MOTIVATION AND ATTITUDE TOWARDS LEARNING CHEMISTRY

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ABESTRACT

The purpose of this study is to investigate the relationship between attitudes and motivations of first year Biology and Chemistry students to learn chemistry. The study adopted co relational research design. A total of 155 first year biology and chemistry students (95 first year Biology and 60 Chemistry students) taking chemistry in the second semester of 2017/2018 at Dire University, Ethiopia, were involved in this study. Data for this study were collected using Attitude Inventory Test and the Achievement Motivation Scale. Data were analyzed using Statistical Package for Social Science (SPSS) version 21. The results show that there is no statistically significant difference between biology and chemistry students in their attitudes and motivation towards learning chemistry. Furthermore, there is no a statistically significant relationship between attitudes and motivation of these students towards learning chemistry (i.e. there is negligible degree of relationship between attitude and motivation to learn chemistry). The relationship between attitude and motivation might be due to chance. On the basis of the results of this study, it can be concluded that there is no statistically significant relationship between attitude towards chemistry and the motivation to learn chemistry. The results did not support the expectation that there is a statistically significant relationship between attitude towards a given domain of science and the motivation to learn it. Therefore, teachers must help students comprehend basic facts, principles, concepts and theories and should encourage them apply these to solve chemistry problems and enhance the motivation. This would improve students' ability to answer difficult chemistry questions which might appear every examination. *[African Journal of Chemical Education—AJCE 9(2), July 2019]*

INTRODUCTION

Chemistry enables students to provide explanations for almost all natural phenomena they encounter in their daily life or school laboratories [44]. It's also a requirement to study pharmacy, medicine, pharmacy, environmental science, chemical engineering, geology, biology, agriculture and others so on [7, 13]. Generally, chemistry affects all aspects of human life and help people in making decisions in areas such as health, environmental conservation (environmental care and love), dietary intake (starch, carbohydrates, fats, vitamins) and food choices which are directly related to their daily life and affect the quality of their lives. However, studies have shown that the majority of students at secondary school perceived chemistry as a difficult subject and this perception become more evasive when they reach university. Numerous studies have shown that there is a gradual decreasing attitudes of students towards chemistry as subject of study (or loss of interest in the subject) and motivation to learn chemistry as students move from lower secondary school to higher educational institutions [33, 39]. These studies affirmed that the decline in attitudes and motivation is accompanied by feelings of dreaded, boredom, rejection, and experiences of failure, which have been a concern of many educators and researchers for decades. Therefore, the issue of students' attitudes towards chemistry and motivation to learn became an international concern because the decline in attitudes and motivation towards chemistry learning has a direct influence on the understanding of key concepts associated with the discipline, and consequently on school achievement [8, 29, 45].

Although numerous studies have been conducted to examine the effect of attitudes and motivation on students' achievement in chemistry as well as on factors that affect the attitudes and motivation of students towards chemistry, the extent to which the attitudes of students towards science change with their motivation to learn science (chemistry) are not yet to be empirically

examined well. Most of the studies conducted so far have been focused on the influence of attitudes towards chemistry and motivation on students' achievement in chemistry. The majority of research studies on the students' attitudes towards chemistry and motivation to learn have been mostly restricted to the investigation of the effect of attitude and motivation on achievement as well as the effect of attitude on motivation but not on the degree of relationship between motivation and attitude. What is not yet clear is the correlation between attitude towards chemistry and motivation to learn it.

To the best knowledge of the researchers, there has been little or no systematic study aimed directly at exploring the correlation between attitudes of students towards chemistry as a subject of study and motivation to learn chemistry yet. Therefore, the main purpose of this study is to explore the correlation between attitude toward chemistry as subject of study and motivation to learning chemistry. So, this study seeks to address the following questions :(1) what is the attitudes and motivations of first year biology and chemistry students towards learning chemistry? (2) Is there a significant difference between attitudes of first year chemistry and biology students towards chemistry and their motivation to learn chemistry? And (3) Is there a correlation between attitudes and motivation of first year chemistry and biology students towards chemistry?

Students' Attitude towards Learning

Attitudes are defined by [2] as learned tendencies towards content of science or other subjects, people, situations, institutions and certain objects. He asserted that like effective teaching method, attitudes influence meaningful learning of science. Several studies have revealed that students develop a learned disposition to respond in a consistently favorable or unfavorable manner with respect to a given subject or attitude object and this disposition is term in literature attitude

[11, 17, 36]. The attitude object can be subjects taught in school such chemistry, biology, and physics and attitude denotes interest or feelings towards studying these subjects.

