



Assimilation: Indonesian Journal of Biology Education

ISSN 2621-7260 (Online)

Journal homepage: <https://ejournal.upi.edu/index.php/asimilasi>



Differentiated instruction analysis on the topic of cell reproduction in 12th grade of senior high school

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ARTICLE HISTORY

Received: 5 June 2023

First Revised: 22 August 2023

Accepted: 30 September 2023

First Available Online: 30 September 2023

Publication Date: 30 September 2023

KEYWORDS

Cell reproduction topic

Differentiated instruction

Lesson plan analysis

ABSTRACT

Differentiated instruction is learning that accommodates the diversity and differences in the characteristics of students. Therefore, teachers who teach in the classroom not only provide subject matter and value to students in the same way for all students in the class, but teachers need to pay attention to the diversity of students and provide services according to their needs. This study aims to determine the application of differentiated instruction in the classroom. The subjects of this study were teachers who taught grade XII on the topic of cell reproduction. This research is qualitative research with an explorative descriptive method. Data collection techniques in this study were interviews and assessment of teacher lesson plans. Primary data was obtained from the results of the analysis of lesson plans and the results of interviews with three teachers. Through this research, it was revealed that the teacher had implemented differentiation instruction, especially in cell reproduction material. However, not all teachers have implemented all aspects of differentiated instruction in content, process, and product.



INTRODUCTION

Currently, learners have diverse characteristics (Celik, 2019). It is common knowledge that learners in the classroom have different abilities, readiness levels, diverse cultural backgrounds, diverse experiences, interests, needs, learning styles, motivation levels, self-regulation competencies, and others (Zelalem et al., 2022).

Differentiated instruction is learning that accommodates the diversity and differences in learner characteristics. Learners have various kinds of differences in experience, talent, ability, interest, culture, learning method, language, and other differences. Therefore, teachers who teach in the classroom do not only provide subject matter and give grades to students in the same way for all students in the class, but teachers need to pay attention to the diversity of students and provide services according to their needs. Differentiated instruction is one way for teachers to meet the needs of each learner because differentiated instruction is a learning process where learners can learn subject matter according to their abilities, interests, and needs so that learners feel failed and not frustrated in their learning experience (Eikeland & Ohna, 2022).

Differentiation is a teaching philosophy rooted in the deep diversity of learners, recognition of differences, and encouragement to help all learners thrive (Van Geel et al., 2019). As Dack & Triplett (2020) point out, differentiation is an organized, yet flexible way to actively adapt teaching and learning to diverse learners wherever they are and to help them achieve their maximum capabilities as learners. This pedagogical framework asks teachers to adapt content, resources, teaching methods, learning activities, modes of assessment, and aspects of the learning environment to take into account learner differences (Zelalem et al., 2022).

Teachers must realize and understand that there is not only one way, strategy, or method, to learn a lesson in implementing differentiated instruction. Teachers need to arrange learning materials, learning activities, tasks done in class and at home, and final assessments according to learners' readiness to learn the lesson, learners' interests or preferences in learning, and how to deliver the lesson according to learners' learning profiles. So, in differentiated instruction, three aspects can be differentiated by the teacher so that learners can understand the lesson, namely the content aspect that will be taught, the process aspect or meaningful activities that will be carried out by learners in class, and the third aspect is the assessment in the form of making products at the end that can measure the achievement of learning objectives.

Content differentiation means that teachers can vary the level of cognitive ability. For example, in a biology class, learners can read textbooks or other literature at different reading levels tailored to their specific needs. Since most classes only have one set of textbooks at the class reading level, teachers should provide other reading materials at different levels. Teachers can use libraries, where books and other learning resources are available, to find alternative materials (Smale-Jacobse et al., 2019).

Process differentiation means teachers can vary learning activities based on learners' interests or learning styles. For example, in class, learners could conduct internet research, interview community members, or build models. While all learners have the same content to cover, they can choose from a range of activities or processes that appeal to learners or different learning styles of learners (Smale-Jacobse et al., 2019).

Product differentiation means that learners have choices in how they demonstrate what they have learned. For example, in a science class, learners could write a paper, carry out a lab activity and report the procedure and results, or present the results of a PowerPoint discussion on the topic. Any of these options can also be used to differentiate target levels. For example, everyone in a science class can do a lab, but the requirements for writing up procedures and results may vary for each group (Smale-Jacobse et al., 2019).

In addition, differentiated instruction is one of the efforts in developing the concept of independent learning that is being launched in the current National Education System and accordance with the thoughts of Ki Hajar Dewantara. Differentiated instruction strongly supports

the educational process that is student-centered and aims to develop various aspects of individual abilities in facing the progress of an increasingly advanced and complex era (Faiz & Kurniawaty, 2020). This differentiated instruction expects change so that it contradicts the educational process that tends to be conventional and stagnant (Fitra, 2022). Differentiated instruction is also referred to as a form of effort in the learning process by paying attention to the learning needs of each student, but not burdening the teacher. Where teachers can explore themselves, and design learning according to mapping the learning needs of students.

Based on the description above, the purpose of this article is to analyze differentiated instruction on cell reproduction material. Some of the research results above are the results of research related to learning in schools, especially on cell reproduction material. Looking at the results of these studies, the author also analyzes how learning about cell reproduction occurs in schools today, whether it has implemented differentiated instruction in learning or not.

