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TEACHERS' AND STUDENTS' VIEWS ON THE USE OF SONGS IN TEACHING AND LEARNING IONIC BONDS

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Abstract: Taking into consideration learner engagement during a chemistry lesson is a very crucial step if conceptual understanding is one of the goals. In the current times, teachers are drastically losing a grasp of their learners during lessons, especially chemistry lessons. However, studies that borrowed from the kindergartens have proved that incorporation of songs during lessons may engage learners. This qualitative research, which took an action research design, explored the feasibility of applying songs in rich science content in enhancing interest, motivation and engagement in ionic bonding and similar chemistry concepts among Kenyan high school students. The aim of the study was to transform the attitudes of learners towards chemistry through the use of songs and to increase learner participation during chemistry lessons. The study used Two purposively sampled chemistry teachers and 60 purposively sampled form two learners. From the 60 learners, 8 were chosen through random sampling to take part in focus group discussion (FGD). Multiple tools including interview protocols, lesson observation protocols and focus group discussion protocols were employed for data collection. Findings revealed that songs enhanced learner engagement during the lesson, captured learner attention, enhanced recall abilities of the learners, and restored their positive attitudes towards chemistry. Additionally, it was found that songs promoted diverse learner preferences and learning extension outside the classroom. The study recommends that schools should advocate for use of songs as one of the instruction strategies in the classroom since it has a very high potential of engaging learners and sparking their interest towards learning of chemistry. The findings of this study are intended to inform curriculum developers from various contexts on the formation of a policy that guides the use of songs as high school classroom teaching strategies.

Keywords: science content songs, ionic bonds, views, chemistry, pedagogies

Introduction

Chemistry involves studying matter, with focus on its structure, properties, composition and the changes that it undergoes. Chemistry syllabus transverses across high schools and tertiary institutions. The changes observed on learner attitudes towards chemistry in the recent past have however remained unprecedented. In the recent times, reduced learner interest and engagement in have been on the increase, and have consequently caused poor grades in chemistry in Kenya and related contexts globally. As found by Wangari (2011), though the Kenyan government invests hugely in chemistry and other science subjects, exam results still indicate low performance among the students. The reduced interest and engagement in chemistry could be blamed on ancient teaching method, the most common one being lecture method. Even though most classroom teachers practice lecture method, it

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encourages learner passivity and catalyses learner disinterest in learning since it is a teacher centred pedagogy (Izuagba, 2015).

Though the lecture method has proven negative impacts, it is still used widely in Kenyan classrooms. Observation has shown that insufficient pedagogies that can engage learners and the haste to cover the syllabus completely are among the main reasons behind the viral application of lecture method in teaching. As revealed by Izuagba, (2015) however, and experienced by a majority of chemistry teachers, the lecture method fails in engaging the learners, thus, an intervention is required. Research in other contexts has exposed songs, and in particular, science content songs, as effective learner engaging pedagogies if applied in instructing science. Defining science content songs, Governor et al., (2012), posit that they are songs composed with science lyrics for instructing science-related concepts.

While there has been a superfluity of studies on the application of songs in teaching and learning, the works have not assessed the relevance of applying songs among adolescent chemistry students. Recent research conducted by (Ludke, 2009; Nurvia, 2016) revealed the positive impacts of teaching languages using songs. By advocating for the use of songs in teaching and learning among teachers and students, Crowther (2006) inspired teachers worldwide to embark on the use science content songs as an instructional strategy.

According to the definition by Governor et al., (2012), science content songs are songs composed with science lyrics for instructing science-related concepts.

Since songs have contributed extensively towards the mastery of hymns and national anthems in global contexts, they are likely to yield higher results if applied in the learning of a subject area like chemistry. According to Stephens (2013) symbolic meanings in national anthems can help in fixing phrases when turned into a song. Because of their ability to fix phrases, songs could guide learners in identifying concepts related to science in phrases and thus lead to retention of concepts if used in a classroom context. Another study by Floridou et al., (2012) found that Finnish participants were familiar with their national anthem since they were enjoying mastery effect from songs that were used to compose the National anthems. The benefaction made by songs in retention of national anthems globally could create the same experiences if transferred in classroom contexts.

