SUNDERLAND REFLECTIVE ACTION IN EDUCATION (SunRAE)
2022, VOL. 1, No. 3, pp. 47-56.
https://ojs.sunderland.ac.uk/index.php/sunrae

ARTICLE

The impact of implementing collaborative learning as means of creating an interactive student-centred learning environment in a Year 10 chemistry classroom in Egypt

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Abstract

This action research, conducted in a Year 10 chemistry classroom at a British international school in Egypt over three cycles aimed to improve the researcher's own skills and knowledge in creating a student-centred learning environment by introducing more collaborative learning activities. The research was needed because the researcher noticed the detachment of pupils at several points in the lesson: the sessions were becoming similar, with students seeming bored even though the researcher tried to make sure they stay engaged and that different parts of the syllabus are covered using sufficient differentiation. Two new strategies were implemented: *think-pair-share* and *peer assessment*. The researcher found the think-pair-share strategy to be useful with the covering new material and peer assessment strategy useful during the revision period.

Introduction

One of the main differences between action research and conventional research is that in action research the researcher is part of the research instead of being an observer. The researcher is investigating his or her own role in improving a certain situation or reaching a certain outcome: "In action research you use your learning to improve your practices for your own and others' benefit" (McNiff, 2016, p.21). This action research aimed to improve the researcher's own skills and knowledge in creating a more student-centred learning environment through introducing more collaborative learning activities. The research was needed because the researcher noticed the detachment of pupils at several points in the lesson: the sessions were becoming similar, and students seeming bored even though the researcher made sure they stay engaged and that different parts of the syllabus are covered using sufficient differentiation.

The research question driving this research was how to create a more student-centered learning environment by implementing collaborative learning strategies?

The research was conducted at a British international school in Egypt inside a Year 10 chemistry classroom over three cycles based on two strategies: think-pair-share and peer assessment. The period over which the research was conducted can be divided into two basic segments which were a) covering new material and b) revision. The researcher found the think-pair-share strategy to be useful with the covering new material segment and the peer assessment strategy to be used during the revision period.

Literature review

Action research and education development

Action research is carried out to solve an existing problem or situation with the researcher being part of the research. The researcher will be aiming at and working to acquire the required knowledge and skills to solve the problem. "Action research is about taking action (what you do), research the action (how you find out about what you do) and learning form the process" (McNiff , 2016, p. 19). It is more of an insider view rather than being an outside viewer spotting a certain situation and reflecting on how it is being responded to by others. Action research can be carried out in different fields and different social circles whether personal situations or those involving the larger circle of one's community.

Action research involves cycles with the following main steps:

1- Determining the problem
2- Planning for solution
3- Collecting data
4- Reflection

If the problem is not resolved, then return to step one, and apply amendments to plan based on feedback and reflection acquired from point three.

There are different models for action research cycles, all involving the basic steps mentioned above. It starts with the Lewin model (1946) then follow other models such as Ebbutt's model (1985), McNiff's model (1988), Elliot's model (1991) and Whitehead and McNiff's model (2006), all of which share the main steps of cycles but differ mainly in the attempt to seek the most effective use of reflection to link repeated cycles.

There are different types of action research, the one used here is a practical action research which aims to improve practice through the knowledge and application of the researcher. According to McNiff (1991), a shift in the focus of educational research can be made from seeking knowledge from resources outside one's self to creating knowledge through practice, "Education is not a field of study so much as a field of practice" (McNiff, 1991, p.5). This concept is used as the basis for linking successive cycles in the action research, where a cycle is planned and strategies are chosen, the researcher evaluates the situation and then, based on the knowledge obtained from actual practice, changes to the actual plan were made to reach the best resolution for the problem.

Another very interesting couple of points, still according to McNiff (1991), are that in conventional research, the researcher will observe, evaluate and provide one fit all strategies and resolutions which are indeed essential for teacher development, whereas action research allows for the reflection of teachers on given situations based on their own context. "Learning involves the evolution of understanding, and professional development involves considered reasons for action. All these aspects involve the critical reflection of individual teachers within their own context specific situations" (McNIff, 1991, p. 13). The researcher finds the individual teacher reflections to be very valuable as it allows for embracing different cultures and social contexts. Secondly, teachers' awareness of their own capabilities and limitations is very important to create learner teachers. Teachers' commitment to making a change in their own circle and utilizing such awareness, both eventually leads to having teachers committed to gaining the knowledge needed to make that change, a value which underpins action research.

