

## DESIGNING A LESSON PLAN FOR MATH SUBJECT IN SECONDARY SCHOOL IN ACCORDANCE WITH 2018 GENERAL EDUCATION PROGRAM

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### ARTICLE INFORMATION    ABSTRACT

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Competence - based teaching has been a concern of many educators in the current period. Preparing the lesson plans before classes greatly determines the success of the lessons. Applying scientific research methods such as theoretical research, investigation-observation, expert method, the article presents the structure and process of designing lesson plans for Mathematics, analyzes and clarifies the steps in the design process, thereby applying the design of specific lesson plans to facilitate teachers in the teaching process. The results published in the paper are unanimously agreed by experts.

**Keywords:** Competence; lesson plan; teaching process; teaching activities; Math.

### 1. Introduction

Education is one of the most important sectors of every country, which plays an important role in determining the future of society. With the constantly changing modern world, educational curricula must be updated and changed to meet the challenges of the present times. The 2018 General Education Program has been built according to the capacity development orientation, which does not specify too much detail for each specific unit of study to encourage teachers to promote initiative and creativity in program implementation. In fact, the feature of openness in curriculum development has caused difficulties and confusion for teachers when designing lesson plans.

Mathematics is an important and highly valued subject in the general education curriculum. Designing lesson plans is an important part of the process of teaching Mathematics in secondary school. However, the design of lesson plans according to the 2018 General Education Program also requires a thorough study and understanding of the structure, method of determining objectives, selection of appropriate teaching, testing and evaluation methods.

In this article, the structure and process of designing Math lesson plans in secondary high schools according to the 2018 General Education Program will be presented, thereby applying the design of specific lesson plans to facilitate teachers in the teaching process. The article is expected to help teachers better understand the requirements and guidelines of the 2018 General Education Program in Mathematics, thereby designing effective and appropriate lesson plans for each student.

## **2. Research content**

### ***2.1. Lesson plans***

According to the Ministry of Education and Training (2020b), a lesson plan can be understood as a classroom scenario developed by the teacher in accordance with the learners, teaching content and specific contexts. In that scenario, the target components, equipment and learning materials, and the process of organizing teaching activities of a lesson are described in detail, helping students achieve their goals of competence and quality.

There is no universal template for individual teacher lesson plans. However, in our opinion, there should be synchronization and agreement on the basic components and main teaching activities in the lesson plan. Approaching the concept of lesson plan according to the Ministry of Education and Training (2020b), the core components of a lesson plan include lesson objectives; equipment and learning materials; and the process of organizing teaching activities (teaching process). The objective of the lesson consists of two components: competence and quality. For Mathematics, the component of competence includes math ability and general ability. Teaching equipment and learning materials are used by teachers and students to support the achievement of the goals of teaching Mathematics. Finally, the teaching process is a series of teaching activities, designed by the teacher in accordance with the cognitive progress of the students, in order to help students achieve their learning goals. Teaching activities include core components: activity objectives, activity content, active products and operational organization. The design of teaching activities is one of the key elements for an effective lesson.

The structure of a lesson plan must satisfy the following requirements: (1) Demonstrating a diverse combination of teaching methods; (2) Demonstrating the subjectivity of students when performing learning activities; (3) High practical applicability: Although lesson plans are individual, they should demonstrate a wide range of applicability by other teachers.

### ***2.2. The process of designing lesson plans for Maths***

In general, the lesson plan is designed through the following steps: (1) Determining the lesson objectives; (2) Selecting and developing teaching content; (3) Identify equipment and learning materials, teaching methods/teaching techniques; (4) Designing the teaching process; (5) Finalize lesson plan. On the basis of the above steps, this section will analyze in detail the activities to be performed in each step when designing a lesson plan for Maths.

***Step 1. Determining the lesson objectives***

The requirements to be met for knowledge and skills related to the lesson are determined from the 2018 General Education program in Mathematics. Teachers can specify or increase the requirements to be met, depending on the students and the specific conditions of the school. The requirements to be met must be determined in the manifestation of which component of mathematical competence.

***Step 2. Selecting and developing teaching content***

Starting from the requirements to be achieved related to the lesson, based on their own knowledge and experience, teachers identify the key contents to be taught. Content can be selected from many different sources such as textbooks, teacher books, reference books, the internet, etc. Besides, teachers are encouraged to design their own practical problems to meet the requirements to be achieved in accordance with the characteristics of the school and the locality. From the identified teaching content, in some cases, the content will affect the goal. Therefore, the objectives of the lesson need to be supplemented accordingly.