Borrowing from the beneficial roles that songs have played in teaching and learning in other contexts, this study aimed at transforming poor learner attitudes and stunted learner engagement in chemistry by using science content songs. The study sought to expose chemistry teachers to a learner engaging instructional pedagogy, in exchange of lecture method and other non-engaging ancient pedagogies. Due to the need to transform the researcher's instructional pedagogies, an action research design was chosen. The research paper first discusses various benefits of songs in teaching and learning borrowing from past studies and the conceptual framework. Secondly, the paper describes the methods that the study employed, succeeded by the study findings. Finally, the paper discusses the study findings and gives recommendations for implementation and future studies based on the findings.

Songs as Mnemonic Devices

Since the traditional generations, mnemonics have played expository roles as recall aids. Through an empirical study on mnemonic devices together with their contributions in teaching and learning science concepts Jurowski et al., (2015) found that mnemonics are relevant in teaching science since they aid in recalling the concepts of a lesson. However, Juroski and allies failed to consider the efficiency of mnemonics initiated by the learners themselves or by individual learners during the lesson. Bellezza and Reddy (2013), by conducting a quantitative study with bias on mnemonic devices versus natural memory with 72 students of psychology, found that the ability to recall was higher in the familiar cues group compared to the unfamiliar one. A deduction can be drawn from the studies that mnemonic devices assist in effectively recalling verbal information. Judging from the deduction, mnemonics could form in learners, memory akin to natural memory, if applied in classrooms.

A study on the effect of musical mnemonic techniques on the learner engagement and the learning outcomes in an all-inclusive classroom categorized songs as mnemonic devices that promote retention of learnt or taught information (Eaton, 2020). Unlike related past studies on songs, the study by Eaton was an inclusive one since it had learners with disabilities as respondents.

Songs and Social Interactions

Taking into account the contribution of songs on social interactions and bonding among communities, the projected expectations of introducing songs in the classroom would be very high. Traditional events among them initiation and wedding ceremonies subject celebrants to singing jointly, songs relevant to the event in celebration. The appealing effect of music is inherent because the action of singing, alongside the musical instruments, build strong social interactions (Geretsegger et al., 2014). When communities and people get exposed to songs that are common to them, social interactions are developed. Even though the study of Geretesegger et al., on songs and social interactions have immense contributions and similarities to the current study, theirs had a bias on Autistic persons. It is unsatisfying that their findings were not inclusive of neurotypical people, yet music is not only a preserve of those living with autism. Neurotypical people too listen to music and have developed tastes for diverse genres of songs.

Earlier studies by Maschi et al., (2013) found that through group music, individuals can gain a collaborative experience and enhancement of their interpersonal traits. It is without doubt that collaboration is a manifestation of interaction, which as found by Maschi et al., could have been catalyzed by group music. In support, studies by Rabinowitch and Meltzoff (2017) exposed the ability of musical engagements to influence interactions and prosocial behaviour rhythmically among pre-schoolers. Citing Kirschner & Tomasello (2010), the duo predicts post musical-experience collaborations among nursery school learners. Findings of the study showed that composition of music, including singing and dancing, enabled participants to collaboratively vocalize, making them to have common experiences and activities. Though the studies focused on kindergartens, it would not be a limitation to investigate similar impacts of music among high school chemistry students.

Impact of Songs on Science Teaching

Being projected instructional strategies, the impacts of songs, and in this case science content songs in a classroom of chemistry seem infinite. Delightful songs can be successful in making learners who disconnected with science lessons to develop some interest and become part of the classroom (Crowther, 2012). Further, if a science lesson is instructed using music, accompanied by singing and dancing, the lesson content is likely to reach participants of diverse ability through multiple modes. This implies that songs are likely to be applied as multimodal instructional resources in a chemistry lesson.

From their study on students' and teachers' experiences on the impacts of music in the teaching and learning of science, Governor et al., (2012) found among other benefits, understanding of taught concepts and acquisition of more examples. In addition, learner engagement increased because the interests of the learners were captured by the songs. Supporting the findings by governor and colleague, Bokiev et al., (2018) ascertained the potential of songs in engaging students and making adding pleasure to learning. Universally, adolescents have positioned music on top of their interests, suggesting that songs rich in science content could not only capture their interest during lessons but also enrich them with extra examples and ideas in a given learning area.

