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## **Interactive and Collaborative Pedagogical Strategies for Teaching General Science at Middle Level: Comparing the Single National Curriculum (2022) and National Curriculum (2006)**

### **Afreen Azhar**

M.Phil. Scholar, Educational Leadership and Policy Studies, University of Education, Lahore Email: syedaaafreen004@gmail.com

### **Dr. Muhammad Anwer** (Corresponding author)

Associate Professor, Division of Education, University of Education, Lahore  
Email: dranwer@ue.edu.pk

### **Javeria Khan**

M.Phil. Scholar, (Department of Educational Leadership and Policy Studies), University of Education Lahore Email: info.javeriakhan@gmail.com

### **Fatima Ijaz**

M.Phil. Scholar, (Department of Educational Leadership and Policy Studies), University of Education Lahore Email: fatimaijaz34519@gmail.com

### **Areesha Arshad**

M.Phil. Scholar, (Department of Educational Leadership and Policy Studies), University of Education Lahore Email: areeshaarshad567@gmail.com

### **ABSTRACT**

This study examines the interactive and collaborative pedagogical strategies recommended for teaching General Science at the middle level (Class 6) in Pakistan's Single National Curriculum (2022) and National Curriculum (2006). This research also explores how these strategies are reflected and implemented in the textbook of grade 6 General Science. Qualitative research design was used with qualitative content analysis as the primary method to systematically analyze both curriculum frameworks and their aligned textbooks. Comparative analysis was then done to identify similarities, differences and shifts in pedagogical emphasis across the two curricula. Purposive sampling was used for the selection of documents, including the SNC 2022, NC 2006 and class 6 General Science textbook published by the Punjab Curriculum and Textbook Board. The findings highlight that the SNC 2022 incorporates a wider range of interactive and collaborative pedagogical strategies as compared to the NC 2006. The NC (2006) includes eight strategies, i.e., traditional, teacher-centred approaches with limited collaborative opportunities, but the SNC (2022) incorporates 19 interactive and student-centred strategies, including critical thinking, creative thinking, collaboration, communication, simulations, games and model making. The SNC (2022) textbook, however, reflects 18 strategies, including both traditional and innovative approaches, promoting active learning, creativity, and teamwork. Overall, the SNC (2022) provides a broader, more comprehensive set of interactive and collaborative strategies for teaching science at the middle level.



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### Introduction

Pedagogical strategies refer to the planned and deliberate methods, techniques, and approaches used by teachers to improve and facilitate the learning of students. These strategies are not only based on theory but also influenced by the social, cultural, economic and political features of the learners. Effective pedagogy is not simply about transferring the knowledge or the information; rather, it is about stimulating the interest (Hajian, 2019). It transforms passive classroom listeners into active classroom participants who can question, work together and connect lessons to life outside of the school walls. Learning actually happens when students do not just memorize the facts, but instead they get to know how knowledge works in real-life situations (Schank et al., 2013).

The Government of Pakistan introduced the Single National Curriculum (SNC) in 2020 as part of the bigger picture of working towards a unified system of education in response to this issue. The SNC is based on the idea of providing "one system of education for all", with the aim of promoting equity and national cohesion. It proposes a uniform set of standards and the learning outcomes across all the provinces and types of schools, including the public schools, private and religious, from grades 1 to 5 in 2021-22, the grades 6 to 8 in 2022-23, and the grades 9 to 12 in 2023-24 (MoFEPT, 2020). The vision behind this initiative is to ensure every child will have an equal chance of a good education and is evaluated under the same standards, regardless of their socio-economic background (Tayyab et al., 2022).

At the middle level of education, which generally involves students in grades 6 to 8, the need to use such interesting pedagogical strategies is even more important. These are the years when children start to develop more sophisticated reasoning skills, question the world around them and develop the habits which will shape their life-long learning. In subjects like General Science, which require understanding, observation and application, the use of interactive and collaborative strategies can render the difficult concepts more tangible and meaningful (Matcha & Rambli, 2013), but the implementation of the SNC has triggered some issues in terms of its effectiveness, its inclusivity and its capacity to address the deep-rooted educational disparities in the country.