***Step 3. Identify equipment and learning materials, teaching methods/teaching techniques***

The objectives and content of the lesson are the basis for choosing teaching methods/teaching techniques. The selection and identification of appropriate teaching methods/teaching techniques, equipment and learning materials is one of the key factors in helping students achieve their learning goals. Besides the objectives and content of the lesson, the selection of teaching methods/teaching techniques is also based on the students' cognitive progress and the students' experience. In addition, it is necessary to consider the characteristics and requirements of each teaching method/teaching technique, the strengths of the individual teachers and the actual conditions of the school.

Teaching methods/teaching techniques are selected to help students master the content and develop their competence. For example, using problem-solving teaching methods can help students achieve dual goals. First, it will help students capture the results of problem-solving. Second, it also enables students to develop the ability to perform similar processes. From that, it can be seen that teaching methods/teaching techniques affect the determination of goals. Therefore, teachers need to add additional requirements to be met for teaching objectives. For example, in the process of teaching, if the teaching method of scientific debate is used, additional mathematical communication capacity should be added.

After specifying the teaching equipment and learning materials used in the lesson, it is necessary to organize activities for students to achieve the goal of the lesson. Creating conditions for students to practice and manipulate teaching devices at the right time and in the right place will help students actively explore and discover knowledge. In addition to traditional teaching equipment and learning materials, audio-visual media, modern technical equipment, searching for information and documents on the Internet to support the teaching process,... also need to be considered.

***Step 4. Designing the teaching process***

The teaching process is a series of teaching activities aimed at helping students achieve the teaching objectives. Designing the teaching process is the design of a series of

teaching activities. First of all, the Introductory activity for the whole lesson needs to be designed, in which a number of interesting situations are raised, arousing the need for learning. The selected situation can be a representative real-life problem, or an introductory paragraph to elicit new knowledge. Then, a series of teaching activities is designed to help students master each unit of knowledge. The sequence of teaching activities for each new knowledge unit usually includes the following basic activities: Warm-up – Experience; Formation of new knowledge; Practice; Application. In each activity, it is necessary to clearly define the goal; content; teaching methods/teaching techniques and assessment tools. The sequence of teaching activities should be designed flexibly.

#### ***Step 5. Finalize lesson plan***

Each specific teaching activity is designed and completed with a draft lesson plan. After that, this lesson plan needs to be adjusted and perfected based on the comments of experts and colleagues in the same area of expertise. At the same time, the addition, correction and improvement need to be continued in parallel with the actual implementation of teaching.

### ***2.3. Example lesson plan on “Concurrence of three perpendicular bisectors in a triangle”***

Derived from the required requirements of the lesson “*Concurrence of three perpendicular bisectors in a triangle*” in the Grade 7 Math program, that is: “*Identifying the perpendicular bisector of a triangle and recognizing the concurrence of perpendicular bisectors in a triangle*”, the objectives of the lesson on mathematical competence can be determined as follows:

+ *Thinking and reasoning abilities: Observe and analyze* the figure to identify the perpendicular bisector of the triangle. *Perform* mental operations through folding, drawing the perpendicular bisectors in the triangle to predict the property of the concurrence of the three perpendicular bisectors. *Point out* the evidence to argue for the concurrency of three perpendicular bisectors in a triangle. *Identify* the perpendicular bisector and the point of convergence of the perpendicular bisectors in solving some exercises.

+ *Ability to use tools and means:* Using set-square and/or compass, GeoGebra software to draw the perpendicular bisector of the triangle.

+ *Modeling Competence: Determine* the concurrence of the three perpendicular bisectors in the triangle in practical problems, such as determining the position of the swing in the garden equidistant from three houses.

Based on the teaching content and the methods selected for teaching (through experiential activities, modeling teaching, group work, Q&A, presentations), the achievement requirements on the general competence as well as the individual qualities of the learners will be determined. From the requirements of the lesson, the units of knowledge that need to be mastered by students will be determined, including *the concept of the perpendicular bisector of a triangle and the concurrence of perpendicular bisectors in a triangle*.

The relationship between objectives, content, teaching methods/teaching techniques, assessment tools of each activity in this lesson can be determined as shown in the Table 1, which for practical problem solving application as Figure 1.