The results of an empirical science song project study conducted by Yoon (2017) transformed the participants' attitudes towards sciences, thus increasing their conceptual understanding. However, because the study by Yoon (2017) involved general science teachers as participants, the outcomes imprecisely targeted all science subjects, thus were non-specific to a single subject in science like chemistry.

In a similar study by Diakou (2013), it was found that music can prompt positive sentiments among learners, which increased motivation and retention of attention among learners. In the same vein, songs can possibly counter a negative mood and a negative learning atmosphere within the classroom (Hershner, 2018). Similarly, (Ly & Quynh, 2020; Rambli et al., 2013) established that songs can claim the learners' attention and deepen the learning experiences among them. With a deeper learning experience, learners are likely to acquire concepts that would enhance their participation in group discussions and would also enable them to respond to classroom questions (Kotob & Bazzoun, 2019).

Based on the literature, there is a dearth of knowledge and studies on the astounding efforts of music in countering the unpleasant attitudes of adolescent chemistry students. This present study therefore has an intention of finding out the effects of music on lesson engagement among adolescent chemistry students and consequently countering their attitudes towards chemistry. The findings are intended to inform curriculum developers on designing a policy that guides the use of songs as instructional strategies among teenagers. The study was guided by three research study questions.

1. What are the current instructional pedagogies used by teachers in teaching ionic bonding?

2. What are the views of teachers and students on the use of songs in teaching and learning chemistry concepts like ionic bonding?

3. What are the roles of songs in teaching and learning?

Conceptual Framework

Singing establishes strong social connections among learners, which solely amplifies engagement and learning among learners. Singing jointly subjects learners to social interaction. According to Vygotsky (1978) social interaction can be a manifestation of songs, and learning being a social process, can be influenced by social interaction. Related studies by Wertsch (1992) accredited social interaction to learning personal development. In support to the duo's ideas, Rogoff & Chavajay (1995) maintain that cognitive development among individuals is influenced by social activities. In view of this, singing being a social activity, is likely to intensify social interaction during the lesson and consequently result positively influence personal cognitive development and learning among learners.

Making learners more engaged during chemistry lessons would imply that teachers consider interactive instructional and learning strategies like songs. Through Songs, construction of concepts and transformation of learners from their passive states to active ones during chemistry classroom may be on catalyzed. Collaborative composition and singing in a classroom may thus yield gratifying classroom interaction (Kisanga, 2015).

If brought together, song components can form one whole concept. In that case, engaging learners through singing may help them join various song concepts together to form a whole concept, thus obtain knowledge. This is entirely supported by the findings of Koffka (1935) that the whole is better than the sum of its parts. Besides, citing Kohler (1929, 1969), and Wertheimer (1959), Taetle and Cutietta (2002), opine that by matching parts that are closely related, imperfect wholes can be completed. If learners have gained pre-knowledge about a concept, they are likely to understand the concept in details, especially if the related parts from a song are combined to form the whole concept.

