Cylia N. Iweama

AFFILIATIONS
University of Nigeria, Nsukka, Enugu State, Nigeria

REFERENCE
Iweama, C. N. (2024). Inquiry-based Instruction (IBI) as a Teaching Strategy. In E. O. Adu, B. I. Omodan, C. T. Tsotetsi, & B. Damoah (Eds.), *Pedagogical strategies for 21st-century classrooms* (pp. 23-29). ERRCD Forum. https://doi.org/10.38140/obp1-2024-04

Learning Outcomes

After studying this chapter, you should be able to:
- conceptualise inquiry-based instruction (IBI) as a teaching strategy
- understand the advantages and disadvantages of IBI
- prepare an IBI classroom
- discuss techniques ineffective IBI classroom
- reflect on the dos and don'ts in IB teaching
- establish case study in IB teaching.

Clarification Of Key Terms

For students/readers to comprehend this chapter clearly, the following points should be clarified: the definition of IBI, understanding the advantages and disadvantages of IBI, preparing an IBI classroom, discussing ineffective techniques in IB classrooms, reflecting on the dos and don'ts of IB teaching, and establishing a case study in IB teaching.

Concept Of IBI: This is also known as inquiry-based learning. Petr (2010) states that "inquiry-based instruction is a type of instruction during which knowledge is created while solving a certain problem through consecutive steps. These steps include setting hypotheses, choosing suitable methods to investigate a certain phenomenon, obtaining results and processing them, drawing conclusions, engaging in discussion, and often cooperating with peers." Papacek (2010) asserts that inquiry-based instruction is one of the effective activating methods of problem-solving education and is based on a constructivist approach to learning. The teacher does not present the subject matter as a whole-class presentation in a pre-determined way; instead, he/she facilitates the creation of knowledge through problem-solving and a system of questions (communication apparatus). It is viewed as a form of self-directed learning where students take charge of their education.

4.1. Chapter Model

The educational literature provides extensive documentation of the range of inquiry phases and cycles (Pedaste et al., 2015). Marshall (2013), for instance, outlines the four Inquiry Phases (IP) as Engage, Explore, Explain, and Extend, specifically incorporating formative assessment (constantly checking in with students) and reflective practice (now where?) into each step. This contrasts with the five IPs listed by Bybee et al. (2006), which are Engagement, Exploration, Explanation, Elaboration, and Evaluation. An inquiry cycle is typically presented in

a manner that implies an organised progression of phases. Nevertheless, researchers clarify that Inquiry-Based Learning (IBL) is not a predetermined, homogeneous linear process (Pedaste et al., 2015).

The constructivist theory of learning, cognitive psychology, and best practices in STEM instruction form the foundations of the 5E inquiry-based instructional methodology (Bybee and Landes, 1990). The five steps of the 5E learning cycle are Engage, Explore, Explain, Elaborate, and Evaluate. The 5E instructional model connects educational activities, provides consistency across various teaching philosophies, and aids science teachers in determining how to interact with students (Biological Sciences Curriculum Study, 2019). The 5E learning cycles yield greater gains in students' capacity for scientific inquiry than traditional teaching models (Bybee, 2009).

Engage: Students can be mentally engaged through questions or activities, pictures, videos, demonstrations, kinesthetic exercises, and free writing. Explore: Students engage in practical exercises to understand concepts. They pose testable questions, collect data, conduct research, formulate hypotheses, test these hypotheses, draw conclusions, and present their findings. Explain: The teacher clarifies terminology and presents interactive materials, textbooks, levelled readers, and articles (both print and online) that were introduced in the Explore phase. Elaborate: Students participate in extracurricular activities to apply what they have learned to new contexts, including discussions, project-based learning, lab experiments, careers, and contemporary science. Evaluate: The educational process involves reviewing and reflecting on their learning, conducting self-evaluations, performance-based evaluations, compiling portfolios of student work, and employing claim-evidence reasoning (including scenario and prompt final presentations).

4.2. Introduction To Inquiry-Based Instruction As A Teaching Strategy

There has been an obvious need for instructional techniques that embed questioning, critical thinking, reflection, collaboration, communication, and research to ensure that our students have the necessary tools to meet the demands and expectations of their future. For this contribution, Inquiry-Based Instruction (IBI) is synonymous with Inquiry-Based Learning (IBL) and will be used interchangeably. Inquiry-based instruction is a student-centred instructional strategy that facilitates learning through meaningful tasks such as cases, projects, and research (Avsec & Kocijancic, 2016). Students are required to work cooperatively to identify solutions to problems, develop their research abilities, and enhance their capacity for making trade-offs (Avsec, Rihtarisic & Kocijancic, 2014). With IBL, students actively participate in their education and strive to make sense of their surroundings (Alfieri et al., 2011). At this stage, the concept of IBI must be viewed.