Without targeted policy interventions and societal shifts, a curriculum reform alone will not be able to bring transformative change. The National Curriculum of 2006 focused more on content coverage and basic skill development, with comparatively less emphasis on inclusive or interactive pedagogical practices, in contrast to the SNC. The shift from the 2006 curriculum to the SNC thus presents an opportunity to explore how pedagogical strategies, especially interactive and collaborative ones, are conceptualized and applied within the two frameworks. The focus of this study is to explore and compare the interactive and collaborative pedagogical strategies recommended for teaching General Science at the middle level (Class 6) in two key curriculum frameworks in Pakistan. The study aims to examine how these strategies are reflected in curriculum documents and in the textbook, and to what extent they align with student learning outcomes.

The curriculum of General Science for middle level is built on the idea that science would help the students make sense of the world by encouraging them to ask questions and explore the reasons behind the natural events. This curriculum encourages inquiry-based and hands-on learning where students have an opportunity to actively explore scientific ideas rather than just memorize the facts. It is also based on the international



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education standards to offer quality and relevance (SNC, 2022). A significant characteristic of this curriculum is that it involves the assimilation of the STEAM method of uniting Science, Technology, Engineering, Arts, and Mathematics. The approach will also guide the students to acquire key skills in problem-solving, creativity and critical thinking, among other skills that are required to lead a successful life in the 21<sup>st</sup> century. (Adeoye & Jimoh, 2023; Jamil et al., 2023; Jamil et al., 2024; Jamil et al., 2021; Naseer et al., 2022; Prapulla et al., 2022). The curriculum is carefully structured to help the students build the knowledge step-by-step as they move forward in the various grades. It uses a student-centred method which focuses on developing higher-order thinking skills as opposed to just recalling the information. It also attempts to demonstrate how various branches of science are related and gives students an understanding of the larger picture of how science works in real life (SNC, 2022).

By emphasizing the scientific processes and hands-on experiments, the SNC tries to help the students take ownership of their learning. This way, they are encouraged to be naturally curious, ask questions and seek answers for themselves. As they do this, they begin to explore deeply, solve problems and can think like young scientists. Through active and engaging learning experiences often described as hands-on and minds-on, students not only build practical scientific skills but also develop a better attitude toward science. Instead of just learning what is happening in a given situation, students are guided to ask why it is happening. This shift helps them understand problems more deeply and nurtures a scientific mindset that focuses on reasoning, investigation and critical thinking (SNC, 2022).

### **Research Objectives**

To identify the interactive and collaborative pedagogical strategies recommended for teaching General Science at the middle level (Class 6) in the Single National Curriculum (2022) and the National Curriculum (2006).

To compare the interactive and collaborative pedagogical strategies mentioned in the Single National Curriculum (2022) with those outlined in the National Curriculum (2006).

To analyze how these interactive and collaborative pedagogical strategies are reflected and implemented in the Class 6 General Science textbooks developed under both curricula.

### **Review of Related Literature**

Pedagogy is the broad concept that is concerned with what the instructors do to influence the learning of students. It includes the strategies, methods, and styles that teachers use to help students learn effectively. The task of the teacher is to help facilitate the process of discovery and meaning-making, rather than the transmission of information (Moreno, 2009; Scarino, 2014). According to Bransford et al. (2000), to be effective, teaching should build on what students know, offer opportunities for active engagement, and stimulate reflection. Effective pedagogy is also interesting in the establishment of the learning environment in which students are active and able to construct knowledge themselves (Khodadad, 2023). This includes techniques such as questioning, experimentation, project work and discussion.

The interactive pedagogical strategy focuses on the creation of a learning environment that is engaging and participatory, where the students are actively involved in the learning process rather than passively receiving the information. It focuses the learner in the classroom as opposed to the traditional teaching methods that place the teacher at the



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center of the classroom and students are also largely just listening (Giorgdze & Dgebuadze, 2017). In this approach, the role of the teacher changes from being a source of information to a facilitator or guide who helps students explore, question and construct their own understanding. Learners become active participants who are critical thinkers, share ideas and can apply their knowledge in meaningful contexts.