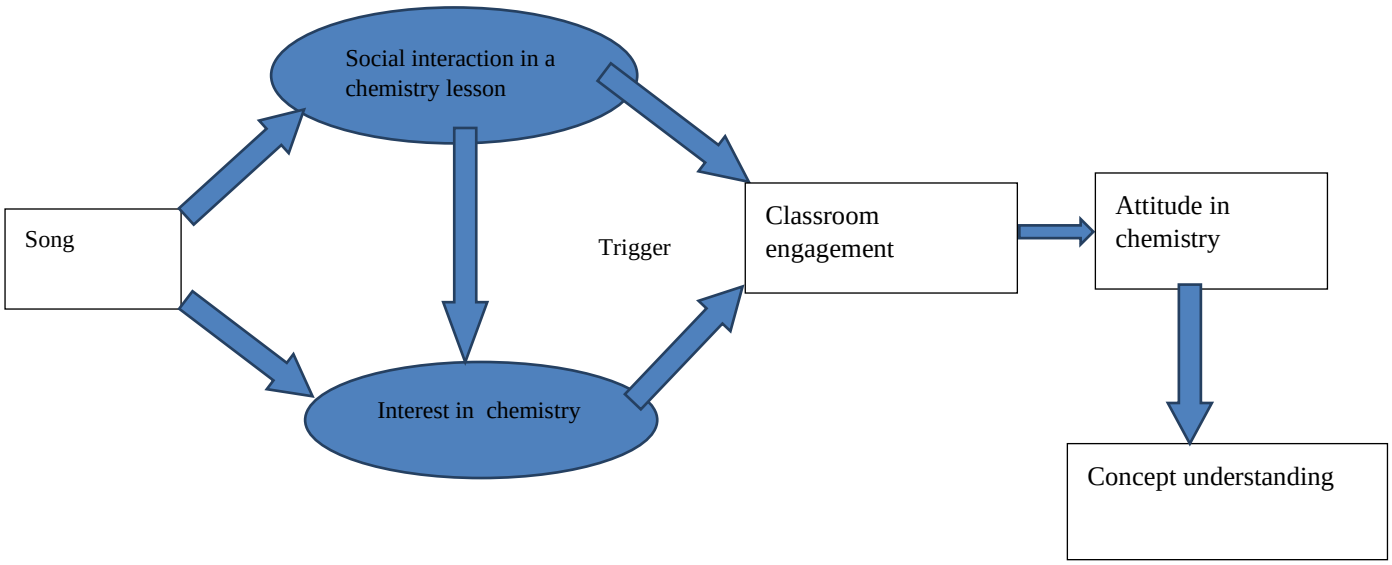

Figure 1: showing the conceptual framework adopted by Omollo, D.O

Materials and Methods

This study was guided by a qualitative research approach since through this approach, the participants were granted to apprise their views and experiences on instructing or learning through songs. That

being the case, the study participants got a rare chance to describe their experiences in teaching or learning the properties and formation of ionic bonds through songs, and the obstacles they encountered with this instructional pedagogy. The study borrowed from the assertion of Creswell (2014) that qualitative research study intensifies the understanding of collective issues, based on the participants' views.

An action research design was adopted for the study since through action research, the participants were subjected through a socio-collaborative process with an aim of identifying poor instructional methods and consequently developing reliable interventions (Hendricks, 2017). During reconnaissance, the two collaborating teachers separately shared the pedagogical practices they are employing currently to instruct ionic bonding and the associated challenges. Among the pedagogical practices cited by the teachers were lecture method, use of charts and use of atomic models. The two collaborating teachers reported that they find it too challenging to spark interest and engagement among their learners using the cited methods. Questions were further raised on how a model or a chart presented by a teacher in class could engage learners with ionic bonds and restore their attitudes towards chemistry.

Considering the interest of teenagers in songs and how much time they spend mastering lyrical lines of various artists, an intervention of teaching through songs was settled on. This led to an intervention lesson in the participating class, where the collaborating teachers played the role of lesson observers. During the first intervention, science content songs were downloaded from you tube (see appendix c) and projected for learners to see the lyrical lines and sing along. They were then asked formative questions based on contents from the song, which were part of the chemistry syllabus on ionic bonding.

It emerged from the first cycle that the accent used in one of the songs was not clear to the learners since it was western. Additionally, there were no sound enhancements, thus the learners strained to listen. The lesson was later improved by blending the you tube songs with learners' own compositions. Further, sound enhancers were used and the learners were given printed copies of the songs being played so that they lose no track of any lyrical line. After the second intervention, the two collaborating teachers, together with the eight learners from the participating class of 60, were engaged in interviews and focus group discussions (FGDs) respectively, under guidance by the reflections they gathered at the post intervention stage. This Action research was conducted in two cycles each lasting four days since the study timeline was short.

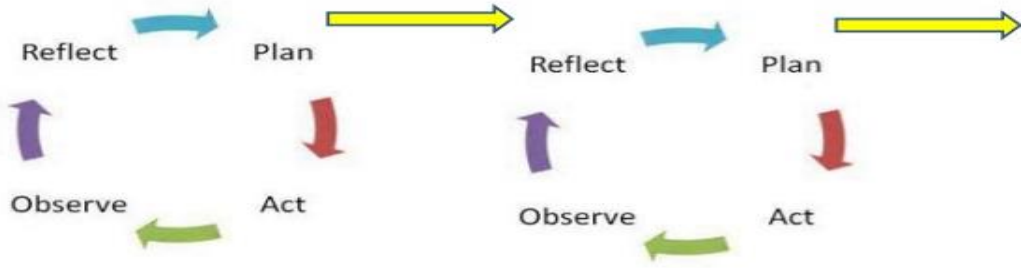

Figure 2: showing the Action research model adopted from (Lewin, 1946).