Attitude encompasses three components, namely: the cognitive, the affective, and the behavioral components [11, 17, 28]. Evidences show that positive attitudes towards learning chemistry is among the key factors that foster the development of students' knowledge and understanding of chemistry concepts and improve their motivation to learn it [42, 51]. He claimed that students who have negative attitudes towards chemistry have also low motives to learn it. For instance, positive attitude towards learning chemistry would be associated with evidence of motivated behavior and foster their capability to recognize chemical and define key concepts, identify important scientific questions, use their understanding of chemical concepts to explain phenomena, use their knowledge in chemistry to read a short article, or analyze information provided in commercial advertisement or internet resources while a negative change was linked to less motivated behavior [36, 42].

Despite the importance of favorable attitudes and motivation for effective learning of science, studies have proven that the favorable attitudes and motivations of students that arise at early age do not remain constant throughout their schooling [46]. They asserted that students at middle high school are not well disposed to study chemistry and have low motives compared to those at lower level and this situation becomes more frustrating when they reached upper secondary schools and Universities. This study revealed that considerable number of students have negative attitudes towards chemistry and low motives to learn it which in turn results in their poor performance or achievement in chemistry.

According to [44], many students have poor attitudes towards chemistry and there is a gradual decline in their motivation to learn it. He asserted that a large proportion of students even

did not notice the relation of chemistry to their daily life which worsens the situation. This decline in attitudes towards chemistry as subject of study and motivation to learn it has been considered as among the main factors that results in poor performance or achievement of students in chemistry.

Several studies have been explored that factors found to be influencing attitudes of students towards science. These factors include: relevance of the subject to the field of study, relevance of curriculum to students' daily life, poor teaching and assessment methods, career interest, the type of science courses taken (content difficulties, for example, abstract nature of chemistry), lack of ICT support for teaching, influence of family on students, social implication of chemistry gender, motivation, attitude of society towards science, teachers ability to relate their lesson to the daily life experiences of students, prior knowledge, cognitive styles of students, social implications of science, thinking that chemistry is not related to daily life, classroom behaviors of teachers, and achievement others [9, 13, 41, 50].

Students 'Motivation towards Learning

The motivation of students can be external or internal (intrinsic). Extrinsic or external motivation generally comprised of recognition and praise for good work or well done assignment in a given subject while internal or intrinsic motivation encompasses an internal desire to learn about specific science topic or do a particular assignment [47]. These researchers contended that intrinsically motivated student process information more deeply, achieve higher scores and showed more persistence than those who are extrinsically motivated. According to, motivation is one of the most important factors influencing success or failure of students in their learning.

Generally, motivation, attitude and anxiety are essential affective factors that have significant influence in the realization of students learning [49]. Therefore, he recommended that teachers must know the degrees to which their students' are motivated to learn a given scientific content or concept in advance.

The relation between motivation and attitudes has been considered as a prime concern in science education. It has been suggested that the motivation of students to lean is determined by their attitudinal orientations towards the learning task itself as well as their attitudes towards other groups [21, 46]. This study showed that high levels motivation coupled with proper attitudinal trends results in high levels of students' involvement in learning and the attainment of desired learning outcomes. According to [19, 39, 46]. "Motives are rooted in needs, experiences, perceptions, concepts and persuasions and are manifested subjectively in emotions, desires, inclinations, aspirations, interests, ideals and dreams."

Students' Learning

Studies suggest that there is a relationship between attitude and methods of instruction and between attitude and achievement. Therefore, it is possible to predict the level of achievement from attitude scores. Although many researchers argue that teaching methods have a great impact on students' attitude to learn a subject, the relationship between students' attitudes towards chemistry and motivation to learn chemistry has not yet been examined. In this study, the relationship between attitudes towards chemistry and motivation to learn chemistry were investigated. The relationship between gender and motivation to learn chemistry as well as gender and attitude towards chemistry were also explored.

It was observed that the students who have negative attitude towards chemistry have lack of motivation for class engagement while students who have positive attitudes towards Chemistry have motivation for class engagement [16, 50, 51, 39]. Detailed examinations of students' attitudes towards science demonstrated that attitudes of students towards science changes with exposure to science, but the direction of change may be related to the quality of that exposure, the learning environment, and teaching method [9, 31, 37]. A positive attitude influences expected achievement and is heavily influenced by attitudes towards science [9, 33, 36]. Students who have a positive attitude towards and beliefs about chemistry will succeed at a higher level [6, 30, 32]. Student attitudes towards Chemistry also play a powerful role in how they think about using problem-solving method in their chemistry or any science class [22, 25, 28].