4.3. Inquiry-Based Instruction As A Teaching In Classroom

The inquiry approach placed a strong emphasis on four key components, such as student-centred learning.ntred, non-passive learning; process-oriented material; and a focus on concepts rather than facts. This method highlights the importance of reflective exploration and engaging outcomes in the teaching and learning process. It encourages students to assist one another in acquiring knowledge rather than simply accepting what the teacher presents. Rather than being content-focused, the philosophy of the inquiry technique is process-oriented, prioritising conceptual understanding over factual recall. It is centred on the pupil, not the teacher, and promotes active participation rather than passive behaviour (Beyer, 1971).

4.4. Advantages Of Inquiry-Based Instruction

Several studies have illustrated and concluded on the merits of the application in the stated class setting. Learning goes hand-in-hand with Science, Technology, Engineering, and Mathematics (STEM) instruction and inquiry. Research suggests that Inquiry-Based Science teaching improves students' comprehension of concepts in the field of science. It also exposes learners to develop and experience critical thinking skills, thereby furnishing them with a sense of accomplishment in the long run.

In a video titled "Seven Skills Students Need for the Future," Wagner (2009) identifies a variety of skills needed for students to succeed globally. Namely, these are the seven skills:

1. Critical thinking,
2. Problem solving,
3. Collaboration and leading with influence, agility and adaptability,
4. Initiative and entrepreneurialism,

5. Effective oral and written communication,
6. Accessing and analyzing information and
7. Curiosity and imagination.

Marks (2013) explains that this is supported by the fact that in an IBL context, students learn, practice, and reflect on these seven abilities in a way that is authentic and representative of procedures used in the real world. According to Guido (2017), there are seven merits to IBL:

i. Consolidates curriculum material
ii. Prepares the mind for learning
iii. Enhances a deeper comprehension of the topic.
iv. Makes studying enjoyable
v. Encourages initiative and self-reliance
vi. Works in nearly every classroom, and
vii. Offers differentiated instruction.

According to Jonassen (2000), students take ownership of their learning as they examine and explore, as they are expected to make decisions and draw conclusions. Goldston et al. (2010) contend that while inquiry-based learning (IBL) emphasises critical thinking, problem-solving, and communication skills, it also considers the knowledge-related aspect of learning. Similarly, Sockalingam et al. (2011) noted that when students have the opportunity to work on a topic, they acquire new knowledge and further extend and deepen their existing understanding. Students' critical thinking abilities increase when they learn through exploration and investigation in real-world situations (Hwang & Chang, 2011). In a similar vein, Marks (2013) concludes that learners who actively engage in inquiry master both content and cognitive habits. According to Harlen (2013), students gain understanding through their thinking and reasoning in various ways, including the enjoyment and satisfaction that comes from learning something for themselves, firsthand experience of what works as opposed to simply being told, satisfaction and stimulation of their natural curiosity about the world around them, and the development of increasingly strong ideas about it. Students who participate in inquiry-based practices demonstrate higher levels of academic self-efficacy, resolve conflicts more frequently, are less hesitant to take risks, and are more inclined to persist in trying new strategies for success after experiencing failure, according to a study by Gu et al. (2015). Inquiry-based learning has numerous merits, including improved self-confidence, retention of what was discovered, and enhanced communication skills. Students understand that failure is part of learning and, therefore, are not afraid of failing, which provides them with more opportunities to succeed in life. Other benefits include sharpening critical thinking skills, leading to greater intelligence, and fostering better interpersonal relationships with others.

4.5. Disadvantages Of Inquiry-Based Instruction

Ecolf (2020) asserts that although this procedure has a few drawbacks, they should not be overlooked, even if they are not very noticeable. These drawbacks can be addressed with good management. The following are some drawbacks and how to fix them: Many timid and reserved pupils may experience issues due to their lack of confidence. This can be avoided if the teacher provides each pupil with individualised attention and additional support. Its impact may be compromised if the teacher holds a concealed attitude toward this idea. Therefore, the teacher must commit to practising it fully. Its effectiveness can also be hindered by an inappropriate location. Every student should have the opportunity to voice their thoughts under a fair system that is established. A poorly handled scenario may not yield positive results. The lack of a strong foundation could render the entire operation ineffective. As a result, teachers need to be knowledgeable and help pupils choose the right path. There may occasionally be some confusion among the students.

