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Teachers' and Learners' Perceptions of the Use of Science Content Songs in the Teaching and Learning of Ionic Bonding

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Abstract

Factoring learner engagement during chemistry lessons is key if conceptual understanding is an objective. This qualitative action research study explored the possibility of using science content songs to enhance learners' engagement, motivation and interest in ionic bonding and related chemistry concepts among high school learners in Kenya. The study aimed at transforming learner attitudes in chemistry through songs as pedagogies and making them active participants during chemistry lessons. Two chemistry teachers and 65 form two students were purposively chosen to participate in the study. Out of the 65 students, 8 were selected through a random sampling method to participate in a focus group discussion. Data collection was conducted through multiple methods which included; lesson observation, interview, and focus group discussion. It was found that songs engaged learners throughout the lesson, captured their attention, enhanced their recalling abilities, and had the potential to restore their positive attitudes towards chemistry. Additionally, findings revealed that songs enhanced diverse learner preferences and extended learning outside the classroom. The study recommends that schools should consider the use of songs as a classroom instructional strategy due to its high potential to engage learners and spark learners' interest in chemistry learning.

Keywords: science content songs, ionic bonding, teacher perceptions, learner perceptions, chemistry teaching

1. Introduction

Chemistry is the study of the structure, properties and composition of matter, and the changes that matter undergoes. It is taught in both high schools and tertiary institutions. The changes experienced in the attitudes of learners towards chemistry over the recent past however remain unprecedented. Recently, chemistry has been hit by increased learner disinterest and disengagement, which have cumulatively resulted in poor chemistry grades in Kenya and similar contexts. As noted by Wangari (2011), despite huge government investments in science subjects like chemistry, learners still record low performance. The disinterest and disengagement in chemistry could be attributed to traditional teaching methods like the lecture method. The lecture method, which is practiced by a majority of classroom teachers, is teacher-centered, thus it makes learners passive and withdraws their interest from learning (Izuagba, 2015).

Despite its negative impacts, the lecture method remains widely used in Kenya. Experience shows that inadequate learner engaging teaching pedagogies, coupled with the rush to complete the syllabus, could be the reason behind the widespread use of lecture method. The lecture method, however, as found by Izuagba, (2015) and experienced by chemistry teachers, does not engage the learners, hence the need for an intervention. Among the engaging pedagogies that have been researched in other contexts is teaching through songs, and in this case, science content songs. According to Governor et al., (2012), science content songs are songs designed to instruct science-related concepts.

While there have been a plethora of studies on the use of songs in teaching and learning, the studies have not explored the impacts of learning through songs among teenage chemistry students. Recent studies by (Ludke, 2009; Nurvia, 2016) exposed the impressive results of teaching languages through songs. Crowther (2006), through his advocacy for the use of songs in teaching and learning, has inspired teachers globally to consider using science content songs. According to the definition by Governor et al., (2012), science content songs are songs designed to instruct science-related concepts. Such songs have the science content and concepts to be instructed in their lyrics.

Considering the contribution of songs towards mastery of national anthems globally since childhood, songs would probably have greater impacts if used in enhancing the learning of a subject matter such as chemistry. Stephens (2013) recognizes the symbolic meanings in music like national anthems which help fix phrases when sang. The ability of songs to assist in fixing phrases, if applied in a classroom set-up, could assist learners to identify science-related concepts within the phrases, enhancing concept retention. In another study Floridou et al., (2012) proved familiarity with the national anthem among Finnish participants, indicating mastery effected by songs. The contributions that songs have made in national anthem retentions thus could also be taken advantage of in classrooms to create similar experiences among learners.

Because of the contributions of songs in teaching and learning in various contexts, the current study sought to transform poor attitudes and low engagement developed by learners in chemistry through the use of science content songs. The study intended to expose teachers to

a learner-engaging pedagogy, which could replace non-engaging traditional pedagogies like the lecture method. The need to change the teaching pedagogies of the research informed the decision to settle on action research. The paper first explores various roles of songs in teaching and learning based on existing literature and the conceptual framework. It then describes the methods applied during the study, followed by the findings. Lastly, the findings are discussed and recommendations given for implementation and future studies.