In an interactive classroom, lessons are developed around the activities that facilitate teamwork, discussion and problem-solving. Individual tasks often become group ones in which each of the students contributes to the achievement of a common goal. This approach not only enhances the learning outcomes but also helps the students develop their important social and communication skills, which include listening to other people, respecting other people's opinions and working collaboratively. Research shows that learning from interactive teaching improves the retention and understanding of the students (Alard & Kosiewicz, 2021; Hung & Chen, 2018). While students only remember some 30% of material learned passively, when they learn by active and hands-on involvement, they remember as much as 90% of their learning (Giorgdze & Dgebuadze, 2017).

Giorgdze and Dgebuadze (2017) present some common interactive strategies that teachers may use. These strategies make lessons more dynamic and relevant to the lives of students; students can make connections between theory and practice. According to Senthamarai (2018), interactive teaching strategies are one of the best methods to engage students in learning actively. These strategies promote participation, creativity, collaboration and making learning more meaningful and fun. Interactive teaching is a two-way process in which both the teacher and students play an active role in the learning process (Orshanskyi et al., 2020).

The collaborative pedagogical strategy marks a shift from the traditional teacher-centred approach to a more student-centred learning environment. In this approach, learning does not heavily rely on lecturing, listening or note-taking. Instead, students will actively work in groups to solve problems, complete projects, or create projects. Collaboration encourages not only the learners to become responsible for their own learning, but also to help and learn from each other (Laal et al., 2012). In the 21<sup>st</sup> century, collaboration has become an important element of effective education for promoting not only collaborative teaching and learning but also collaborative thinking and working (Riaz & Din, 2023; Sulaiman & Shahrill, 2015). Through collaboration, students develop teamwork, communication and problem-solving skills which are very important for everyone's academic success as well as in real life.

The role of the teacher in collaborative pedagogy has changed significantly. The teacher is the facilitator or mentor who creates the meaningful learning experiences instead of being the source of knowledge (Gautam & Agarwal, 2023; Jagtap, 2016). Teachers facilitate the process, facilitate discussion among students, and encourage students to share their exploration of ideas. This helps to create a dynamic and inclusive learning environment in the classroom where all students can contribute and learn from each other (Laal et al., 2012).

### **Types of Collaborative Pedagogical Strategies**

#### **Think–Pair–Share**

Think-Pair-Share is a successful collaborative learning approach that assists students in thinking and learn together. First, the students spend a few minutes thinking/writing by themselves on a question. Then they go back to their classmates and share their ideas. This helps the students to know the topic better and learn from each other. In the end,



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each pair shares with the entire class what they discussed with each other. This activity enables the students to feel confident, to be active in the learning and to be able to improve their speaking and thinking skills (Riel, 2022).

### **Jigsaw Technique**

The jigsaw is a pedagogical strategy that is collaborative, in which students work together and are dependent on one another to complete a task (Shume et al., 2016). The teacher in this strategy aggregates the class into small groups and assigns each group a different part of a lesson or topic to learn. Later, all the groups share what they learned to help the whole class understand the whole topic, just as putting together the pieces of a puzzle.

### **Group Problem-Solving**

It is a teaching and learning strategy in which students collaborate within small groups to solve a particular problem or complete a task. Instead of working individually, students work with others, share ideas, discuss possible solutions, and come to a collective answer.

### **Peer Review**

Peer review is an effective collaborative pedagogical strategy in which students work together to review and to make each other's work better (Riel, 2022). It helps them to understand that their classmates are valuable sources of knowledge and not just the teacher. By giving and receiving feedback, students learn from each other and come up with better ideas, be they writing an essay, preparing a presentation, or completing a minor task. Teachers can facilitate this process by modelling to the students the ways to give helpful and respectful feedback. This way, it builds teamwork, responsibility and communication skills, and also makes learning more interactive and supportive.