The action research study had the following objectives;

1. To add interest to teaching and learning of non-practical chemistry contents like ionic bonding through the use of content songs as a pedagogical strategy.

2. To shift teaching and learning from the boring traditional strategies to more learner engaging and interactive strategies

3. To improve learners' attitudes in chemistry and to make them part of the teaching and learning process.

Participants

Two purposively chosen form two chemistry teachers were involved in this research study as collaborating teachers. Participating in the study was also a form two stream of 60 students from a secondary school in Vihiga county, Kenya. Form two class was conveniently sampled since it is familiar with ionic bonding, which is part of the form two syllabus. Besides, the intervention could easily transform the attitudes of form two students compared to the students in higher classes. From the form two class, eight participants were randomly sampled to take part in the FGD. Random sampling method limited the chances of bias by making it certain that all the brackets of learners, based on diverse chemistry abilities, had a representative in the research study (Sharma, 2017).

Instruments

The study employed lesson observation protocols (appendix D), interview protocols (Appendix A) and FGD protocols (Appendix B). Through multiple data collection methods, evidence from the findings were strengthened through triangulation. Denzin and Lincoln (2018) postulate that triangulation enhances increased rigor by facilitating comparison results from each of the data collection tools employed.

Lesson observations were administered in the class of 60 during the reconnaissance and the intervention. They gave data on preintervention strategies used in instructing ionic bonds. Further, intervention lesson observation gave data on reactions of the 60 students in a song-aided lesson. Entrance interviews and exit interviews with the teacher participants were administered during the reconnaissance and the post intervention discretely. Lastly, FGD was held with the 8 student

participants immediately after the post intervention of the second cycle. The interviews gave data on teachers' views on teaching through songs while FGD gave data on students' views on learning through songs.

Data analysis

The data were sorted and analysed following the suggestions by Whitehead and McNiff (2006), that only data relevant to the study should be sorted from the data collection tools employed. Transcription of audio records from interviews and FGD were done to get verbatims. Together, the verbatims and data from other tools were compared to establish a stronger justification of the findings.

Results and Discussion

In this section, the findings from the study are presented, with emphasis on the views of teachers and learners on teaching and learning ionic bonds through songs. The teachers were coded as [1]teacher 1 and [2]teacher 2.

[1]Pseudonym for a collaborating teacher.

[2]Pseudonym for a collaborating teacher.

Pre-intervention Instructional Methods and Resources

Data from the lesson observation conducted at reconnaissance revealed that the most common strategies and materials used by teachers in ionic bonding are: lecture method, models and charts. Upon reflection on the strategies, the teachers' lack of learner-engaging pedagogies and interactive resources was evident. This observation was confirmed by teacher 1 during entrance interview that, "I use the lecture method to impart more skills on the areas that I feel that the models or charts never touched on."

Though the lecture method benefits the teacher, its impacts on the learners are unfriendly as explained by teacher 1.

The lecture method does not engage my learners fully. The lecture method most of the times become very boring to my students. Most of the students get little on concepts taught (Entrance interview, 10th September 2021).

In any lesson, desirable outputs from the students can only be attained if learners concentrate. The choice of a teaching method therefore should be that which enhances concentration among the learners. Results from this study however revealed that the lecture method is not child-friendly since learners have a very low concentration span, which cannot be maintained by the teacher-dominant lecture style.

When asked whether her learners concentrate when she uses lecture method, teacher 2 said, "For the learner participation, I think there is a problem with lecture method because most of them if you use continuous lecture method, they lose concentration."

It also emerged that Lecture method cannot capture the attention of the learners and restore their attitudes towards chemistry. On attitude, retention, and lecture method, teacher 1 revealed that;

The lecture method has a very big challenge because one the retention is very low; the retention is very low. It does not help to change the attitude; it has the opposite effect. In fact, they can hate the subject (Entrance interview, 10th September 2021).

Similar findings were obtained from the observation protocols. It was observed that learners were less engaged, less active, interacted less, concentrated less, were not responding to the questions asked by the teacher, and most shockingly, seemed not to be part of the lesson.