1.1 Songs as Mnemonics Device

Since ancient times, mnemonic techniques have been very critical in serving as recall assistants. An empirical study conducted by Jurowski et al., (2015) concerning mnemonic devices and their potential in teaching and learning science subjects found them to have a remarkable contribution towards teaching since they enhance the recalling of lesson concepts. Juroski however ignored the effectiveness of self-initiated mnemonics to benefit all learners in a classroom. Through a quantitative study on mnemonic devices and natural memory using 72 psychology students, Bellezza and Reddy (2013) showed that the group which was exposed to familiar cues recalled more concepts than the group that was exposed to unfamiliar cues. It can therefore be deduced from the studies that through mnemonic devices, verbal information can effectively be recalled. Arguing from this deduction, mnemonic devices, if used in teaching and learning, could form memory that is similar to natural memory among learners.

An exploration of the effect of musical mnemonic strategies on the achievement and engagement of learners in an inclusive class recognized songs as mnemonics which enhance retention of the learned information (Eaton, 2020). Unlike similar past studies, Eaton's study was inclusive of learners with disabilities. Through rhythms and word connection, songs act as mnemonic devices.

1.2 Impact of Songs on Interactions

Considering the social interaction and bonding contributions of songs within communities, they would pose higher expectations if brought to the classroom. During events like initiations and weddings, celebrants usually sing together, with the songs matching the occasion being celebrated. Music appeals inherently since the singing action, together with the musical instruments, create some sense of social interactions (Geretsegger et al., 2014). Upon exposure to songs thus, people and communities get introduced to some levels of social interaction, especially if the songs are common amongst them. Even though Geretsegger and colleagues conducted the study on music and social interactions, their study was only limited to people with Autism. It is unfulfilling that the findings were non-inclusive of neurotypical persons yet they too listen to and have tastes for music.

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.

1.3 Songs and Science Teaching

As potential teaching strategies, the benefits of songs in a chemistry classroom seem unimaginable. Enjoyable music can assist students who feel out of place during science lessons have a sense of belonging in the classroom and find it friendly (Crowther, 2012). Additionally, a science lesson through music, especially alongside and dance, are likely to reach participants with varying abilities through multiple modes. In a chemistry lesson therefore, songs are likely to serve as multimodal teaching resources.

Governor et al., (2012), studying the experience of learners and tutors in teaching and learning science through music, found conceptual understanding and provision of extra examples as some of the benefits of songs in teaching. Moreover, science content songs engaged learners since they first captured their interests. In support, Bokiev et al., (2018) proved the ability of songs to engage learners and make learning pleasant. Globally, teenagers place music at the heart of their interests, implying that content rich songs could not only engage them but also equip them with additional examples and concepts in a given learned area.

The empirical results of the science song project study by Yoon (2017) changed the attitudes of the participants, making them to understand science better. However, being that only science educators participated in the study, the results were general for all sciences and not specific on a single science subject like chemistry.

Another study by Diakou (2013) found that songs can arouse positive emotions in learners, which result to increase in their motivation and attention retention. Similarly, music creates a positive mood and a positive learning atmosphere in the classroom (Hershner, 2018). Working on a similar study, (Ly & Quynh, 2020; Rambli et al., 2013) found that songs can win the attention of learners and enhance a deeper learning experience among them. Through that, students may gain ideas for participation in group discussions and answering classroom questions (Kotob & Bazzoun, 2019).

Given the literature, little is known regarding the remarkable efforts of songs in transforming the poor attitudes of teenage chemistry students. Thus, the present study intends to find out the impact of songs in engaging teenage chemistry students during lessons and in turn transforming their attitudes towards chemistry. This was guided by two research questions.

- i. What are the perceptions of teachers and learners on the use of songs in teaching and learning chemistry concepts like ionic bonding?
- ii. What are the benefits of using songs in teaching and learning?

1.4 Conceptual Framework

Songs build social interaction among students, which then leads to learner engagement and learning. Singing together makes learners interact socially. Vygotsky (1978) considers learning a social process originating from human intelligence and asserts that songs can lead to social interactions. Further studies by Wertsch (1992) attributed social interaction to personal development. In support, Rogoff & Chavajay (1995) posit that social activities lead to individual cognitive development. Being social activities, Songs, therefore, are likely to enhance social interaction during a lesson, leading to personal cognitive development among learners.