According to Crockett (2021), the main disadvantages include testing performance, reluctance to participate, which could be detrimental to the teacher's mindset and preparedness, student readiness, assessment, questioning, portfolios, and checklists and ratings.

Inquiry-based learning is not a perfect teaching and learning strategy in the classroom setting, like any other strategy, it has its hiccups. Here are some of the challenges: time-consuming assessment, a tendency not to favour shy students who may struggle to think quickly or who have low confidence, and the challenge of categorising all students as one, as some are weak, average, or intelligent.

4.6. Preparing An Inquiry-Based Classroom

This section explains how to organise a classroom for effective teaching delivery.
- The teacher must understand the student(s).
- Exercise patience and logical distance.
- Set practical restrictions.
- Adhere to the schedule you have already established.
- Recognise the factors that influence behaviour.
- Schedule a consultation
- Engage with students
- The teacher should be in charge of the class
- Delegate some duties to those trustworthy to deliver
- Students should be encouraged to be active participants

4.7. Techniques In Effective Inquiry-Based Classroom

There are several techniques that teachers can utilise in the classroom to achieve effective teaching and learning outcomes. Here are some of them, according to Schwartz (2015):
- Rather than teaching the topic standards, assist students in locating the knowledge they need on their own.
- Instead of telling students what they need to know, set up the environment so they can discover it for themselves.
- Use class time to connect disparate parts of knowledge.
- Since many students have trouble reading, engage them with spoken words.
- Avoid assigning the most tedious version of the work to struggling students, forcing them to complete it repeatedly.
- Astonish students by displaying a primary source document on the screen without any background information.
- Since the conventional method of delivering knowledge isn't particularly effective, don't be afraid to experiment with inquiry -based learning.
- Acknowledge "bends" in the results and be willing to abandon the prescribed course of action.
- Allow students to ask engaging questions, even if they don't align with pacing recommendations.
- Utilise the meta-practice of inquiry to approach the practice of teaching and to make improvements.
- The following suggestions are also provided:
- The class must commence with a question.
    - Students should be allowed to explore after the question is asked.
    - Students should discuss the topic with one another to ensure adequate comprehension.
- Teachers should provide resources for students to utilise.
- The teacher concludes the topic.
- Evaluation is crucial to observe what needs to be amended subsequently, using "carrot and stick methods."
- The teacher must summarise what was taught by highlighting the major/key points.

4.8. Dos And Don'ts In Instructional-Based Teaching

Every class has a teacher in charge, and that position of authority comes with a certain power. As a result, there are dos and don'ts of teaching that educators must follow to be successful. There are many things that teachers at all levels of education should and shouldn't do regularly. These classroom management strategies should serve as your guide, whether you are teaching a small or large class. Here are 20 teaching guidelines for effective classroom management:
1. Always act professionally, even when feeling irritated by a manager, parent, or child. Maintaining control is never easy, as we all have emotions and a tendency to lash out when triggered. However, keeping your composure demonstrates sophistication, maturity, and professionalism.
2. Be impartial; refrain from making investigative comments in the notes you send to the principal or the parents. Despite pressure from administrators or a desire to sugarcoat the truth, it is important to write frank progress reports that do not falsify information or ignore issues. Teachers who embellish the truth to defend themselves when they make mistakes are disdained by their students.
3. Prepare fallback strategies in case an activity does not go as planned. Teachers are expected to be tactically flexible, allowing them to learn a new method if they find that their current strategy is ineffective in the middle of a lesson.