Though the Kenya institute of curriculum development, as evidenced in the course books and the approved syllabus, recommends the use of charts and models in teaching ionic bonding, their interactive potential, and ability to engage the learner, especially those with diverse learning preferences are questionable.

Responding to the question on the potential of charts and models to engage her learners, Teacher 2 had to say;

For the chart, I don't think it engages them much because first of all you draw it on the board, they will concentrate there. The chart must remain in class so that they look at it every time. Not all my learners are usually engaged with my charts or models (Entrance interview, 10th September 2021).

Given the current advancements in teaching and learning, charts and models are too ancient to offer a learner interactive and engaging environment to the current generation of learners and ultimately boost their attitudes towards a science subject like chemistry. Additionally, drawing from the data findings of this study and the findings of Graulich (2015), models do not engage the learners, portraying them as passive recipients of information.

These results corroborate the findings of Nganga and Kambutu (2017) that teacher-centred pedagogical practices have colonized other teaching methods in Kenyan classrooms. The results are also consistent with the findings that despite being popular, the lecture method is teacher-centred, leading to increased passivity and withdrawal of interest from learning among learners (Izuagba, 2015). Chege (2013) further found that the lecture method reduces learner activity and forces the learners to be passive listeners during teaching and learning.

Students' Views on Learning chemistry concepts Through Songs

FGD revealed that the students generally felt and appreciated the potential of songs ease the understanding of chemistry and related concepts like ionic bonds, as compared to the teachers' lectures. They adored learning through songs and wished that their teachers could implement this instructional strategy in all other chemistry areas. One learner for instance responded that, "I was amused the bonding songs since through them, I understood more about ionic bonding…that teaching method is likely to enhance more comprehension of chemistry among the slow learners like me."

The lesson observations done by collaborating teachers 1 and 2 showed that the learners' responses to the classroom questions was perfect, a clear show that they understood the concepts. A good number

of the learners, when asked to describe the formation of ionic bonds, demonstrated ability. As stated by a student participant, students with no records of ever answering any question in class were observed answering questions at the intervention. She revealed that, "some students have never answered any question in a chemistry class but had something to contribute during the lesson with songs."

What increased contribution among the learners in terms of quiz-response was the inflated interest and boosted attention in chemistry, which had been influenced by the songs that were played as they sang along. With the attention, interest and concentration of the learners captured, their engagement with the chemistry lesson was also achieved. When asked if songs could boost learner engagement during chemistry lessons, one student gave this in response:

Songs are sources of entertainment. If a teacher teaches through songs in a class, learners have to concentrate since while the lesson is going on, some of the students may feel like sleeping. But with the input of songs inside the class, they will be able to concentrate (FGD, 20th September 2021).

The findings also revealed that the learners cherish songs and singing, and can readily adapt or fit, if songs replace traditional pedagogies as instructional pedagogies. The learners admitted that they spend more time singing and were ready to compose science content songs for their situational use during their chemistry lessons. Two student participants said this concerning the students' love for music and the possibility of them benefitting through songs.

My take is that chemistry lessons using songs are likely to assist learners a great deal since learners, me included, love songs and our frequency of singing is very high …therefore, when chemistry is taught using songs, forgetting what has been learnt can be very hard (FGD, 20th September 2021).

The student participants saw the potential of songs to minimise forgetting of concepts they have learnt valuable and had revealed that the difficulty in forgetting would boost their chemistry performance. On the songs' ability to boost recall, a participant said this:

Frequent interaction with songs during chemistry lessons helps learners to recall each song and this may help them during exams without having to strain going to the teacher to ask questions on what they have not understood (FGD, 20th September 2021).

It was also found that instruction through songs is multimodal, thus fit for different styles of among the learners. Since learners have their preferred specific styles of learning, subjecting the entire classroom to a common instructional pedagogy might be a practise of bias, implication being that only one section of the classroom would be find the lesson enjoyable. With instruction through songs, however, as revealed by the FGD, the lesson would be enjoyed by most of the learners. On the diversity of learning styles through songs, one of the participants had these perceptions:

It is very interesting to learn chemistry through songs since some of the learners are not good at reading their notes in the books but through singing, they get the concepts because they are good in singing and poor at reading (FGD, 20th September 2021).