To engage students in a chemistry lesson, teachers could embark on interactive teaching and learning strategies like songs. Songs may lead to concept construction and learner transformation from passive to active participants in a chemistry classroom. Collective composition and listening of songs in a classroom may thus lead to productive classroom interaction (Kisanga, 2015).

If connected, the contents of a song can form a whole concept. If learners are engaged through a song, they may connect parts of the song to have a whole, thus acquiring knowledge. According to Koffka (1935), the whole is better than its parts. Kohler (1929, 1969), and Wertheimer (1959), as cited by Taetle and Cutietta (2002), maintain that completing imperfect wholes is possible when closely related parts are matched. With prior knowledge of a concept, a detailed understanding is likely to occur if related parts of a song are joined to make the entire concept.

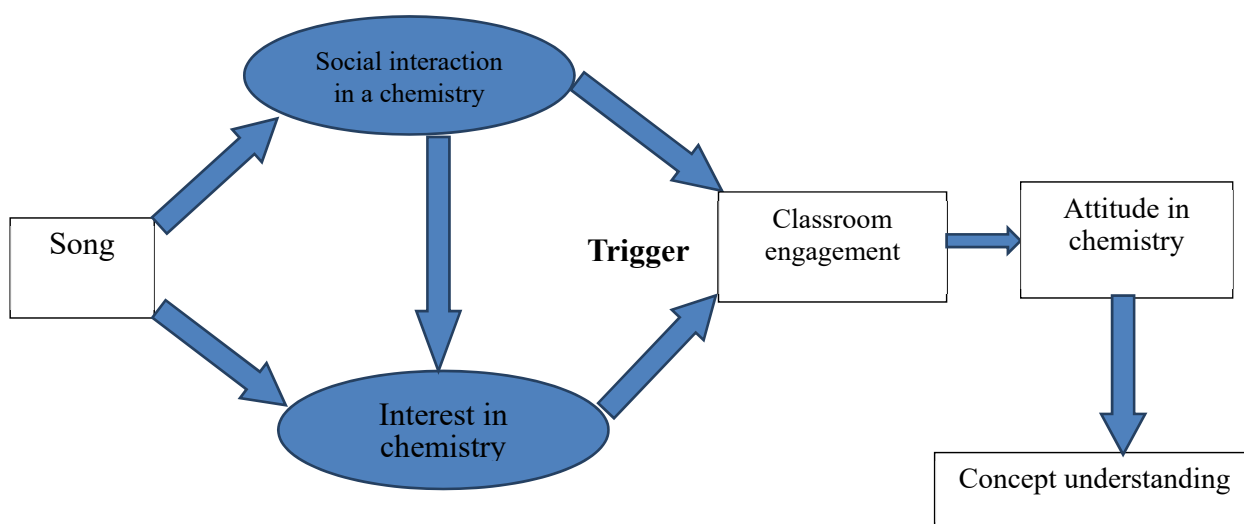


Figure 1. Showing the conceptual framework

2. Materials and Methods

A qualitative research approach was adopted during this study since the approach accorded the participants a chance to tell their experiences with the use of songs as a teaching and learning strategy. In this case, the participants described their experiences in the use of songs in teaching and learning properties and uses of ionic bonds, and the challenges they faced concerning the teaching strategy. According to Creswell (2014), qualitative research enhances the comprehension of a social phenomenon, based on the perceptions of the participants.

An action research design guided the study since action research subjected the participants to a socio-collaborative process that aimed at investigating poor pedagogical practices and devising interventions for them (Hendricks, 2017). During the reconnaissance stage, the collaborating teachers shared their current pedagogical practices and the associated challenges concerning the subtopic ionic bonding. This was followed by the intervention stage where an intervention lesson was conducted in the participating class using songs, with the collaborating teachers as lesson observers. Thereafter, the collaborating teachers and eight students from the participating class were subjected to an interview and focus group discussions respectively, following their reflections at the post-intervention stage. Two action research cycles were conducted in this study due to limited time. Each cycle lasted five days, with four days in between the cycles.

