Journal of educational equipment: Education management, Volume 1, Issue 326 (December 2024)
ISSN 1859 - 0810

The modeling-based teaching method for the series chapterin advanced mathematics at tra vinh university

Phạm Minh Triển*, Trương Thị Ngọc Chinh*

**GV Trường Đại học Trà Vinh*

Received: 2/12/2024; Accepted: 2/12/2024; Published: 9/12/2024

Abstract: *This paper highlights the critical role of the modeling-based teaching method in the instruction of the series chapter in Advanced Mathematics at Tra Vinh University. This method aids students in bridging theoretical knowledge with practical applications through visual models and mathematical tools such as graphs, equations, and series. In addition to explaining the fundamental concepts of mathematical modeling, the paper provides real-life application examples, such as calculating bank loan interest and predicting population growth. The study asserts that modeling not only enhances students' logical thinking and problem-solving abilities but also improves learning outcomes through active learning approaches. This approach is deemed an essential solution for improving teaching quality amidst the modernization of education.*

Keywords: *Teaching method, modeling, series, Advanced Mathematics.*

1. Introduction

Teaching Advanced Mathematics in universities is not only about providing specialized knowledge but also about fostering students' logical thinking, analytical skills, and practical applications. The *Series Chapter* plays a significant role as the foundation for many scientific, technical, and technological fields. However, this topic often poses challenges to students due to the abstract and complex nature of its concepts and formulas.

The modeling-based teaching method is considered an effective approach to address these challenges. Instead of relying on traditional methods, this approach focuses on connecting theory with practice through visual models and real-life scenarios, enabling students to understand and apply knowledge more effectively. The term *"mathematization"* refers to using mathematical language to transform real-life problems into mathematical representations. The ability to mathematically model practical situations involves synthesizing skills such as extracting mathematical information from real-world scenarios, transitioning between real-life contexts and mathematics, and establishing mathematical models of practical problems [1]. This paper explores the theoretical basis, role, and specific applications of the modeling-based teaching method in the Series Chapter while proposing solutions to enhance students' learning outcomes at Tra Vinh University.

2. Content

2.1. Concepts of Model and Mathematical Model

A model is described as a substitute object through which the essential features of real objects or systems can be observed. Models serve as intermediaries to study original objects for specific purposes. A model can take the form of tangible objects, images, or diagrams and can also be abstractly represented through descriptions, such as economic, financial, or political models.

Mathematical models differ from models in other sciences as they omit qualitative attributes, relying instead on precise language to express fundamental quantitative relationships. These relationships allow for the derivation of additional quantitative connections. Broadly speaking, mathematical models are widely used in natural sciences and engineering (e.g., physics, biology, electronics) as well as in social sciences (e.g., economics, sociology, political science).

From a narrower perspective, mathematical models may take the form of drawings, tables, functions, graphs, equations, diagrams, and more [2]. Occasionally, the term "mathematical model" is narrowly defined by teachers as physical

teaching aids or mathematical software to represent specific mathematical objects, such as planes, lines, function graphs, or polyhedrons. Regardless of form, mathematical models in mathematics remain symbolic, given that mathematical objects themselves—numbers, shapes, graphs—are inherently abstract.

2.2. The Mathematical Modeling Teaching Method

Mathematical modeling is one of the eight key mathematical competencies identified by PISA (Programme for International Student Assessment), including: Thinking and reasoning; Engaging in mathematical arguments; Communicating mathematically; Modeling; Problem posing and solving; Representation;Using mathematical symbols, terminology, and operations; Utilizing tools and computational methods. In mathematics education, modeling is a process that helps students explore real-life situations through mathematical tools and language, such as drawings, tables, functions, graphs, equations, symbols, formulas, and diagrams [5], [6].

The modeling-based teaching method emphasizes the connection between abstract mathematical concepts and real-world scenarios. By employing models, diagrams, or visual representations, students not only grasp theoretical knowledge but also understand its practical applications.

Key features of this method include:

+ **Practical Relevance**: Modeling helps students realize the practical applications of mathematics in areas such as economics, engineering, technology, and natural sciences.

+ **Support for Logical and Creative Thinking**: By analyzing problems through models, students develop hypotheses, test their validity, and hone critical thinking and problem-solving skills.

+ **Active Learning**: Students take an active role in their learning process, fostering independence, creativity, and responsibility, which are essential for lifelong learning.

2.3. Applying the Modeling Method to the Series Chapter in Advanced Mathematics

The modeling process, as described by Swetz and Hartzler (Blum et al., 2007), involves four steps:

+ *Constructing a Realistic Model*: Identify key elements of the system and establish governing rules.

+ *Developing a Mathematical Model*: Represent the problem in mathematical language, noting that multiple models may exist depending on the selected elements and relationships.

+ *Applying Mathematical Tools*: Analyze and solve the problem using appropriate mathematical tools.

+ *Validating and Interpreting Results*: Assess the model's and results' suitability to the real-world problem. If necessary, repeat the process to refine the model and answer the initial question [5], [6].

Examples of Applying the Modeling Method in Teaching the Series Chapter in Advanced Mathematics.

Example 1: Practical Problem: You take a bank loan of 200 million VND at an interest rate of 1% per month, repaid in equal installments over 12 months. Calculate the monthly payment and the total amount to be repaid during the loan term.

Formula for Calculating the Monthly Payment (Using Series): The monthly payment A is calculated using the formula: $A = \frac{P.r.(1+r)^n}{(1+r)^n - 1}$

Where

+ P: The initial loan amount (200 million VND).

+ r: Monthly interest rate (1% = 0.01).

+ n: Loan term in months (12 months).