Creating an interactive student centred learning environment

What is a student centred learning environment?

A student centred learning environment is one in which the role of the teacher is to facilitate learning rather than taking over the learning process. Knowing the background of learners and their needs forms the bases for establishing such an environment. According to Johnston (2004), actual learning happens in active learning environments where learners build their own knowledge through experience rather than being passive recipients of information delivered by the teacher. Student centred learning arose from the theory of constructivist learning which is defined as an "active process in which learners are active sense makers who seek to build coherent and organised knowledge" (Mayer, 2004, p. 14).

Collaborative learning as a form of student centred learning

According to Panitz (1997), collaborative learning is applied whenever groups of people come together to share and respect each other's abilities and contributions; it is a practice that goes beyond the classroom environment to include all aspects of social life and it is free from the competition encountered in individual work: "as a pedagogy CL involves the entire spectrum of learning activities in which groups of students work together in or out of class" (Penitz, 1999, p.7).

According to Johnson and Johnson (1986), working in groups results in higher level of thinking and long-term memory of learnt information. Working in groups allows learners to compare their learning approaches and share different techniques. It offers a comfort zone for low achievers and students who feel embarrassed to share their questions with the rest of the classroom: they can ask their classmates for help and feel more comfortable about it. According to Kessler, et al. (1985) working in groups reduces anxiety.

Teachers do have an active role in collaborative learning: their role is to facilitate learning and plan for activities that allow students to dive into the curriculum and gain the required knowledge by themselves (Penitz, 1999). In order for students to reach the expected benefits of deeper understanding and higher level of achievement from collaborative learning, teachers need to plan for suitable instructions (Van de Pol, Volman, & Beishuizen, 2010). The interaction between students during collaborative work must aim towards reaching the learning goals through regulated social activities that guarantees commitment to these goals (Van Leeuwen and Janssen , 2007).

Teachers need to plan very carefully for their input during collaborative learning. During collaborative work the students must retain control of their own learning. The more the teacher becomes the centre of the learning process the less control the students will have. Teachers' tailored guidance is required during collaborative learning in two aspects which are, content and relational aspects. It was found to be very useful when this guidance is provided in the "meta level" (Van Leeuwen and Janssen, 2019 , p.25), which is to guide students through strategies that enable them to gain content knowledge and to work efficiently with one another.

Panitz (1999) offers a similar description for the role of teachers in collaborative leaning, which is that is they control and regulate the learning environment through planning for learning and social activities while allowing learners to be responsible for their learning process.

The researcher believes that Vygotsky's theory of zone of proximal development gives the idea of gradually allowing the students to control their own learning. When starting to introduce collaborative learning as one technique to shift the classroom environment to being more student centred, students will find it challenging at first to dig their own path to knowledge through different learning strategies rather than receiving the information directly through a lecture style teacher centred learning environment. It may be they will need more guidance at the beginning but by gaining the appropriate assistance and practice, over time they will develop the confidence and skills to take more control over their learning: "The zone of proximal development defines those functions that have not yet matured but are in the process of maturation, functions that will mature tomorrow but are currently in an embryonic state. These functions could be termed the "buds' or "flowers" of development rather than the "fruits" of development. (Vygotsky, 1978, p.86).

Methodology

Pedagogy

During the course of this action research new subject material was first covered followed by a period of revision before the final exams. The aim of this action research was to study the effect of collaborative learning on creating a more student centred learning environment through two strategies which are *think-pair-share* and *peer assessment*.