2.1 Participants

This action research study involved two form two chemistry teachers, Mr. Tembo (Note 1)¹ and Miss Zuhura (Note 2), who were purposively chosen as collaborating teachers, and one form two-stream which was taught by either of them. Form two class was purposively chosen because they were well conversant with the topic of structure and bonding, which is taught in the form two syllabus. Additionally, it was easier to transform learner attitudes in lower secondary classes like form two, compared to upper classes. From the participating class, 8 learners were chosen through a random sampling method to participate in the focus group discussion (FGD). The random sampling method reduced bias by ensuring that all the categories of learners, concerning performance in chemistry, were represented in the study (Sharma, 2017).

2.2 Instruments

The instruments for data collection which were used in this study include lesson observation guides, interview guides, Focus group discussion protocols, and Document analysis protocols. Multiple data collection methods helped in strengthening evidence from the study findings through triangulation. According to Denzin and Lincoln (2018), triangulation helps to increase rigor as it allows comparison of the results from each data collection instrument.

Lesson observations were conducted at reconnaissance and intervention stages. Entrance and exit interviews were conducted with the teachers during the reconnaissance and post-intervention stages respectively. Finally, a focus group discussion was conducted with the learners after the post-intervention stage of the second action research cycle.

2.3 Data Analysis Procedure

Sorting and data analysis was conducted according to the procedures suggested by Whitehead and McNiff (2006), where only relevant information to the study was sorted from the data collection instruments used. Audio data from interviews and FGDs were first transcribed verbatim and together with data from other data collection instruments, a comparison was made to build a stronger justification based on the study findings.

3. Results and Discussion

Findings are presented in this section based on students' and teachers' perceptions of the use of songs in teaching and learning ionic bonding. The participating teachers were coded as Tembo and Zuhura.

3.1 Learners' Perceptions of the Use of Songs to Teach Chemistry Concepts

During FGD, the learners had a general feeling that songs make understanding of chemistry concepts like ionic bonding easier compared to the teacher's explanations. They cherished the use of songs and suggested that their teachers should implement the strategy even in other chemistry areas. One student for instance said, "I enjoyed the song in teaching ionic bonds because they made me understand more about ionic bonds...that method may lead to more and well understanding of chemistry to the slow learners like me as well as others."

The lesson observations by Miss Zuhura and Mr. Tembo showed that the learners responded perfectly to the summative questions, indicating an understanding of concepts. When prompted to describe how ionic bonds are formed, a majority of the learners expressed will. As stated by another student, learners who had never responded to any question before, were able to answer questions during the intervention. She said, "I have never heard some students answering questions in class, especially in chemistry but using the songs, I have at least heard their voices."

The secret for the increased response to questions, according to the students, was their increased interest and attention in chemistry, which had been sparked by the songs. Through increased attention and concentration, learner engagement with the lesson occurred. When asked their views concerning the potential of science content songs to engage learners in a chemistry lesson, another student had this in response:

"Songs are a source of entertainment. In class when the teacher is teaching through songs, you must concentrate because when the teacher is teaching in class, some students are feeling like they want to sleep but through songs, in class when the teacher is teaching through those songs, they are able to concentrate" (FGD 20th, September 2021).

According to the findings, students like songs and are ready to adapt, should their teachers switch to songs as pedagogies. They confessed that most of their time is spent singing and expressed readiness of composing science content songs for their classroom use. Two students had this to say regarding the learners' affinity for music and their ability to benefit through songs:

“I think that learning chemistry through songs can help students a lot because students like songs and they sing more frequently ...so, when you teach chemistry through songs, it’s very hard for them to forget” (FGD, 20th September 2021).

The learners valued the ability of songs to reduce ease of forgetting learned concepts and had a view that by not easily forgetting, their performance in chemistry would be boosted. Concerning the ability of songs to enhance recall, one student had this to say:

“Learning chemistry through songs frequently helps students to remember each and every song which may help them during examinations without straining to go to the teacher and ask questions if they have not understood”. (FGD, 20th September 2021).