Purpose of the study

The main purpose of this study was to determine the correlation between the attitudes and motivation of first year chemistry and biology towards chemistry. This study was also aimed to examine the attitudes and motivation of first year chemistry and biology students towards chemistry courses. Therefore, this study was intended to seek an answer for the following questions.

Research questions

1. What is the general motivation and attitude of first year biology and chemistry students towards Chemistry as subject of study?
2. Is there any significant difference between attitude inventory test and achievement motivation scale scores of first year chemistry and biology students?
3. Is there correlation between attitudes and motivation of first year biology and chemistry students toward chemistry and their achievement in chemistry?

Research Hypotheses

The null hypotheses tested in this study were: There is no significant difference between first year biology and chemistry students regarding their attitude towards chemistry and motivation to learn chemistry.

RESEARCH DESIGN AND METHODOLOGY

Design of the study

This study aims to examine the relationship between attitudes of first year biology and chemistry students towards chemistry and their motivation to learn chemistry as subject of study. For this purpose, co relational research design have been adopted to answer the research questions raised earlier and to ascertain the extent to which attitudes of students towards chemistry and their motivation to learn are related to each other. Co relational research design allowed the researchers to ascertain if there were any relationship between the variables; how strong the relationship; and the direction of the relationship. The study was not concerned with cause-effects relationship.

Population and Sample of the Study

This study was conducted at Dire Dawa University, Ethiopia. The population of this study comprises of the total number of students at Dire Dawa University from year one to year three in the College of Natural and Computational Science.

The sample of the study consisted of 95 year I Biology students (female = 57 and male = 38) taking chemistry courses and 60 year I Chemistry students (female 29 and male = 31) at Dire Dawa University. All year I Biology and Chemistry students of the 2017/2018 academic year taking different chemistry course during the second semester were involved in the study. Of the total 155 students involved in the study, 55.5% were females and 44.5% were males.

Data Collection Instruments

The instruments used in this study were standardized Achievement Motivation Scale and Attitude Inventory Test. The scales used as data collection tools in the study are detailed below

Achievement Motivation Scale (AMS)

The Achievement Motivation Scale for learning chemistry developed by [6, 23, 24] was adapted and utilized in this study to determine students' motivation towards learning chemistry. The Achievement Motives Scale consisting of thirty items or statements was used to measure students' hope of success and fear of failure. The scale has four sub-divisions. The sub-dimensions were intrinsic motivation, which refers to the willingness to learn chemistry for its own sake and extrinsic motivation, which refers to the willingness to learn chemistry; the a motivation dimension refers to an unwillingness to learn chemistry; the extrinsic motivation has again two sub-dimensions, namely: Extrinsic motivation-career sub-dimension, which refers to learning chemistry for future occupation goals;; and the extrinsic motivation-social sub-dimension which refers to learning chemistry in order to show success to around (use of chemistry in problems solving and usefulness of chemistry in daily life situation) [28, 50, 51, 22].

The scale has a 5-point Likert-type pattern, ranging from strongly agree to strongly disagree. Coding of the scale was done by allocating scores as follows: strongly disagree = 1 point, disagree = 2 points, neutral = 3 points, agree= 3 points, strongly agree= 5 points. The values of Cronbach alpha for the scale was 0.824, which is high according to [34] recommendation.

Attitude Inventory Test

Attitude inventory scale towards chemistry developed by [36] was adapted and used in this study to determine the attitudes of first year chemistry and biology students towards chemistry. The scale consisting of 30 statements in 5-point Likert-type scale (strongly agree = 5, agree = 4,

neutral = 3, disagree = 2, and strongly disagree = 1). The statements of the scale were designed to measure students attitudes towards chemistry in seven areas, namely: (a) chemistry as a subject of study; (b) use of chemistry for problem solving and decision making; (c) relevance of chemistry to daily life (application of chemistry in their daily life); (d) willingness to learn chemistry or behavioral tendencies to learn chemistry (their interest to learn chemistry course); (e) importance of chemistry course for their field of study, (f) difficulty of chemistry course, (g) behavioral tendencies to learn chemistry (their interest to learn chemistry course), and (h) usefulness of chemistry course for their future career. Statements under chemistry as a subject of study were designed to determine students' attitudes towards chemistry compared to other subject or fields of study.

Both the Attitude Inventory Test and Motivation Scale survey questionnaires used in this study have five Degrees of intensity with weights of 5 being the highest and 1 being the smallest rating. The items were categorized as positive and negative statements to draw the attention of the respondents. The items with positive numbers and phrases were given values of (5 = strongly agree, 4 = agree, 3 = neutral, 2 = disagree, 1 = strongly disagree), whereas the negative phrases were given negative weights in increasing order (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree). Scores were evaluated separately and then the total scores summed up for each student.

