Original Article

Innovative Instructional Approach for Teaching and Learning of Biology and Other Science Subjects

Veronica, C. Ude
Department of Science and Computer Education, Faculty of Education, Godfrey Okoye University Enugu, Nigeria

Abstract

Instructional approach is the practice of creating instructional experiences which make the acquisition of knowledge and skill more efficient, effective, and appealing. In a classroom setting, teachers use their knowledge of subject matter, teaching and learning and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments. Instructional materials must be provided in the classroom model in a way that encourages active learning among the students. However, previous curricular models mainly rely on customary student-centered, teacher-centered learning strategies. Recent scholarship encourages educators to use student-centered learning strategies. The classroom model must present instructional materials in a way that promotes student engagement in active learning. The majority of past curriculum approaches, however, focus on the traditional student-centered, teacher-centered learning techniques. Recent academic work urges teachers to employ student-centered learning techniques. Based on a survey of recent literature, this article explains the self-organized learning environment (SOLE), an active learning technique, as well as the scholarly process used to create an original teaching and learning approach. In the secondary schools in Nigeria, this research suggests possible pedagogical benefits of SOLE in scientific teaching and learning.

Keywords: Instructional approach, innovation, curriculum, technology, self-organized- learning-environment (SOLE)

Introduction

The ultimate objective of curriculum is to equip students with the skills necessary to interact with the constantly evolving difficulties of science instruction. Globalization, changing student characteristics, science and information technology, the complexity of the health system's regulations and policies, and professional standards were all notably mentioned. The goal of curricula is to introduce students to the theoretical foundations of science instruction while also igniting their intellectual curiosity and critical thinking. From both the teacher and student perspectives, recent teaching and learning methodologies have promoted these results (Billur, Chun, and tamer 2019). Despite improvements in secondary school science teaching and learning, traditional teacher-centered approaches still predominate nationally. As a result, science teachers

must experiment with novel pedagogical approaches to present the curriculum content (Santos, 2019).

Recent literature emphasizes the necessity to focus curriculum content to match the issues that recent graduates face (Panagiotis, 2013), as well as the need for novel teaching methods and active learning strategies (health service executive, 2009). Science curricula shouldn't be static and should respond to socioeconomic and self-reliance developments in light of these clinical and educational issues (Santosa, 2019).

A new pedagogy that promotes a learning-centered approach to education must replace content-driven courses in science instruction. The learning demands of every student, however, cannot be met by a single teaching strategy (Kettunen, Kairisto-Mertanen, and Penttila, 2013). With a focus on student engagement and lifelong learning, the Nigerian curriculum was changed as a result of the center for educational study and adaptation center (Cesac) process (Mahabali, 2014). The aims of the national goals are, however, furthered by more recent trends in curriculum changes that incorporate fundamental educational ideas like learning-centered, fact-based, and case-based approaches.

Science education has traditionally been dominated by well-established learning theories like self-efficacy (Juliasantos Amelia Simoes, Margaridavieira, 2019, self-actualization (konst and kairisto-Mertanen, 2020), experiential learning (Caroline, 2014), and adult learning (Catherine Mcauley 2010). Owston (2019) asserts that there are multiple perspectives that can be used to describe learning. However, more recent interpretations of these learning theories place an emphasis on knowledge transformation that is pertinent to learners and seeks to broaden their frame of reference (law, n., chow, a., & Yuen, a.h.k 2015). The theories that support knowledge transformation center on the learner's day-to-day interactions and an explanation of the cognitive and affective learning domains. Therefore, learning-centered education should concentrate on both ways to acquire new information and the information already available (Beers, 2005). Consequently, knowledge will change in an age where information generation develops and becomes accessible just in time.

Opportunities for integrative learning are increased by the use of instructional methodologies (Baggaley, 2014).

Science instructors are dedicated to fostering diversity, promoting excellence in teaching and learning, and creating metrics for high-quality learning as part of their work to advance innovation in teaching and learning in our secondary schools. Therefore, integrated learning is a strategy for encouraging and developing students' learning across disciplines across time as well as between institutions of higher learning and everyday life (Baggaley, 2014).

Therefore, establishing a self-organized learning environment (sole) is motivated by the use of active-learning strategies that will improve science teaching and learning. In light of this, self-organized learning environments employ pedagogical approaches and serve as an illustration of ways with a history of use in science teaching and learning.

Self-organized learning environment (SOLE)

Mitra (2014) created the self-organized learning environment (sole) as a teaching strategy. She was motivated by a number of theories about constructivism, child development, and social cognitive growth (Mitra, 2014), as well as by the idea that students learn best through collaboration, exploration, and curiosity (Catherine, 2015). Additionally, a self-organized learning environment is one that encourages online communication, experimentation, and creativity. Without much assistance from the instructor, learners form their own groups and are free to move around, use resources cooperatively, or switch to another group.

The qualities of sole, according to school in the cloud, are as follows: in other words,

Pupils are driven by their own preferences, interests, and the learning process.