Study findings also revealed that songs cater for various learning styles among the students. Since each learner has a preferred learning style, subjecting all learners to one common learning pedagogy would be biased, implying that only a section of the learners would enjoy the lesson. With songs, however, as found during the FGD, most of the students found themselves enjoying the lesson. On songs and diversity, one of the students had these views:

“Learning chemistry through songs is a very interesting process because some students may...some students are not better at reading their notes on their books but when they sing, they are better at singing, they can sing the song better than reading” (FGD, 20th September 2021).

The students also reported the ability of science content songs to increase learners’ attitudes towards chemistry. It emerged that teachers think learners are lazy yet they don’t just find reasons to engage with what they do not enjoy, but just changing to teaching through songs might restore their attitudes. On science content songs and attitude change, student 1 had these views:

“Songs can change the attitude towards chemistry because some students understand songs and like songs more ...they are just lazy to learn but when you teach chemistry through songs, they might like songs and sometimes given the summarised notes they can also read them and sing the song which helps them to understand” (FGD, 20th September 2021).

From the focus group discussion, it was found that songs enhance learner participation in various ways like singing, responding to lesson questions, and composition of songs. Further, songs claimed the interests of learners who fear participating in class due to low confidence levels and engaged them. With songs, all learners participated as evidenced by the views of one of the students below:

“Some students are very afraid they cannot participate or they cannot have people hear their opinion...when you give a wrong answer, some people may laugh at you but during songs when you teach through songs, you see everybody is singing and you have that desire to join them in singing, so it increases your class participation” (FGD 20th, September 2021).

Findings revealed that science content songs not only engage learners within the chemistry classroom but also enhance extended engagement with chemistry concepts outside the classroom. Moreover, they promote engagement even when the teacher is not in the

classroom. In his view of songs enhancing the extension of the learning process outside the classroom and in the absence of the teacher, a student said:

“The songs will bring you to class because you will have that attitude, you want to be at the song, you want to know the song and can sing the song anywhere...In the classroom, some students like making the noise when the teacher is in class but when there is singing, there is a song being sung, they’ll want to hear the song and know the song” **(FGD 20th, September 2021)**.

3.2 Teachers’ Perceptions of Use of Songs to Teach Chemistry Concepts

Judging from the interview findings from the collaborating teachers, songs can make learners recall the lesson concepts. Reflecting on the comparative abilities of songs and lecture methods to enhance recalling of chemistry concepts, Tembo said:

“Using songs, I think the learners can remember a lot because if they can grasp the song and the song sticks... unlike the lecture method whereby you only talk talk talk talk, then at the end of the day there is nothing tangible that the students get” **(Exit interview Tembo, 20th September 2021)**.

Though her students had over time formed negative attitudes towards chemistry, Zuhura had a feeling that songs as pedagogies have the potential to restore her learners’ attitudes towards chemistry. She revealed that learners do wish that lessons end, but during the intervention, they even wanted it to continue. She said:

“It can bring the attitude of learners in chemistry back. So, when you use songs, their participation obviously will improve and with that their attitude will also improve...most of them were engaged, they were singing and they even liked the lesson, they didn’t want it to end, so I think that shows a good attitude...I think if the practice continues, maybe the attitude will lead to a good performance” **(Exit interview Zuhura, 20th September 2021)**.

Tembo also had a view that songs can transform learners’ poor attitudes in chemistry. He noted that when the learners insisted that the songs be replayed despite it being lunchtime, their attitudes were already changing.

“Now the change of attitude will be there because from the look of things when they were insisting, please replay...it was lunchtime and they never even cared about going for lunch, they only wanted to hear the songs, one more, one more, once more, once more” **(Exit interview Tembo, 20th September 2021)**.

From their views, both teachers maintained that once learners change their attitudes, they obviously engage and eventually perform better in chemistry.

Being that the songs, whether composed or downloaded have science content, the content might be part of additional examples left during teaching or missing in textbooks. By singing, therefore, the learners might not only get more examples but also a better understanding of the chemistry concepts. From the joy of singing, learners are likely to develop positive attitudes towards chemistry.

The ability of learners to answer questions in class could have been attributed to conceptual understanding and diverse learning styles enhanced by the songs.