Think-pair-share

Think – pair – share (Lyman, 1981) is a collaborative learning strategy which allows learners time to think, discuss thoughts and ideas with partners and to finally share them in group discussions. The strategy of think-pair-share can be applied to different aspects of the learning process:

a- After reading a text.
b- During lab work.

c- As a response to a prompt

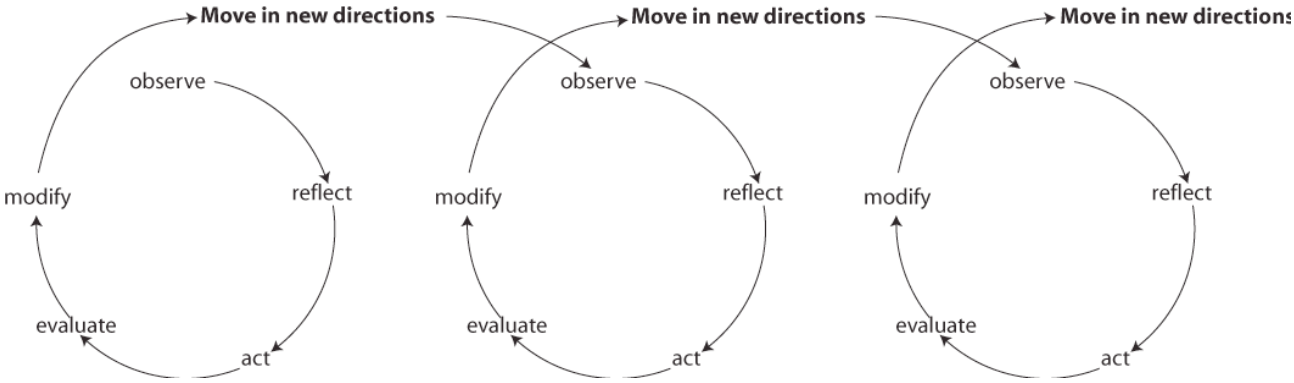
The students are asked to read a certain text, then the researcher will ask questions related to this text and students take time to **think** about these questions and then they are **paired** to **share** their thoughts together and then with the entire classroom in the form of a group discussion. The same procedure can be applied to practical work or a prompt, where students working in pairs can share their observations and analysis related to the experiment.

Peer assessment

During the revision period peer assessment was used as a form of collaborative learning. Students worked in pairs to assess each other's work. Part of the revision is done through answering past paper exam questions. Students would check each other's work, discuss their answers and provide feedback. Referring to the mark schemes or model answers was an inseparable part of the process. According to Topping (1998), peer assessment allows learners to realise the gaps in their own knowledge of the subject material through being critically engaged in subject content and by comparing their work to that of other learners.

Action research cycles

This action research was conducted over three cycles. The action research model adopted in this research is Whitehead and McNiff's model (2006):



The cycle is made up of five consecutive steps that ends with a modified plan to move in new directions. It starts by observing a certain situation or problem followed by the researcher's reflection which involves planning and searching for the required knowledge and skills by which the researcher can improve the situation. This is next put into action, then through data collection and analysis the plan is evaluated and modified to move in new directions that are expected to work better for that given situation.

Data collection and analysis

Taking a qualitative data collection approach, data was collected on the basis of method triangulation - that is to use more than one method for collecting data (Polit and Bick, 2012). According to Patton (1999), using more than one method to collect data related to a certain research question provides a full scale image and wider understanding of the situation.

The methods used for collecting data in this action research are:

1- Peer observations
2- Notes
3- Student interviews

First cycle

<u>Situation:</u>

Students were first introduced to the idea of collaborative work through the think-pair-share strategy. First, they were asked to individually read the text thoroughly from the course book and think about it.

Then, they were asked to pair up with the person setting next to them to discuss their thoughts and identify the main points included in the text and be ready to discuss them with the rest of the class.

Data:
Data is collected in this cycle via researcher's notes and observations in addition to peer's observation.

Researcher's observations:
Students needed different periods of time to read and think about the text individually depending on their varying capabilities. Pairing to discuss the information included in the text was successful for pairs of moderate to high achievers - they created concept maps and listed main points. Two of the student pairs were almost dysfunctional during the pair discussions as one of the students in both pairs were low achievers. For the sharing part, low achievers and shy students were reluctant to participate during the group discussion.

Peer observation:
In general, the students were able to reach and point out the main concepts of the lesson through collaborative work. Some of the students didn't fully participate in the session; they either need further guidance or encouragement. More attention should be given to plenary to allow students to compare their ideas and notes they figured out on their own to a solid reference to consolidate the information.