**Figure 1:** Determine the most reasonable place for the swing

**Table 1:** The connection of components of the activities in the lesson

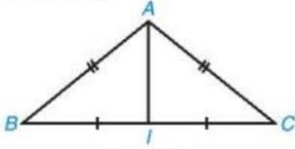
Activities	Objectives	Contents	Methods/ technologies/ equipment for teaching	Methods/ Evaluation Tool
<b>Introduction</b>	Inspire students' interest, needs and motivation about the lesson.	Problem statement (Figure 1): Consider the position of the three houses as the three vertices of a (non-obtuse) triangle. It is necessary to place a swing in the garden equidistant from the three houses. Please determine the location for the swing.	Visualization, presentations/photos.	Observation
<b>A. The perpendicular bisector of the triangle</b>				
<b>Experiential activities</b>	Able to draw the perpendicular bisectors of line segments (the side of the triangle)	Draw the perpendicular bisector of one side of a triangle.	Practice	Observation of the process/product.
<b>Concept forming activities</b>	Able to describe the perpendicular bisector of a triangle.	Describes the perpendicular bisector of a line segment	Presentations	

Activities	Objectives	Contents	Methods/ technologies/ equipment for teaching	Methods/ Evaluation Tool
<b>Practice activities</b>	Able to Identify the perpendicular bisector of a triangle	The following questions are posed: 1. If triangle ABC is isosceles at A, what is the comment about the perpendicular bisector of side BC (point A)? 2. How many perpendicular bisectors does each triangle have? 3. Practice recognizing the perpendicular bisector of a particular triangle.	Questions and Answers	Student responses.
<b>B. Convergence of three perpendicular bisectors</b>				
<b>Experiential activities</b>	Able to predict the concurrency of the perpendicular bisectors in a triangle.	The following tasks are assigned: 1. Fold the perpendicular bisectors from the prepared triangles and predict their intersection. 2. Draw the perpendicular bisectors of a triangle and predict their intersection. 3. Use GeoGebra software to plot the perpendicular bisectors of a triangle, move the triangle, and predict their intersection.	Teamwork, practice, tablecloth method, using a pointed triangle piece of paper and GeoGebra software.	Observation/product/answers.
<b>Theorem-forming activities</b>	Able to argue and state the theorem “Three perpendicular bisectors of a triangle converge at a point. This point is equidistant	Students' activities: Draw triangle ABC (non-obtuse) and three perpendicular bisectors of AB, BC, CA. Observe the figure and answer whether the three perpendicular bisectors pass through a point?	Teamwork, tablecloths.	Student responses.

Activities	Objectives	Contents	Methods/ technologies/ equipment for teaching	Methods/ Evaluation Tool
	from the three vertices of the triangle”			
<b>Practice activities</b>	Able to identify the perpendicular bisectors of triangles and their concurrence	Students determine the point of convergence of the three perpendicular bisectors of a triangle through assignments.	Individual, Group (pair)	The answer/ rubric
<b>Application activities</b>	Able to specify the location for the swing in the situation in Figure 1.	Determine the location of the swing.	Questions and Answers	Student responses.

Once the connection of the components of each activity has been established, the teacher continues to design each activity in detail to facilitate teaching. The following will describe in detail the Practice activity for the knowledge unit “*Convergence of three perpendicular bisectors*”. The organization of practice activities is shown in Table 2.

**Table 2:** Organization and implementation of the Practice activity

Student activities	Teacher's activities
<p>- Working in a group, solving problems posed by the teacher.</p> <p>- From the given requirements, students will draw a picture to solve the problem:</p>  <p>Prove: a) Two triangles <math>AIB</math> and <math>AIC</math> have: <math>AB = AC</math> (isosceles triangle), <math>IB = IC</math> (<math>AI</math> is the median); common <math>AI</math> edge. Hence <math>\Delta AIB = \Delta AIC</math>.</p> <p>Deduce <math>\widehat{AIB} = \widehat{AIC}</math>, where <math>\widehat{AIB}</math> and <math>\widehat{AIC}</math> are complementary adjacent angles, so <math>\widehat{AIB} = \widehat{AIC} = 90^\circ</math>. Hence <math>AI</math> is the perpendicular bisector of side <math>BC</math>.</p>	<p>- Ask students to state how to determine the point of concurrency of three perpendicular bisectors in a triangle.</p> <p>- Assigning tasks to students (<i>Example 1, Connecting Knowledge to Life, Vol. 2, page 78</i>): Let <math>ABC</math> be an isosceles triangle at <math>A</math>. Draw the median <math>AI</math> of triangle <math>ABC</math>.</p> <p>a. Prove that <math>AI</math> is the perpendicular bisector of side <math>BC</math>.</p> <p>b. Is the point equidistant from the three vertices of triangle <math>ABC</math> lying on <math>AI</math>?</p>