### **Using Case Studies**

It is a useful collaborative teaching strategy as it gives students a chance to work together to understand and solve real-life problems. In this method, students observe and discuss a situation to determine what went wrong and discuss what they could do in case of that situation as a team. Since every student has their own experiences and opinions, they learn how to listen and cooperate and how to decide in a group. This kind of activity helps the students to develop critical thinking, teamwork, communication and problem-solving skills that are good for their future learning and professional life (Riel, 2022).

### **Research Methodology**

This research takes on a qualitative research design by using qualitative content analysis and comparative analysis to understand the interactive and collaborative pedagogical strategies that are embedded in curriculum documents and textbooks. The study uses purposive sampling techniques to select relevant educational documents that are related to the study in a deliberate way and include national curriculum documents as well as the Class 6 General Science textbook published by the Punjab Curriculum and Textbook Board. Data collection was solely carried out by document analysis, of which the researcher was the main instrument. Qualitative content analysis is the first and foremost method of offering a structured, systematic and interpretive method for analyzing the textual content of the Single National Curriculum (2022), National Curriculum (2006) and the corresponding textbook of Class 6 General Science. Through careful



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interpretation of the textual data, this method allows us to identify recurring themes, patterns and representations of pedagogical strategies within each document. Following the completion of the content analysis, a comparative analysis is carried out to carefully examine similarities, differences and the significant shifts in pedagogical emphasis between the two curriculum frameworks as well as in their associated textbooks. The data analysis procedure was proceeded in two related stages of first performing an in-depth document analysis, to identify, synthesize, and infer significant pedagogical aspects and second, comparative analysis, to make pertinent conclusions on pedagogical practices development and transformation in middle-level General Science education in Pakistan.

### Findings

The researchers have analyzed the interactive and collaborative pedagogical strategies mentioned in the Single National Curriculum (2022) and the National Curriculum (2006) for teaching General Science at the middle level. A table was developed to show the presence or absence of twenty-five strategies identified from the literature as key components of inquiry-based and collaborative science instruction. Class 6 General Science textbook based on both curricula was examined to see how these strategies were reflected in instructional content. The tables were carefully reviewed and compared recommended strategies in the curriculum documents and their implementation in the textbooks.

**Table 3.1:**(Analysis of Pedagogical Strategies for teaching science in the Documents)

Sr.	Pedagogical Strategies across Both NC (2006) and SNC (2022) Curricula	Both NC (2006)	SNC (2022)
1.	<b>Inquiry-Based Science Learning</b>	✓	X
2.	<b>Problem-Based Learning (PBL)</b>	✓	✓
3.	<b>STSE (Science-Technology-Society-Environment)</b>	✓	X
4.	<b>Homework</b>	✓	X
5.	<b>Print Resources</b>	✓	X
6.	<b>Non-Print Resource</b>	✓	X
7.	<b>Use of Technology</b>	✓	X
8.	<b>Field Trips &amp; Guest Speakers</b>	✓	✓
9.	<b>Critical Thinking</b>	X	✓
10.	<b>Creative Thinking</b>	X	✓
11.	<b>Communicating</b>	X	✓
12.	<b>Collaborating</b>	X	✓
13.	<b>Elicitation</b>	X	✓
14.	<b>Brainstorming</b>	X	✓
15.	<b>Discussions</b>	X	✓
16.	<b>Demonstration / Exposition</b>	X	✓
17.	<b>Investigation /hand on</b>	X	✓
18.	<b>Case Study</b>	X	✓
19.	<b>Comic Strip</b>	X	✓
20.	<b>Simulation</b>	X	✓



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21.	<b>Model Making</b>	X	✓
22.	<b>Research</b>	X	✓
23.	<b>Games</b>	X	✓
24.	<b>Mind Mapping</b>	X	✓
25.	<b>Collaboration and Cooperation</b>	X	✓

### National Curriculum (2006)

The researcher has identified twenty-five pedagogical strategies as shown in the table above. The NC (2006) includes eight strategies such as inquiry-based learning, problem-based learning, STSE, field trips, homework, use of Science Equipment & supplies (Print-Non print and non-print resources), and use of technology. These indicate inquiry-oriented and activity-based methods, though NC (2006) largely includes traditional strategies, as they offer limited opportunities for collaboration and group-based inquiry. Collaborative approaches such as cooperative learning and group communication are not explicitly emphasized in NC (2006).