The potential of songs rich in science content to change the attitudes of the students towards chemistry was also clear from the findings. It emerged from the findings that learners are perceived to

be lazy by their teachers just because they find no reasons to engage with lessons that they do not enjoy. However, their attitudes might be restored if a teaching pedagogy that sparks their interest, like songs is employed. Below is what a participant said on the protentional of songs to be an attitude changer:

Songs are able to change our attitudes towards chemistry since most of us understand songs and like singing. We are lazy yes but when taught chemistry using songs, we may love the songs and they may summarise our notes. Through singing, we understand (FGD, 20th September 2021).

From the focus group discussion, it was also clear that songs support lesson participation among learners in various ways including singing, answering questions and song composition. Songs further grabbed the interests of students that face difficulty in class participation due to low self-esteem and kept them engaged. By singing, all students participated in the lesson, as proved by one of the participants in the views below:

There are learners who are so afraid that they can neither participate nor allow other learners to hear their answers. They fear being laughed at or mocked upon giving a wrong response but chemistry lessons are conducted through songs, they see everyone singing and acquire the desire to join in singing along, thus increasing their participation in the lesson (FGD, 20th September 2021).

FGD findings also revealed that apart from engaging learners during chemistry lessons in the classroom, songs with science content also extend engagement with chemistry content outside the chemistry classroom. Further, the learners remain engaged even in the absence of the teacher. In his contribution of songs on extended learning and learner engagement when the teacher is absent, a participant said:

The songs can bring us to class because we shall have a positive attitude, we would want to interact with the song, to master the song and to sing it everywhere we go. In our class, some of us make noise in the absence of the teacher. Through songs however, when there is a song being sung, they will be interested in hearing and knowing the song (FGD 20th, September 2021).

The FGD data collected from the 8 students resembled the collaborating teachers' lesson observations during the intervention. The lesson observation made among other revelations, that songs generally engaged the learners, increased their participation in the lesson, and enhanced their question answering abilities.

Teachers' Views on Teaching chemistry concepts Through Songs

Basing on the findings from the interviews with collaborating teachers 1 and 2, songs amplify concept-recall among the learners. Upon reflection on the relative abilities of songs and lectures to influence recall of chemistry and related concepts, teacher 1 said:

Through use of songs, it is my view that learners can recall so much since if so long as they are able to grasp the song and memorise it, the concept will stay in their memory. In contrast to the lecture method which only involve talking and more talking and leaves the students with nothing tangible (Exit interview Teacher 1, 20th September 2021).

Although her learners had gradually developed very negative attitudes in chemistry, teacher 2 had a conviction that songs as instructional tools have all it takes to regain the lost attitudes of her students in chemistry. She confessed that students want lessons to end but when the intervention was being done, all learners were advocating for lesson continuity. She said:

Songs can bring back learners' lost attitudes. When songs are used, there is an improvement in their attitudes, and consequently, their lesson participation increases. The strategy engaged most of them, they seemed to be singing and enjoying the lesson, they never wanted it to end, demonstrating a changed attitude. I am certain that should the strategy continue, their attitudes are likely to lead to improved performance (Exit interview teacher 2, 20th September 2021).

Teacher 1 supported the view that songs are able to metamorphose the poor attitudes of students towards chemistry. His observation on the learners insisting that the teacher replays the song through it was minutes past their lunch time implied that the attitudes of the learners was on the verge of positive transformation.

Attitude change will be there since by the learners insisting, and demanding a replay by shouting, please replay. Though it was lunchtime, they never bothered and wanted to listen more to the songs and to sing along. This was a great show of positive attitude (Exit interview Teacher 2, 20th September 2021).

Since songs, composed by the learners or downloaded from the internet are rich in science content, the given content may contain extra examples assumed by the teacher while teaching or ignored in textbooks. Through songs therefore, the students find a chance to not only get additional examples, but also to understand chemistry concepts deeply. With the joy that comes with singing, the students' negative attitudes towards chemistry may metamorphosize towards positivity. It could be because of better conceptual understanding and diversity in learning styles as boosted by songs, that the learners found it easier to respond to questions.