Findings from the exit interviews with teachers revealed that songs arouse the interest of learners in chemistry, increasing their participation and attention during chemistry lessons. This in turn results to increased learner engagement. Zuhura had this to say:

“Obviously using songs arouse the interest and all of them were happy. Then another thing, they were engaged, then that is remarkable compared to other teaching methods where they just look at you...The role of songs in teaching I think is just for engagement, attention, participation of students in class and they are also very important in the bloom’s taxonomy, they help in recalling. They help in that recalling aspect.... High performance, attention, attitude, participation and the interest” (**Exit interview Zuhura, 20th September 2021**).

On his part, Tembo attributed the high learner participation to increased attention, which was caused by high levels of engagement. In his response on the role of songs in enhancing learner engagement, he said:

“The participation was quite high, the students were enthusiastic...The learners were engaged for the first time like the whole class was engaged, like the entire class wanted to sing the song. It was something new to them and something very very entertaining... it was something that captured their attention... over 90% of the students participated... they were very enthusiastic...they wanted you to replay the song more” (**Exit interview Tembo, 20th September 2021**).

Findings from the study revealed that songs have the potential to engage learners, capture their attention, enhance conceptual understanding, and increase learner participation in a chemistry lesson. With songs as reinforcements, increased response occurs through participation, concentration and answering summative questions in class (Skinner, 2014, 2016). These findings are in consistency with the Vygotskian social constructivism theory, which views songs as promoters of social interaction that enhance learning through collaboration (Vygotsky, 1978). Moreover, if different concepts of a song are connected, a whole chemistry concept can be formed (Koffka, 1935; Taetle & Cutietta, 2002).

It was clear from the findings that songs have the potential to enhance classroom participation, learners’ ability to answer questions in class, interest towards chemistry, increased attention in class and engagement even outside the classroom. These results are in line with those of Kotob and Bazzoun (2019) who observed that through science content songs, learners can acquire scientific contents that assist them in engaging with classmates in discussions and answering classroom questions. In addition, songs have been found to have very strong emotional effects on the learners, which can lead to increased attention and engagement (Gardner, 1983), as cited by (Coyle & Gómez, 2014).

While it is the dream of teachers to see their learners perform better, very few of them target the emotions of their learners through their teaching pedagogies. This study supports the assertions of Koelsch (2014) that music can elicit strong emotions among people and influence their moods. Being that attitudes are manifestations of emotions; songs are

eventually capable of making learners develop positive attitudes.

Comparing the results of this study with those from an empirical study by Jurowski et al., (2015) on the impact of mnemonic devices among the songs, recalling of taught information is central. Similarly, a study by Nikkhah et al. (2019) revealed that music promoted recall of more words among the learners who were taught through music. And these findings also support the results of Eaton (2020) that songs enable learners to retain the information that they have learnt.

Different learners have different methods of learning, thus the need for diversity in classrooms. Crowther (2012) observed that when science is taught through music, different participants in a classroom can be reached through multiple modes. He further found that when music is enjoyable during a lesson, learners who feel detached, get attached to the lesson and find it friendly. Consequently, the learners become active participants. Findings of this study demonstrated the fact that learners enjoyed it when the lesson was enshrined with songs relevant to the concepts under discussion, and this was important in boosting their learning and engagement with the lesson.

4. Conclusion

This study sought to transform poor attitudes and low engagement developed by learners in chemistry through the use of science content songs. Findings revealed the potential of songs to engage learners, capture their attention, enhance conceptual understanding, and increase learner participation in a chemistry lesson. Additionally, it was found that songs equip learners with extra examples and increase their ability to answer questions in class. Further, songs enabled learners to recall the learned content.

Following the findings from the study, schools, are urged to adopt the use of science content songs as a method of engaging their science students during science lessons and transforming their attitudes towards science subjects like chemistry. With such policies, the study believes that the performance in science subjects nationally can be positively impacted.

Though the study was conducted in a double-streamed mixed public school, findings of this study can inform similar studies in similar contexts or other contexts. It is suggested that future studies focus on the impact of songs on chemistry areas involving experiments since mnemonics can enhance mastery of concepts like solubility of salts and qualitative analysis.

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Declaration of Interest Statement

The authors declare that they have no conflict of interests.

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Notes

Note 1. Pseudonym for a collaborating teacher

Note 2. Pseudonym for a collaborating teacher

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