Table 1. The scale of the statistical value adopted to assess students' attitude and motivation

Weighted Mean	Arbitrary Value	Verbal Interpretation
4.51 –5.00	5	Very True to Me
3.51 –4.50	4	True to me
2.51-3.50	3	Somewhat True to me
1.51- 2.50	2	Untrue to me
1.00-1.50	1	Very untrue to me

The calculated reliability coefficient of the scale was 0.92

Interpretation of the Total Score Range

The scale used for measuring students' attitudes towards chemistry range from 30 to 150 points. For positive items, the high average reflects a more positive trend to learning chemistry while the low average reflects a negative trend. For the negative items, the high total score corresponds to, lower average which reflects a low trend towards learning chemistry, and the high average reflects a positive trend to the subject.

Table 2. Interpretation of the Total Score Range (which one is better?)

	For positive items			For negative items		
Total score	150-105	104 to 75	<74	< 74	104 to 75	150-105
Average	5.0-3.5	3.49-2.5	< 2.49	5.0-2.5	2.49-1.5	< 1.49
Percentage	≥ 70%	69.5-50%	< 49.5%	<49.5%	69.5-50%	≥70%
Level of trend	High	Average	Low	High	Average	Low

Research Procedures

Attitude Inventory Test and Achievement Motivation Scale were administrated to first biology and chemistry students to measure their "attitudes towards chemistry course" and "Motivation to learn chemistry," respectively. The survey questionnaires in the Attitude Inventory Test and Achievement Motivation Scale were distributed to the respondents was during their Chemistry class to identify their Assertiveness and enthusiasm towards their chemistry subject. This study was conducted at Dire Dawa University in college of natural and computational science on students taking chemistry courses in the second semester of 2017/2019 academic year. The assessment of students' responses to the survey questionnaire in Attitude Inventory Scale and Achievement Motivation Scale yielded a scientific investigation.

The statements of attitudes towards chemistry and achievement motivation to learn chemistry were designed to investigate students' attitudes regarding: chemistry as subject of study

compared to other subjects, difficulty of chemistry, usefulness of chemistry in problem solving and decision making, relevance chemistry to life and behavioral tendencies to learn chemistry. At the same time, achievement motive scale (AMS) questionnaires administered to students in both group to measure their motivation. The statements were designed to measure students' hope of success and fear of failure. The motivation survey questionnaires were designed to explore some behavioral characteristics of respondents such as their likes and dislikes of various aspects of chemistry.

Data Analysis

Student responses to the instrument were coded based on the 5-point Likert Scale using the defined criteria. For positive items, higher scores represented more positive responses while for negative items, lower scores represented more positive responses. The data collected from survey were analyzed using Statistical Package for Social Sciences (SPSS). Analysis of variance (ANOVA) was carried out to determine whether a statistically significant difference in attitudes and motivation of respondents exist. Pearson's Product Moment Correlation was used to determine whether significant relationship exist between the attitudes and motivation of the respondents.

RESULTS AND DISCUSSION

Significant Difference in the Attitudes of the Respondents in chemistry Subject

Table 3: Analysis of Variance on the Attitudes of the Respondents in chemistry Subject

Source of variation	SS	df	MS	F	P Value	F Crit
Between Group	0.06	1	0.006	0.038	0.845	4.098
Within a group	5.954	38	0.156			
Total	5.960	39				

Level of significance at 0.05

Table 3 reveals the ANOVA on the attitudes of the respondents Chemistry in subject. This shows that the tabular value of 4.098172 is greater than the computed value of 0.038304 at correlation significance at 0.05 levels. The approximate significance is 0.845877. This indicates that it failed to reject the null hypothesis and therefore concludes that there is no significant difference in the attitudes of the respondents in the Chemistry subject. Studies reviewed suggests that there is a relationship between attitude and methods of instruction and between attitude and achievement. Therefore, it is possible to predict the level of achievement from attitude scores [13, 16, 18].

Significant Difference in the Motivation of the Respondents in chemistry Subject

Table 4: Analysis of Variance on the Motivation of the Respondents in chemistry Subject

Source of variation	SS	df	MS	F	P- Valu	F Crit
Between Groups	0.422	1	0.422	1.163	0.287	4.098
Within Groups	13.78	38	0.362			
Total	14.20	39	14.20			

Level of significance at 0.05

Table 4 reveals the ANOVA on the motivation of the respondents Chemistry in subject. This shows that the tabular value of 4.098172 is greater than the computed value of 1.16395 at correlation significance at 0.05 levels. The approximate significance is 0.287449. This indicates that it failed to reject the null hypothesis and therefore concludes that there is no significant difference in the motivation of the respondents in the chemistry subject. It was observed that the students who have negative attitude towards physics have lack of motivation for class engagement, and also the students who have positive attitudes towards Chemistry have motivation for class engagement. Research has shown that attitudes towards science change with exposure to self-learning strategies in science [9, 31, 10].