It was also clear from the exit interviews with teacher 1 and teacher 2 that singing not only triggered learner interest but also sparked their attention and participation during the chemistry lesson. With higher attention, learner engagement can possibly occur. Teacher 2 said:

It is quite obvious that the songs used aroused the interest of the learners, made them happy, engaged them with the lesson, and that was remarkable compared to lecture method where they just stare at you. Songs in teaching play a role in engagement, attention capture, participation boosting, developing bloom's taxonomy, and enhancing recall of concepts. All these will influence interest and attitude in chemistry positively and impact improved performance (Exit interview Teacher 2, 20th September 2021).

Teacher 2, in his view, credited the elevated participation among learners to increased class attention, which was triggered by high engagement levels. Relating songs to engagement among learners, he said:

The learner participation was top notch and the learners had enthusiasm. It was my first time to witness a whole classroom engaged during a lesson, do not even say chemistry lesson. The entire

class was singing the song. To them, it was new, entertaining, and claimed their attention. Class participation was over 90%. (Exit interview Teacher 1, 20th September 2021).

Findings from the research study exposed the high potential of songs to have learners engaged in a chemistry lesson, grab their attention, promote understanding of concepts, and boost learner participation. With music acting as reinforcement, more response occurred through elevated learner participation, increased lesson concentration and giving answers to lesson quizzes (Skinner, 2014, 2016). The study findings showed some consistency with the Vygotsky's social constructivism theory, which perceives music as an influencer of learning through social interaction and collaboration (Vygotsky, 1978). Besides, connecting various song contents makes a whole learning concept in chemistry and other subjects (Koffka, 1935) and (Taetle & Cutietta, 2002).

The role of songs in learner participation, question answering ability, affinity to chemistry, classroom attention and extended engagement with content came out clearly from the findings. The findings expressed ultimate concurrence with the results by Kotob and Bazzoun (2019) that songs rich in science content equip students with scientific content which enable them to engage in classroom discussions and respond to classroom quizzes. Similar findings by Gardner (1983), as cited by Coyle and Gómez (2014) showed that songs have strong emotional impacts on the students, that increase attention and engagement among the learners.

Whilst most teachers dream of better performance among their learners, only a section of them apply instructional strategies that touch their learners' emotions. It is in this regard that these findings support those of Koelsch (2014) that songs are able to yield strong emotions and better moods among learners. Since emotions are manifested in attitudes, learners can acquire positive attitudes towards chemistry when they learn through singing.

These findings also show congruence with Jurowski et al., (2015) songs have a positive impact on recalling taught or learnt information. A similar study conducted by Nikkhah et al. (2019) showed that the learners who were exposed to music during teaching recalled more words. These findings also bolster the findings by Eaton (2020) that songs, retention of learners' experience occurs.

Every classroom deserves diversity in instructional strategies since each learner has a specific preferable learning style. The results from this study are in line with the observations of Crowther (2012) music in science teaching reaches learners through a variety of modes. Further, enjoyable music brings back to class, learners who have lost interest in learning, thus making them active participants. Findings of the current study expressed the revelation that students enjoyed lessons taught through related songs, and this gave them a better learning experience and engaged them more with the lesson.

Conclusion

This study aimed at providing an intervention to poor attitudes and reduced learner engagement during chemistry classes through songs rich in science content. Findings exposed the rich ability of songs to hook learners' concentration, engage them with the lesson, grab their attention, promote understanding of concepts. It was also found that songs give learners more examples and enable them to answer classroom questions. Additionally, songs made it easier to recall concepts.

Based on these findings, learning institutions, especially high schools, are urged to consider instructing science through songs rich in science content for engagement of their students and transformation of their attitudes in sciences. With songs as instructional strategies, performance and attitudes towards science subjects can gain positive impacts nationally.

It is suggested that future studies consider the impact of songs on chemistry concepts having experiments, and on other subject areas.

The study had the limitations below, which also need to be addressed in similar future studies:

The study was conducted in a narrower context since it was limited to a very small sample size, which represented the broader context.

Due to a shorter time limit on the side of the researcher and rush to compensate for the year that was lost to Covid-19 on the side of the research participants, only two action research cycles were conducted. The study however required more cycles for a proper intervention of the identified problem.

Declaration statement

We, the undersigned, hereby declare that this writing is our work. It represents our own effort and has not been taken in whole or in part, without reference to whom or from where the information was attained.

*Signature:  Date: 5th May 2022

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Declaration of Interest Statement

The authors declare that they have no conflict of interests.

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