Analysis:
Data collected were used to point out the positive and negative aspects of the first cycle. Starting by the positive points, students were able to a great extent to build their own knowledge of the subject matter through the planned collaborative learning activity, which is in line with the idea that students learn more efficiently while constructing their learning through exploring and building their own experience (Lee and Hannafin 2016).

Now moving to the negative points which are, firstly, that low achievers couldn't keep up in pair discussions when paired up with higher achievers. This contradicts what is stated in literature that collaborative work is particularly beneficial for low achievers, especially when paired with higher achieving students (Sills, Rowse and Emerson, 2016). The researcher believes that these students need to gain more confidence to be able to participate in peer or group discussions. This can be done through the supporting role of the teacher which can be in the form of guiding instructions and tips on how to read a text efficiently to extract required information and through scaffolding. Over time, students will less and less dependent (Calder, 2015). Second is the issue that some students were too shy to participate in group discussions. One of the most important factors to consider when implementing collaborative learning or indeed any learning environment is to establish a safe environment where students are not afraid to be judged or embarrassed to make mistakes (Clapper, 2010).

Action:
1. Researcher will closely monitor the pairs with low achieving students and offer instructions and guidance more frequently and emphasize prior knowledge and set clearly the new knowledge that is expected to be gained.
2. Starting next session with a talk about how the students feel about the activity to give the learners the chance to speak out their worries.
3. Decide upon the needed time for individual thinking or reading based on the minimum time required by low achievers. Students will also be advised to use internet to search for any information they need.

Second cycle

Situation:
It was explained at first that the session will proceed through the think-pair-share activity then the researcher wrote the following quote from John Steinbeck on the board: " Ideas are like rabbits. You get a

couple and learn how to handle them, and pretty soon you have a dozen" and use it to explain that this is what this activity is all about, we all have valuable thoughts that are worth sharing, in the hope that this will break the ice for low achieving and shy students to participate in group and pair discussions. Then, prior knowledge was checked and the knowledge that is expected to be learnt will be clearly emphasized and explained on the board.

Considering the time for what was mentioned above, students was required to read a short piece of text followed by the same steps from the first cycle but this time special attention was paid to pairs with low achieving and shy students through giving detailed and frequent instructions and scaffolding.

Data:

Researcher's observations:
Social interaction: A huge difference for the aforementioned withdrawn group of students' attitude towards this collaborative learning activity was noticed, using the quote from John Steinbeck which the learners found to be funny and interesting and the short discussion held afterwards succeeded to a great extent in creating a feeling of safety in participating for those students; also the more detailed and frequent instructions and scaffolding was empowering for them and gave them more confidence.

Subject matter: during the first cycle, it was clear that the high to moderate level students were able to build their knowledge of subject matter successfully through collaborative work. During this cycle the image became clearer for low achieving students in terms of subject matter knowledge as they started to participate in group discussions. Being paired with higher achieving students did help a lot with constructing subject knowledge which showed in their participation in group discussions

Peer observation:
Compared to the first cycle, students were more engaged, they had better understanding of the strategy and were able to benefit better from the situation. It was nice to see low achieving students proudly participating in group discussions and sharing their ideas. The classroom environment was positive in general. There is noticeable increase in learners' independence from the teacher. Allowing the students more time to read and giving them instructions whenever needed was a good idea to allow them to gradually shift their learning attitude from being teacher centered to being more student centered.

Analysis:
This cycle has drawn the researcher attention to the conflict existing between two groups in literature, one pressing the importance of direct instructions from teachers (Rosenshine, 1976; Ding and Li, 2014) and the other advocating for the learning to learn concept and that students once given control of their own learning and with the proper guidance while maintaining the role of the teacher as a facilitator in the learning process will gradually develop the skills they need to construct their own knowledge (Lee and Hannafin, 2016).

The first group argues that low achieving students did achieve better progress when given detailed direct instructions on subject matter by teachers (Rosenshine and Stevens, 1984), also that the lack of direct instruction where the teacher delivers solid subject knowledge to students can cause them to struggle with standardized tests (Leonard, 2018).

The second group which is on the side of student-centered learning argues that this kind of learning environment equips students with skills required in the real world such as communication skills, critical thinking and verbal skills (Lee and Hannafin, 2016).