Significant Difference between Attitude and Motivation of the Respondents towards Learning Chemistry

Table 5: Analysis of Variance on the Attitude and Motivation of the Respondents in Chemistry Subject

Source of variation	SS	df	MS	F	P -Value	F Crit
Between Groups	0.845	3	0.281	1.085	0.360	2.724
Within Groups	19.741	76	0.259			
Total	20.587	79	20.58			

Level of significance at 0.05

Table 3 reveals the ANOVA on the attitudes of the respondents in subject. This shows that the tabular value of 2.724944 is greater than the computed value of 1.08549 at correlation significance at 0.05 levels. The approximate significance is Chemistry 0.360449. This indicates that it failed to reject the null hypothesis and therefore concludes that there is no significant difference in the attitudes and motivation of the respondents in the Chemistry subject. Similar results were obtained in the study conducted by [31, 4, 5] after exposing students to a self-learning device.

Significant Relationship between Attitude and Motivation of the Respondents towards Learning Chemistry

Table 6: Pearson Product Moment Correlation on the and Motivation of the Respondents in chemistry Subject

Correlation	Attitude	Motivation
Attitude	1	
Motivation	0.923852	1

Table 6 shows the Correlation of attitude and motivation of the respondents towards learning chemistry. There is a high to very high positive relationship between the attitude and motivation of the students. The relationship is positive; as the attitude increases, the motivation also increases. The value of r = 0.923852 indicates a high to very high positive relationship between the attitudes and motivation of the 446 chemistry students at correlation significance at 0.05 level. The coefficient of determination is r^2= 0.85350252, this presents that attitude improves prediction of the rated factors by 85.35%. The relationship between attitude and motivation is statistically significant. This result agrees with [46, 9, 1] that positive attitude influences expected achievement and the opinion that Students who have a positive attitude towards and beliefs about chemistry will succeed at a higher level.

CONCLUSIONS

This study place great emphasis on the relationship between attitudes and motivation of students towards chemistry. From the results of this investigation, it is possible to conclude that there is a strong relationship between attitude towards domains of science and motivation to learn. The findings of the study suggest that most of the students find that they feel good when they are successful in chemistry. In other words, they feel good when their endeavor to succeed in chemistry became fruitful. The responses of almost all students show that they enjoy studying chemistry when they found it useful for solving problems in their everyday life. This also confirms that there is no significant difference in the attitudes of both Biology and Chemistry students, the respondents' motivation for both samples; and attitude and motivation of the respondents in the chemistry subject. Moreover, the relationship between attitude and motivation is due to chance.

What promotes attitudes toward learning chemistry remains unequivocal, In this study, an attempt was made to analyze some factors related to the attitudes toward learning chemistry, The findings revealed that whether the student is a male or female, he/she has a low attitude toward learning chemistry, the causes could be basically due to the difficulty of the material, the low awareness of the importance of chemistry in our daily life, lack of exposure and fieldtrips, unattractive and low equipped laboratories, together with the poor motivated teachers.

The findings of this study also provide useful information to chemistry teachers and curriculum planners to revise their teaching and learning methods, so that students' attitude towards learning and engagement in chemistry activities increase.

The researchers believe that the Attitude Inventory Test would be a useful tool for chemistry teachers and chemistry educators to gauge their students' towards chemistry as subject of study and chemistry content prior to beginning chemistry course. The information gathered from the Attitude Inventory Test could allow them design instructional interventions to help increase student success, interest, and performance, which could help to increase attitudes, and students' intentions to pursue chemistry or science based careers.

IMPLICATIONS/RECOMMENDATION

The implication of the findings this study is that both attitudes towards chemistry and the levels of motivation of students should be taken into account when planning instructional activities. The responses of the majority of students show that the decline in their attitudes and motivation towards chemistry is due to: the abstract nature of chemistry, poor teaching and assessment methods, lack of practical activities or hands-activities, career opportunity, and so on.

Therefore, the teachers must use effective instructional strategies that provide sufficient opportunity for students to engage in the teaching-learning process, and construct their own understanding using their prior knowledge. Teachers should also use computer assisted simulations to help students' visual abstract concepts chemistry. Students should be motivated to work hard and enjoy learning chemistry moving they beyond the assigned work in the subject.

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