Calculate $A = \frac{200.0,01.(1+0,01)^{12}}{(1+0,01)^{12} - 1} \approx 17,8$ million dong per month. The total amount payable after 12 months is $A.n$ = 17,8.12 ≈ 213,6 million dong. Top of Form

Relating to a series of numbers:This installment loan can be described by a geometric series representing the total interest as:

$$P.r\left[1+(1+r)+(1+r)^2+...+(1+r)^{n-1}\right]$$

This calculation assists banks in designing flexible loan packages and helps borrowers understand their financial commitments [7], [8].

Example 2: Real-life problem: A city has an initial population of 1 million people, with an average population growth rate of 2%/year. Calculate the expected population of the city after 10 years.

The population after n years is calculated according to the formula: $P_n = P_0(1+r)^n$

In which:

+ P_0 Initial population (1 million people)

+ r: Annual growth rate (2% = 0.02)

+ n: Number of years (10)

Calculate P_{10} = 1.(1+0,02)^{10} = 1,219 million

people. After 10 years, the population is expected to be about 1,219 million people. Relating to a series of numbers: If we want to calculate the total population growth over each year (the initial population plus each year), we represent it as a finite geometric series: Total population growth P_0 ($r + r^2 + r^3 + ... + r^n$). This calculation helps assess the size of the increased population and supports the government in planning infrastructure, education, and health policies to meet future population needs. Bottom of Form

3. Conclusion

The modeling teaching method has been proven to be a useful and effective tool in teaching the number series chapter of Advanced Mathematics at Tra Vinh University. This method not only helps students gain a deeper understanding of theoretical concepts but also improves their ability to apply mathematics to practical situations, thereby developing logical thinking and problem-solving skills. The application of modeling in teaching not only requires innovation from lecturers but also support in terms of facilities, technology, and close coordination between stakeholders. This is a necessary direction to improve the quality of education, meeting the needs of society in the context of modernization and international integration.

References

[1]. Đỗ Đức Thái, Đỗ Tiến Đạt (2020), *"Xác định năng lực toán học trong chương trình giáo dục phổ thông mới",* Tạp chí Khoa học Giáo dục, số 146. Hà Nội

[2]. Nguyễn Danh Nam (2016), *Phương pháp mô hình hóa trong dạy học môn Toán ở trường phổ thông*, Nxb Đại học Thái Nguyên, 2016.

[3]. Trần Trung (2011), *"Vận dụng mô hình hóa vào dạy học môn Toán ở trường phổ thông",* Tạp chí Khoa học, Trường ĐHSP Hà Nội, số 06, tr.104-108, 2011.

[4]. Trần Vui (2009), *"Sử dụng toán học hóa để nâng cao hiểu biết định lượng cho học sinh trung học phổ thông",* Tạp chí Khoa học Giáo dục, số 43. Hà Nội

[5]. Blum, Galbraith, Henn, Niss, *"Modelling and applications in mathematics education",* The 14th ICMI Study, Springer, 2007.

[6]. Berinderjeet Kaur, Jaguthsing Dindyal, *Mathematical applications and modelling*, World Scientific Publishing, 2010.

Quy trình thiết kế bài giảng..... *(tiếp theo trang 61)*

3. Kết luận

Việc thiết kế bài học theo phương pháp dạy học nêu vấn đề sẽ mang lại nhiều lợi ích quan trọng, cả về mặt lý thuyết và thực tiễn, trong quá trình dạy học.

Đối với giáo viên, đây là công cụ hỗ trợ họ tổ chức lớp học khoa học, tự tin hơn khi đứng lớp và đảm bảo đạt được các mục tiêu giáo dục, như: Đảm bảo tính khoa học và định hướng mục tiêu của bài học, tạo nên sự thống nhất và liền mạch trong chương trình giảng dạy. Ngoài ra, giáo viên tập trung vào mục tiêu giảng dạy, tránh lan man và lãng phí thời gian, một bài học thiết kế tốt sẽ có cấu trúc hợp lý, từ mở đầu, phát triển nội dung, đến kết thúc, đảm bảo tính logic và dễ hiểu…

Đối với sinh viên, thiết kế bài học tạo cơ hội cho họ tiếp cận với nội dung học tập một cách chủ động, sáng tạo và hiệu quả hơn, như: Sinh viên dễ dàng nhận biết nội dung chính và định hướng học tập, tận dụng tối đa thời gian học tập trên lớp, đảm bảo đạt được tất cả mục tiêu bài học, giúp sinh viên hình dung lộ trình học tập và hiểu mạch kiến thức.…

Do đó, việc thiết kế bài học là yếu tố quan trọng góp phần nâng cao chất lượng giáo dục trong bối cảnh hiện nay.

Tài liệu tham khảo

1. Khoa Giáo dục chính trị - Đại học Sư phạm Hà Nội (1997), *Phương pháp giảng dạy môn GDCD ở trường THPT,* NXB Giáo dục, Hà Nội.

2. V.O.Kon (1976), *Những cơ sở dạy học nêu vấn đề,* NXB. Giáo dục, Hà Nội.

3. I.Ia. Lecne (1997), *Dạy học nêu vấn đề,* NXB. Giáo dục, Hà Nội.

4. M.I.Makhonutốp (1972), *Lý luận và thực hành dạy học nêu vấn đề*, Cađan.

5. A.M.Machiuskin (1976), *Tình huống có vấn đề trong tư duy và trong dạy học,* NXB Giáo dục, Hà Nội.

6. Lưu Xuân Mới (2000), *Lý luận dạy học đại học,* NXB Giáo dục, Hà Nội.