4. Make plans for various instructional methods, including verbal, auditory, visual, and kinesthetic. Remember that pupils learn best through diverse approaches, so every lesson should contain a variety of situations that help reinforce the concept.
5. Teachers must always keep in mind that every child is unique. Each student has their own individuality. Never personalise a student.
6. Prepare for varying levels of learning capacity. Research shows that students learn best from their peers, so wherever possible, classes should integrate unified learning.
7. Allow students to choose their tasks. Give them options from which to select. It may require more effort to provide choices, but focus more on the process than on the result.
8. Encourage youngsters to take risks and let them make mistakes. Motivate them to try again afterwards. We must learn from our errors and implement the appropriate strategies and procedures.
9. Strengthen the integration of subjects and values by using teachable moments.
10. Include these three phases in your lesson planning: before, during, and after reading.
11. Consistently evaluate your teaching strategies and students' growth in the classroom. Always ask yourself: Did I utilise the best approach in teaching this concept? Could I have done anything better to reach every child? Did I sufficiently plan for the students, and were the exercises meaningful?
12. Create opportunities for students to employ psychological techniques to assess, evaluate, synthesise, and apply knowledge to real-world circumstances.
13. Create a literate environment that features words printed everywhere. To encourage children to engage in reading and writing activities and to recognise their reading and writing skills, provide opportunities and resources.
14. Use an equitable curriculum to prepare children for success in school and in life.
15. Include Kagan's PIES model in your instructional strategies so that students can take full responsibility for their education.
16. Instead of being passive observers, aim to develop engaged participants in every lecture. The days of teacher-centred instruction are over; teachers must now devise inventive ways to teach technology-related subjects and classes by using engaging activities, as students are easily distracted.
17. Regularly monitor and evaluate each student's reading development and proficiency. This continuous evaluation guides and informs instruction.
18. Encourage students to be willing to learn throughout their lives.
19. Enhance the classroom's sense of belonging and acceptance. This regard fosters a supportive and cooperative environment.
20. To be approachable, particularly with children and others, teachers must be enthusiastic, caring, and readily available (Godwin, 2022).

4.9. Don'ts In Instructional-Based Teaching

1. Don't make fraudulent accusations against a student or teacher
2. Never underestimate any student's learning ability
3. Avoid using physical force or aggressive behaviour toward any pupil.
4. Avoid becoming overly friendly with any pupil; doing so could send the wrong message.
5. Do not throw items or objects at any student in anger
6. Don't insult any student referring to her parent's failure or poverty status
7. Always remember to care about the well-being of your students, especially when they are in a challenging situation.
8. Avoid the use of sarcasm and contempt as a reaction to student discipline
9. Keep away from notifying parents of the negative attitudes of their students
10. Avoid working with individual effort, recall you can't do it alone. Work as a team with the students if you expect more and better rewards.
11. Only make effective criticisms and adjustments that would enhance the progression of plans.

4.10. Case Study In Inquiry-Based Teaching

The term "assigned scenarios" refers to circumstances in which students are asked to observe, evaluate, record, apply, conclude, summarise, or recommend as part of an instructional approach (not a theory). To facilitate analysis and discussion, case studies are developed.

Students are encouraged to use their subject-specific knowledge, critical thinking abilities, and problem-solving techniques in secure, practical settings.

Active learning techniques, including case, scenario, problem, and inquiry-based learning, are appropriate for face-to-face, online, or hybrid settings. These methods require students to employ their subject-specific knowledge, critical thinking skills, and problem-solving techniques in a secure, real-world context.

In case-based learning (CBL), students are presented with a case or dilemma to resolve in an actual setting. Background information and supporting details are provided to the students, who have the option of working alone or in groups. Rather than providing answers, the course organiser acts as a facilitator to aid in learning. A case study is typically based on real events (names and details are often modified to maintain confidentiality). Many case studies provide supplementary information and evidence, prompting students to formulate a response to an open-ended inquiry or to develop solutions that will guide their learning.
The best examples:

- are created by clearly stated learning objectives,
- have a goal of education,
- are genuine and pertinent,
- use prevalent or typical examples,
- Think about conundrums to encourage decision-making,
- add supplementary information where required, and
- have likeable characters, and some even use their voices (like those of patients) to add drama and authenticity.

To promote case-based learning:

- Allow them enough time to study the case and reflect on it. The case can be presented before the class.
- Briefly describe the case and offer some suggestions for addressing it.
- Form groups (preferably 3-6 pupils) and supervise them to ensure everyone is participating.
- Request that groups share their ideas and rationale.
- To clarify and advance the conversation, ask questions.
- Summarise the issues raised. At the conclusion, be sure to tie the various threads of the conversation back together. After asking each group to summarise their results, compare the group responses. Assist the entire class in interpreting and understanding the implications of their responses.

Brief Problem-Based Assignment

During class, students compete in problem-based tasks relevant to their discipline. The goal is to produce a written response (1500 words) to the issue or to work in groups to create and present a 10–15-minute presentation outlining a solution.

Conclusion

The method is an essential and better alternative to traditional classroom methodologies used previously. The above discussions depict that this instruction is primarily student-centred; learners are expected to examine questions and provide solutions scientifically. It is also excellent for real-life application, with teachers being less active during the process. Therefore, to fully comprehend the concept, students are encouraged to engage in one-on-one experiences to gain a deeper understanding of its hallmarks and benefits.