Collaborative: by working together, children develop their social skills.

Curious: students that are curious are inspired to wonder and help them build understanding.

Open-minded: both the instructor and the students are open-minded.

Transformative: in this case, critical thinking is crucial.

Encouragement: This calls for educators to effectively encourage students, and patience: this calls for educators to exercise patience in order to be effective.

Activities associated with sole use of SOLE

The instructor poses a question at the start of each activity in an effort to pique students' interest. The learners discuss what they have learnt and give feedback on the exercise at the conclusion (Mitra, 2014). Students appear to generate and enhance meaning in a sole by using the informational content of the topic they are investigating.

The following steps make up the sole activity

First step: asking questions to encourage curiosity as the sole process is explained, the question will be written as an actual process of discovery.

Step 2: research

Students search online for the answer to the question in groups. While the teacher offers support and facilitation, the students work together to explore the question.

Any group disputes should be settled by the students themselves, according to the teacher.

Students are urged to work together in their current group or switch to other groups.

The students are given few regulations, and this absence of rules allows them to switch groups.

Talk to other groups and one another, and move around to check out their peers' efforts.

Step 3: examine

The instructor encourages the pupils to discuss their concepts for group learning.

Discuss the similarities or differences in their responses to enable students to see connections to other situations in their lives.

The instructor promotes discussion. & encourages discussion of the query and inquiry process

What would they do differently the next time? Is a question that the students are actively considering? What did they consider the good work of others?

Process of developing questions (Set induction)

The elaboration of a question is crucial since it promotes in-depth discussions rather than looking for quick solutions ("school in the cloud", 2016).

As a scientific educator, you must encourage your pupils to think critically, collaborate together, explore hypotheses, and make connections across different subject areas as they learn.

When doing this, you might wish to start by asking straightforward questions, like

• Where is?

• Who is…….?

What is the world's largest fish?

• Why do trees turn green?

What causes the sky to be blue? (2016's "school in the cloud")

These kinds of inquiries allow students to delve deeper into a subject, make connections between many areas, and create a solid grasp of their response. However, as long as a question provokes thought and grabs students' attention, there are no restrictions on what it can be. To get you started, consider the following samples of questions arranged by learning purpose or topic: examples of questions on science issues that call for in-depth comprehension and abstract thought

• What would occur if all insects vanished from the planet?

• can life continue on earth?

• do trees have minds?

Does a frog recognize itself as one?

• is it possible to murder a goat by gazing at it?

The goal of these questions is to help you understand important ideas in a context. As a result, the questioning method gives students the chance to investigate a range of sources, infer various solutions, and engage in debate. Please keep in mind that, as a scientific teacher, the goal of the questions is to create methods and abilities that are transferable and practical, not just to find the right answer (Catherine, 2015).

Utilizing technology when using sole

Utilizing technology when using sole

Application of Technology in the use of SOLE

1. Facilitates and inspires student learning and creativity teachers support experiences that foster student learning, creativity, and innovation in both real-world and virtual settings by utilizing their

expertise in the subject matter, teaching and learning, and technology. This will enable the science instructor to:

- Promote, encourage, and exhibit inventiveness and creative thinking in others.
- Involve students in investigating real-world problems and finding authentic solutions by leveraging digital tools and resources.
- Encourage student reflection by utilizing collaborative tools to illuminate and clarify students' conceptual comprehension and thought, planning, and creative processes.
- Serve as an example of collaborative knowledge construction by participating in learning activities with students, coworkers, and others in real-world and online settings.

2. Create and develop online tests and learning experiences to maximize topic learning in context and to achieve the information, abilities, and attitudes outlined in the sole, teachers create realistic learning experiences and assessments utilizing modern techniques and resources. Technology aids science educators in:

• create technology-enriched learning environments that empower all students to pursue their unique interests and take an active role in setting their own educational goals, managing their own learning, and assessing their own progress;

• design or adapt pertinent learning experiences that use digital tools and resources to foster student learning and creativity;

• offer numerous, diverse formative and summative tests to students that are in line with technological and topic standards, then use the results to guide learning and instruction.

Consequences for science instructors and students

In order to maintain the advancement of education in the 21st century, science teachers must incorporate learning-centered pedagogy into the philosophy guiding their teaching approaches. With this approach of learning, students can investigate and justify a variety of theoretical underpinnings as well as real-world applications of knowledge and skills to situations, further ensuring the safety of the students.

Instead of relying on chance during scientific study, science teachers can use sole to direct significant events and make sure that all students are exposed to often occurring critical conditions.

These interactive methods of teaching science help students think out loud, learn new information, solve problems, and exercise critical thinking.

