps to train Chemistry teachers, students, and education stakeholders in developing agreed-upon learning styles for use in teaching Chemistry.

Finally, the article suggests further research on the topic of learning styles, for instance, studying learning styles in all science subjects.

REFERENCES

- Abuge, D. (2021). Learners' cognitive style and senior secondary school Students' Achievement in Mathematics in Bayelsa State, Nigeria. *International Journal of Innovative Social & Science Education Research*, 9(3), 36–45.
- Bhat, M.A. (2014). Understanding the learning styles and influence on teaching and learning process. *International Journal of Education and Psychological Research*, 3(1), 14–21.
- Bosman, A., & Schulze, S. (2018). Learning style preferences and Mathematics achievement of secondary school learners. *South African Journal of Education*, 38(1)1–8.
- Creswell, J. W., & Clark, V. L. P. (2011). *Designing and Conducting Mixed Methods Research*. California: SAGE Publications Inc.
- Dunn, R., & Dunn, K. J. (1979). *Learning style inventory (Modified) Hand out in EDU 745*. Master in Divergent Learning program, Columbia College, Columbia Sc.
- Dunn, R. (1990). Rita Dunn answers question on learning styles. *Educational leadership*, 48(3), 15–19.

- Felder, R. M., & Silverman, L. K (1988). Learning and teaching styles in Engineering education *Engineering Education*, 78(7), 674–681.
- Fries-Britt, S. Y. (2010). Lessons from high-achieving students of color in physics. *Wiley Online Library*, 2(148), 75–83.
- Godwin, I. A., & Basse, I. U. (2013). The Influence of Learning Style and Teaching Strategies on Students' academic Achievements in Biology. *Voice of Research*, 1 (4), 5–13.
- Green, B., & Owo, W. J. (2021). The blended learning technique and lecture method on students' academic achievement in Basic Science in Junior Secondary Schools in Obio/Akpor LGA Rivers State. *Faculty of Natural and Applied Sciences Journal of Mathematics and Science Education*, 3(1), 56–71.
- Ha, N. (2021). Effects of learning style on students achievement: experimental research. *Linguistics and Culture Review*, 5(S3), 329–339.
- Ihrig, L. E. (2017). STEM Excellence and leadership program: Increasing the level of STEM challenge and engagement for high-achieving students in economically disadvantaged rural communities. *Journal for Education of the Gifted*, 41(1), 1–8.
- Jahanbakhsh, R. (2012). Learning style and academic achievement: A case study of Iranian high schoolgirls' students. *Procedia-Social and Behavioural Sciences*, 51, 1030–1034.
- Kessy, Y. (2019). *The relationship between multimedia technologies, students' learning styles, and academic performance*. Munich: GRIN Verlag.
- Kim, M. (2011). The relationship between style differences and career choices for high-achieving students. *Roepers Review*, 33(4), 252–262.
- Magulod, Jr, G. (2019). Learning styles, study habits and academic performance of Filipino University students in applied science courses: Implications for instruction. *Journal of Technology and Science Education*, 9(2), 184–198.
- Mbalamula, Y. (2017). Complementing lecturing as teaching pedagogy and students' learning styles in universities in Tanzania: State of issues. *Educational Research and Reviews*, 12(13), 653–659.

- Mubashira, K., Mumtaz, A., & Aroona, H. (2017). Teaching styles of secondary school English teachers and learning styles of their students and relationship of teaching learning style match with students' achievement. *Bulletin of Education and Research*, 39(3), 203–220.
- Salam, U., Sukarti, J., & Arifin, Z. (2020). An analysis of learning styles and learning strategies used by a successful language learner. *Journal of English Teaching*, 6(2), 111–121.
- Zhang., Quan., Y, Huang., L., & Kuo, Y. (2017). The impact of learning styles on academic achievement. *International Journal of Intelligent Technologies and Applied Statistics*, 10(3), 173–185.