### Single National Curriculum (2022)

In contrast, SNC (2022) emphasizes a broader and more interactive 19 instructional strategies, i.e., PBL, field trips, critical thinking, creative thinking, communicating, collaborating, elicitation, brainstorming, discussions, demonstration/exposition, investigation/hands-on, case study, comic strip, simulation, model making, research, games, mind mapping, collaboration & cooperation. Overall, the SNC (2022) integrates more student-centred, collaborative, and activity-oriented strategies as compared to the NC (2006), which relies more on traditional instructional resources and teacher-led approaches.

### Comparing Both Documents:

It was seen by researchers that both curricula, NC (2006) and the SNC (2022), show only two common strategies that include problem-based learning (PBL) and field trips. Overall, the comparison indicates that the SNC (2022) provides a richer and more comprehensive set of interactive and collaborative strategies than the NC (2006).

**Table 3.2 (Analysis of Pedagogical Strategies for Teaching General Science in Textbooks of Class 6)**

Sr	Pedagogical Strategies	NC 2006	SNC 2022
1	<b>Inquiry-Based Science Learning</b>	✓	✓
2	<b>Problem-Based Learning (PBL)</b>	X	X
3	<b>STSE (Science-Technology-Society-Environment)</b>	✓	✓
4	<b>Homework</b>	X	X
5	<b>Use of Science Equipment &amp; Supplies (Print Resources)</b>	X	X
6	<b>Use of Science Equipment &amp; Supplies (Non Print Resource)</b>	✓	✓
7	<b>Use of Technology</b>	✓	✓
8	<b>Field Trips &amp; Guest Speakers</b>	X	X



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9	<b>Critical Thinking</b>	✓	✓
10	<b>Creative Thinking</b>	✗	✓
11	<b>Communicating</b>	✗	✓
12	<b>Collaborating</b>	✓	✓
13	<b>Elicitation</b>	✓	✓
14	<b>Brainstorming</b>	✗	✓
15	<b>Discussions</b>	✓	✓
16	<b>Demonstration / Exposition</b>	✓	✓
17	<b>Investigation /hand on</b>	✓	✓
18	<b>Case Study</b>	✗	✗
19	<b>Comic Strip</b>	✗	✗
20	<b>Simulation</b>	✗	✓
21	<b>Model Making</b>	✓	✓
22	<b>Research</b>	✗	✓
23	<b>Games</b>	✗	✓
24	<b>Mind Mapping</b>	✗	✗
25	<b>Collaboration and cooperation</b>	✗	✓

### **Textbook of General Science of Class 6 based on the National Curriculum 2006**

The researchers have analyzed the textbook of General Science based on the NC 2006 and found that it mainly reflects the traditional teaching methods. Out of 25 pedagogical strategies, only 11 strategies are reflected and implemented in the activities and exercises of the textbook. It includes strategies like inquiry-based learning, STSE, use of technology, non-print resources, collaborating, elicitation, critical thinking, discussions, model making, hands-on, demonstration, and activities. However, many modern interactive and collaborative strategies such as games, creative thinking, communicating, brainstorming, simulation, case study and mind mapping are missing. Most of the lessons are teacher-centred with fewer activities that encourage student participation or creativity. Overall, the textbook does not fully support interactive or skill-building learning experiences for students.

### **Textbook of General Science Class 6 based on the Single National Curriculum, 2022**

The researchers' analysis of the General Science textbook for the SNC 2022 shows that it offers a variety of teaching strategies. This textbook reflects and implements 18 out of 25 pedagogical strategies, including traditional methods as well as newer approaches like homework, elicitation, collaboration and cooperation, creative thinking, communicating, brainstorming, simulations, research, and games. This addition helps the students engage more actively in learning and develop skills such as creativity and teamwork. The textbook is designed to be more interactive and student-friendly, making science learning more interesting and effective.