Reflective Questions

1. Conceptualise the term inquiry-based instruction (IBI) as teaching in the classroom.
2. Outline the advantages and disadvantages of IBI.
3. What are the procedures for preparing an IBI classroom?
4. What have you learned concerning the techniques in an effective IB classroom?
5. Reflect on the dos and don'ts of IB teaching.
6. How could you establish a case study in IB teaching?

References

Alfieri, L., Brooks, P. J., Aldrich, N. J. & Tenenbaum, H. R. (2011). Does discovery-based instruction enhance learning? Journal of Educational Psychology, 103(1), 1-18.

Avsec, S., Rihtarsic, D., & Kocijancic, S. (2014). A predictive study of learner attitudes toward open learning in a robotics class. Journal of Science Education and Technology, 23(5), 692-704.

Avsec, S. & Kocijancic, S. (2016). A path model of effective technology-intensive inquiry-based learning. Journal of Educational Technology & Society, 19(1), 308.

Beyer, B. K. (1971). Inquiry in the social studies classroom: A Strategy for Teaching. Charles E. Mevrell Publishing Co.

Biological Sciences Curriculum Study. (2019). BSCS 5E Instructional Model. https://bscs.org/bscs-5e-instructional-model/

Bybee, R. W. (2009). The BSCS 5E instructional model and 12th-century skills. Colorado Springs, Co: BSCS.

Bybee, R. W. (1990). Science for life & living: An elementary school science program from biological sciences curriculum study. The American Biology Teacher, 52(2), 92-98.Bybee, R. W., Taylor, J. A., Gardner, A., Van Scotter, P., Powell, J. C., Westbrook, A. & Landes, N. (2006). The BSCS 5E instructional model: Origins and effectiveness. Colorado Springs: BSCS.

Crockett, L. (2021). 8 disadvantages of IBL with solutions. Future-focused learning. https://futurefocusedlearning.net/blog/learner-agency/8-disadvantages-of-inquiry-based-learning-with-solutions

Ecolf, G. (2020). Inquiry-based learning: advantages and disadvantages. Harvard University.

Godwin, P. (2022). 20 Dos and don'ts of teaching. Gopius. https://gopius.com/20-dos-and-donts-of-teaching/.

Goldston, M. J., Day, J. B., Sundberg, C., & Dantzler, J. (2010). Psychometric analysis of a 5E learning cycle lesson plan assessment instrument. International Journal of Science and Mathematics Education, 8, 633-648.

Gu, X., Chen, S., Zhu, W., & Lin, L. (2015). An intervention framework designed to develop the collaborative problem-solving skills of primary school students. Educational Technology Research and Development, 63, 143-159.

Guido, M. (2017). Inquiry-based learning definition, benefits & strategies. Prodigy.

Harlen, W. (2013). Inquiry-based learning in science and mathematics. Review of science, mathematics and ICT education, 7(2), 9-33.

Hwang, G. J., & Chang, H. F. (2011). A formative assessment-based mobile learning approach to improving the learning attitudes and achievements of students. Computers & Education, 56(4), 1023-1031.Jonassen, D. H. (2000). Toward a design theory of problem-solving. Education Technology Research and Development, 48(4), 63-85.

Marks, D. B. (2013). I-B-L: What's your question? National Teacher Education Journal, 6(2), 21-25.

Marshall, J. C. (2013). Succeeding with Inquiry in Science and Math Classrooms. ASCD.

Pedaste, M., Maeots, M., Siiman, L. A., De Jong, T., Van Riesen, S. A., Kamp, E. T. & Tsourlidaki, E. (2015). Phases of inquiry-based learning: Definitions and the inquiry cycle. Educational Research Review, 14, 47-61.

Papáček, M. (2010). Badatelsky orientované přírodovědné vyučování cesta pro biologické vzdělávání generací Y, Z a alfa?. Scientia in educatione, 1(1), 33-49.

Petr, J. (2010). Biologická olympiáda–inspirace pro badatelsky orientované vyučování přírodopisu a jeho didaktiku. Didaktika biologie v České republice, 136-144.

Schwartz, K. (2015, September 21). Ten tips for launching an inquiry-based classroom. KQED. https://www.kqed.org/mindshift/42092/10-tips-for-launching-an-inquiry-based-classroom

Sockalingam, N., Rotgans, J., & Schmidt, H. G. (2011). Student and tutor perceptions on attributes of effective problems in problem-based learning. Higher Education, 62, 1-16.

Wagner, T. (2009). Seven skills students need for their future. Asia Society.