What happened in this cycle is that the researcher combined both approaches. Strategic direct instruction was applied only when needed as a form of facilitation for certain students whom at this particular time zone in their learning journey are in need for such direct instruction, which will become less and less

required as long as it exists as a side strategy under the umbrella of a student centered learning environment.

Action:
Students are ready to practice another form of collaborative learning in the attempt to establish a more student-centered learning environment. For the next cycle another strategy will be applied alongside think-pair-share which is peer-assessment. Students are asked to revise a certain topic as a homework assignment.

Third cycle

Situation:
A certain topic is revised through two collaborative learning strategies, think-pair-share and peer assessment. Students are introduced to the peer assessment strategy. During the first part of the session students will work together to design a concept map for the topic then pairs will share their ideas and work through brief guided inquiry. For the second part of the session, students will answer a worksheet related to the topic then each pair of students working together will check each other's work. A model answer will be provided to each pair to further check their answers and discuss them together on solid basis. Students can return to the teacher for guidance at any point.

Data:
Researcher's observations:
Social interaction and communication skills: the researcher noticed that the students are gaining each other's trust and feeling more comfortable working together. Low achievers and shy students are participating more frequently in group discussions.

Subject matter and building knowledge: very useful brainstorming and exchanges of information were practiced during pair and group discussions, which showed a reasonable degree of subject knowledge. Peer assessment was particularly useful for constructing knowledge and the activity was leveled up by providing the students with the model answer (after they finished answering and assessing each other's work) as it allowed them to clarify misconceptions. Strategic direct instructions and scaffolding were still applied as in the second cycle.

Peer observation:
Students were enjoying group work and felt comfortable working together. Introducing the peer assessment strategy provided deeper understanding of the subject matter and allowed students to practice critical thinking.

Student interviews:
Students' views were gathered at the end of the third cycle. Students who worked together during the actions research were interviewed at the same time. The researcher explained to the students the purpose of the interview was to gather feedback on the new strategies in order to improve the quality of the learning environment. The following table shows the main questions asked during the interview and the point for asking them.

Question	Purpose of the question
Did you feel comfortable to share your ideas and answers with everyone else in the classroom? Explain.	To check whether the students felt emotionally safe or not.
Did you find the sessions to be exhausting?	To check for cognitive overload and whether the process was overwhelming for the students
Did you feel you had enough support and guidance from your teacher?	How students respond to this question will be used to assess the degree of teacher control over the learning process.

A summary of the students' responses to the interview questions

The majority of the students reported that they had no problem sharing their ideas with their partners and the, with the entire class. Some of the students reported that they didn't feel comfortable at first, but it got better as the cycles were repeated. In general, they didn't feel mentally overloaded during the session, they reported that they had enough resources and teacher guidance.

Analysis:

The researcher finds the information obtained from interviewing the students related to social interaction and cognitive load to be a reliable form of qualitative data as the students were talking about their own feelings and mental state. On the other hand, the data collected in relation to the students' perceptions and evaluation of the teacher's guidance and support was decided to be not so reliable because sometimes the students don't have clear perception of the kind of support and guidance they actually need.

Peer assessment is viewed in literature as both a form of feedback and formative assessment (Topping, 1998, Black and Wiliam, 2009). In peer assessment, students communicate feedback to each other in a language that is more accessible to them and they usually feel more comfortable than being assessed by their teacher (Liu et al, 2016). Providing the students with model answers while peer assessing allowed for better assessment and more comprehensive feedback (Peters, Korndle and Narciss, 2018).

Conclusion

In a student-centred learning environment students acquire a lot of skills that prepare them to the real world. It gives them the chance to explore their potential and develop learning and social skills that enable them to be learners for life. The role of the teacher in such a learning environment is as a facilitator who guides the students through learning activities while they are given control over their own learning.

Using collaborative learning lies at the centre of establishing a student learning environment. The students have greater control of their learning. Through collaborative learning students become more engaged in the learning process while developing other important skills such as critical thinking , social interaction and verbal skills.

Strategic direct instruction is still a very important aspect in education that can't be totally eliminated. A combination of both has proven to deliver the best learning outcomes in the context of this action research. The researcher believes that the percentage of student control over learning depends on various factors such as the economic and social context. Also, following the student centred learning approach from an early age will give rise to a generation that is more empowered and more ready for managing their own learning as they grow up.

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