Student activities	Teacher's activities
<p>b. Since the point equidistant from the three vertices of triangle <math>ABC</math> lies on the perpendicular bisector of <math>BC</math>, according to a, we have that point lying on the median <math>AI</math>.</p> <p>- Working in groups, solving the second problem.</p>	<p>- Assigning tasks to students: Explain why the centroid of an equilateral triangle is equidistant from its three vertices?</p> <p>- Comment and evaluate the performance of students.</p>

From the manifestations of thinking and reasoning abilities and activities of students when solving problems in Table 2, the following rubric has been developed to assess thinking and reasoning abilities:

Content	Level of achievement		
	Level 3	Level 2	Level 1
1. Recognize that $I$ is the midpoint of $BC$ .	Be able to argue that $I$ is the midpoint of $BC$ .	State that $I$ is the midpoint of $BC$ without showing any evidence.	Not realizing that $I$ is the midpoint of $BC$ .
2. Prove that $AI$ is perpendicular to $BC$ .	Arguing that two triangles are congruent; Point out two complementary adjacent angles; Deduce $\widehat{AIB}$ và $\widehat{AIC}$ are two right angles.	Arguing that two triangles are congruent or pointing out two complementary angles, but failed to conclude that $\widehat{AIB}$ và $\widehat{AIC}$ are two right angles.	Fail to argue or argue wrongly.
3. Able to conclude that $AI$ is a median.	Summarize the evidence to make a conclusion.	Insufficient evidence to draw conclusions.	Unable to synthesize evidence to draw conclusions.
4. Identify the point equidistant from the three vertices of the triangle lying on the $AI$ .	Arguing that the point equidistant from the three vertices of triangle $ABC$ lies on the perpendicular bisector of $BC$ , which combines the orthogonality of side $BC$ as $AI$ , thereby deducing that the point lies on the median $AI$ .	Argue that a point equidistant from the three vertices of triangle $ABC$ lies on the perpendicular bisectors of the triangle, but cannot combine orthogonality of edge $BC$ as $AI$ to conclude.	Fail to argue or argue wrongly.



The structure and process of designing Math lesson plans have received the consensus of experts in the field of Theory and teaching methods of Mathematics. In addition, 150 secondary school math teachers in Vinh city were also surveyed during a math lesson planning training course organized by Vinh city's education department. The content of the survey is to collect comments and suggestions on the lesson plan "Convergence of three orthogonal lines in a triangle". The results show that the majority of teachers agree with the designed lesson plan, with a consensus rate of 145/150. However, in order to confirm the feasibility and effectiveness of the research results, we will continue to conduct experiments in the near future.

### 3. Conclusions:

In the context that the General Education program 2018 is being widely deployed in secondary high schools across the country, the design of lesson plans according to this program needs to be paid attention. The article presented a lesson plan structure, developed a process for designing lesson plans and described in detail the steps in the process. An illustrative example has been analyzed to create favorable opportunities for teachers in implementing the new General Education program.

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## TÓM TẮT

### THIẾT KẾ KẾ HOẠCH BÀI DẠY MÔN TOÁN Ở TRƯỜNG TRUNG HỌC CƠ SỞ THEO CHƯƠNG TRÌNH GIÁO DỤC PHỔ THÔNG 2018

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Dạy học phát triển năng lực đang là mối quan tâm của nhiều nhà giáo dục ở giai đoạn hiện nay. Thiết kế kế hoạch bài dạy trong quá trình chuẩn bị lên lớp quyết định rất lớn đến sự thành công của bài dạy. Dựa trên các phương pháp nghiên cứu khoa học như phương pháp nghiên cứu lý luận, phương pháp điều tra - quan sát, phương pháp chuyên gia, chúng tôi trình bày cấu trúc và quy trình thiết kế kế hoạch bài dạy môn Toán, phân tích làm rõ các bước trong quy trình thiết kế, đồng thời vận dụng vào việc thiết kế các kế hoạch bài dạy cụ thể nhằm giúp giáo viên thuận lợi hơn trong quá trình dạy học. Các kết quả được công bố trong bài báo dựa trên căn cứ sự đồng thuận của các chuyên gia.

**Từ khóa:** Năng lực, kế hoạch bài dạy, tiến trình dạy học, hoạt động dạy học, môn Toán.