### **Comparing Both Textbooks**

The researchers found that a greater number and variety of modern teaching strategies are reflected in the activities and exercises of the textbook based on SNC 2022 than in the 2006 version. Both textbooks share 11 strategies that are reflected in each. However,



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the SNC textbook includes both interactive and collaborative strategies like collaboration and cooperation, research, creative thinking, communicating, brainstorming, simulations and games, which are not present in the NC 2006 textbook. This makes the SNC textbook more suitable for today's learner in terms of active learning, being creative and developing skills, etc. NC 2006 was more traditional and not very engaging to them. However, some of the strategies mentioned in the SNC have not yet been reflected in the textbook, which indicates there is still room for further improvement.

### Discussions

The SNC is aimed at fostering harmonious interaction between members of other social groups, and providing students with skills such as critical thinking, problem-solving and civic understanding. In this research, the researchers made a comparison between the General Science textbook for Class 6 of the National Curriculum (NC) 2006 and the Single National Curriculum (SNC) 2022. The analysis showed that there were obvious differences in teaching strategies. The NC 2006 science textbook reflects 11 out of 25 strategies and so is more traditional and teacher-centred. Although some good strategies like inquiry, hands-on, investigation, use of technology, discussions and demonstrations are present, still there are many modern and interactive strategies that are missing. As a result, students have fewer opportunities to work collaboratively, communicate ideas or engage in creative learning tasks. On the other hand, the SNC 2022 science textbook has 18 out of 25 teaching strategies reflecting a shift to student-centred learning. The new textbook contains additional strategies such as communicating, creative thinking, brainstorming, simulations, games and research activities. These strategies help to motivate the students and help them with the important skills needed in the 21<sup>st</sup> century (Sedden & Clark, 2016; Watted, 2023). However, it was also found that some of the strategies mentioned in the SNC are still not fully reflected in the textbook, which shows that there is still some improvement needed in textbook development. The comparison also revealed that there are 11 strategies that are common to both textbooks, and there are continuities between some effective teaching practices. But overall, the textbook based on SNC 2022 offers rich learning experiences, better activities and more opportunities for participation and collaboration than the NC 2006 book. When comparing curriculum reforms in general, even outside of science, it is observed that SNC brings several improvements, like updated activities, a vocabulary section at the start, a glossary at the end of the unit, a recall section, links to websites and added project work are missing in the textbook 2006. However, there are still some challenges to implementation, teacher training, and equitable access to education. Effective curriculum reform also demands proper training of teachers, financial support, and improvements in the school facilities. Without dealing with these problems, such as out-of-school children, lack of trained teachers and unequal resources, the objectives of the SNC cannot be fully met. Thus, the above discussion illustrates that, though the SNC is a positive move towards the modernization of education and the promotion of equality of learning, there are certain things that are necessary for the successful implementation of the reform, and this is the consistent implementation and proper support system that is needed to make the reform successful.

### Conclusion

The comparison shows that the science textbook developed based on SNC 2022 is more interactive, modern and skills-based than the textbook of NC 2006. It includes more strategies and provides better opportunities for student engagement. Although the SNC is



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a positive step toward improving education, some strategies are still missing in practice, and strong implementation is needed. For the SNC to be successful, schools need trained teachers, proper facilities, and support for all students to benefit equally from the curriculum.

### Recommendations

Based on the research findings and results, some recommendations are as follows:

Textbook developers should add strategies that are still not reflected in textbooks, especially those mentioned in the SNC document but not implemented in textbooks.

More activities that promote communication, creativity, collaboration and hands-on learning should be included to match modern teaching needs.

Teachers should receive the proper training to use the updated teaching strategies, especially the new student-centred ones introduced in SNC.

Schools should be provided with the necessary materials and facilities to implement all the pedagogical strategies successfully.

Teachers should incorporate digital tools, simulations, virtual labs and multimedia resources to make science lessons more interactive, engaging and support the hands-on and collaborative learning.

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