Students will be able to translate knowledge from many sources into practical understanding that will direct future performances thanks to group dynamics that emerge as the cycles proceed in terms of critical discussion and immersion in simulated critical scenarios. Through the rigorous development of self-confidence in a peer learning environment, the sole efficient instruction under the direction of a professional in both the theoretical and practical facets of real-world circumstances, students' self-confidence is cultivate

Conclusion

The Nigerian national policy of education for the promotion of excellence in teaching and learning of science concepts is supported by research into pedagogical approaches to science teaching and learning. Science education and practice have undergone, and will continue to undergo, fast change as a result of, scientific and technical developments as well as social, cultural, and political influences. It is argued that traditional teaching and learning strategies are teacher-centered. Because it links different learning components, sole has educational value because it can improve and transform knowledge.

The sole innovation points to a new active teaching-learning approach. Within a range of curriculum frameworks, sole is an essential tool for supporting science instructors in the creation and improvement of learner-centered pedagogies. While introducing innovative pedagogies while avoiding curricular and disciplinary isolation, science teachers must be strategic. The goal of curricula is to encourage intellectual curiosity, analytical ability, individual creativity, and critical thinking. Science teachers can evaluate the viability and feasibility of pedagogies that may be used in other subject areas by using sole as an innovative teaching and learning technique. Through a variety of teaching methods and knowledge transformation processes, sole provides students with a wealth of learning opportunities.

The ultimate objective of sole is to push pupils to think independently. By extrapolating and connecting the theoretical and practical knowledge offered in each cycle, this fosters awareness of creative thinking, critical analysis, and decision-making ability. Sole is set up to provide a student-centered curriculum that upholds the fundamental pedagogical principles and meets demands for

science and technology. It has proven to be a difficult but important process for the students to maintain their commitment to using an integrating strategy when establishing student-centered learning.

As a result, from the adoption of sole as an innovative pedagogy, an examination of the students' learning experiences and capacity for engagement will indicate how students transfer this method of learning to real-world situations.

References

Billur, M. A, Chun Z. & Tamer, S. C (2019) Innovative Pedagogical Approaches in Teaching International Business, Journal of Teaching in International Business, 30:2, 96-101, DOI: 10.1080/08975930.2019.1668333

Caroline Lodge (2014) Engaging student voice to improve pedagogy and learning: An exploration of examples of innovative pedagogical approaches for school improvement
Pages 4-19 | published online: 17 Dec

Catherine McAuley (2015) Merging Problem-Based Learning and Simulation as an Innovative Pedagogy in Nurse Education https://doi.org/10.1016/j.ecns.2010.01.003Get rights and content

Esteban, P.G., & Peart, M.T. (2014). Introducing Self-Organized Learning Environments in higher education as a tool for lifelong learning. E-Learning and Intercultural Competences Development in Different Countries, 413-422.

Griffin, Patrick & Care, E. (2015). The ATC 215 method: Assessment and Teaching of 21st Century Skills (PP.3-33). Dordrecht: Springer. https://doi.org/10.1007/978-94-017-9395-7

Jon Baggaley. (2014). MOOC postscript. Distance Education 35, 1:126-132. https://doi.org/10.1080/01587919.2013.876142

JúliaSantosa Amélia SimõesFigueiredobMargaridaVieirab(2019) Innovative pedagogical practices in higher education: An integrative literature review Nurse Education Today 72, Pgs 12-17 https://doi.org/10.1016/j.nedt.2018.10.003Get rights and content

Kettunen, J., Kairisto-Mertanen, L. and Penttilä, T. (2013), "Innovation pedagogy and desired learning outcomes in higher education", On the Horizon, Vol. 21 No. 4, pp. 333-342. https://doi.org/10.1108/OTH-08-2011-0024

Konst (e. Penttilä), T. and Kairisto-Mertanen, L. (2020), "Developing innovation pedagogy approach", On the Horizon, Vol. 28 No. 1, pp. 45-54. https://doi.org/10.1108/OTH-08-2019-0060

Law, N., Chow, A. & Yuen, A.H.K(2015).. Methodological Approaches to Comparing Pedagogical Innovations Using Technology. Educ Inf Technol 10, 7–20 https://doi.org/10.1007/s10639-005-6744-7

Littleton, K. and Mercer, N. (2013) Interthinking: Putting talk to work. Abingdon: Routledge.

MahaBali. 2014. MOOC Pedagogy: Gleaning Good Practice from Existing MOOCS. MERLOT Journal of Online Learning and Teaching 10,1: 44-56.

Mitra, S (2013). SOLE : How to bring Self Organised Learning Environments to your community. TED, assessed 12 October 2013 : http:/www.ted.com/pages/soletookit.

Mitra, S. (2014). The future of Schooling: children and Learning at the edge of chaos. Prospects, 44(4), 547-558. https://doi.org/10.1007/511125-014-9327-9.

Owston, R. (2019). Contextual factors that sustain innovative pedagogical practice using technology: an international study. J.Educ Change 8, 61–77 (2007). https://doi.org/10.1007/s10833-006-9006-6

Panagiotis Adamopoulos 2013. What makes a Great MOOC? An interdisciplinary Analysis of Student Retention in Online Courses. Thirty Fourth International Conference on Information Systems