METHODS

This research is qualitative research with the explorative descriptive method, which uses primary and secondary data to produce research data (Radianti et al., 2020). In the early stages of the research, researchers analyzed the lesson plans made by teachers and interviewed teachers, then the data from the analysis of lesson plans were compared with the results of interviews with teachers with the facts of learning at school.

Primary data was obtained from the analysis of lesson plans and interviews with three teachers. The secondary data is obtained from a literature review related to the results of previous studies that are still related to the topic that is the focus of this research. Data collection techniques in this study were interviews and a review of teacher lesson plans. Data analysis was carried out after all the data was collected, then the data was presented in a simpler and easier-to-understand form, then the data was interpreted and interrelated with the results of previous studies until finally the research conclusions were obtained.

RESULTS AND DISCUSSION

The results of this study refer to several data, including data regarding the results of the analysis of the application of differentiated instruction based on the lesson plan shown in Table 1 and data from interviews with teachers in Table 2.

Analysis of differentiated instruction in lesson plans applied to biology subjects on the topic of cell reproduction based on the suitability of the selection of aspects, namely in the content aspect the teacher prepares a variety of materials using pictures, biological literature books, and animated videos. Content consists of knowledge, concepts, and skills that students need to learn based on the curriculum. Distinguishing content requires teachers to modify or adjust how teachers can provide learners with access to the material being studied (Nepal et al., 2021). As stated by Faber et al. (2018) content can be differentiated by giving learners options to explore topics more intensely, and by providing learners with resources related to their level of knowledge. Differentiating content can include using different delivery formats such as video, reading, images, or audio; providing supplementary materials at different reading levels; using examples and illustrations based on learners' interests; presenting materials in visual, auditory, and kinesthetic modes and the like.

In the process aspect, the teacher guides students by assisting in understanding the material by adjusting the students' abilities. Karimi & Nazari (2021) define the process as "how learners understand and comprehend content". It refers to how curriculum content is delivered to learners or the approach to activities that help learners understand or master content. Differentiating the process of engaging and providing learners with various activities caters to learners' learning styles and preferences to help learners understand what they are learning (Purba et al., 2021). Some

strategies for effective process differentiation are: using tiered activities (activities at different levels of difficulty, but focused on the same main learning objectives); making task directions more detailed and specific for some learners and more open-ended for others; providing source materials at different levels of readability and sophistication; varying learner tasks; encouraging learners to work together or independently.

Table 1. Analysis of differentiated instruction implementation based on lesson plans

No.	Aspects Observed	Implementation of Differentiated instruction
1	Subject Identity	Includes the name of the education unit, KD, learning objectives, indicators, time allocation
2	Formulation of indicators and learning objectives	Indicators of competency achievement refer to KD, using operational verbs that can be measured or observed.
3	Learning material	The learning materials presented are in accordance with the learning objectives, taking into account the different levels of learning.
4	Use of learning models and media	learners' abilities, oriented to learners' learning needs The learning model used is in accordance with the learning objectives, learning media is not listed in the lesson plan
5	Learning activities	Using appropriate apperception and motivation in introductory activities, teachers only summarize the material, learning activities according to the differentiated instruction aspects of content, process, and product.
6	Learning resources	The learning resources used are not listed in the lesson plan
7	Assessment technique	The assessment instrument items used are in accordance with the learning objectives, there are clear assessment procedures

In the product aspect, teachers give assignments to students to make mitotic cell division products by giving students the flexibility to use the media used by students, such as digital posters, self-made drawings, plasticine, or styrofoam products with a mutually agreed upon length of time. Products are essentially what learners produce at the end of learning to demonstrate mastery of content (Pozas et al., 2020). Products are the result of learning (Attwood & Gerber, 2020). Product differentiation is the "output" where learners demonstrate what they have known, understood, and can do after an extended period (Koirala, 2022). Product differentiation consists of alternative ways that learners can demonstrate mastery of concepts (Eikeland & Ohna, 2022) and ways of applying and presenting the knowledge learned by the learner through his or her results (Eikeland & Ohna, 2022). Product differentiation requires learners to demonstrate what they have learned in a variety of ways (Sopianti, 2022), teachers can offer learners a variety of ways such as presentations, quizzes, projects, and models to demonstrate what learners have learned (Koirala, 2022).

Unfortunately, based on the lesson plan analysis, the teacher has not implemented differentiation of the learning environment. The classroom learning environment refers to the setting in which learning takes place and facilitates effective learning between teachers and learners (Eikeland & Ohna, 2022). Since the learning environment is a way of classroom learning that consists of routines, procedures, and the physical setting of the classroom, therefore, the classroom learning environment should be safe and able to stimulate learners actively (Herwina, 2021). When differentiating learning environments, teachers consider learners' "environmental" preferences. For example, some learners need a place to learn together, some need a quiet place, some want to engage in discussions, and some want to work alone. Teachers' strategies often use to create a positive environment include: organizing the classroom to encourage collaboration and

cooperation; ensuring the availability of resources that reflect learners' diverse backgrounds, interests, and readiness; sharing responsibility for teaching and learning; providing learners with individualized attention; adjusting their influence to meet learners' needs; communicating respect and concern for each learner; demonstrating cultural competence; and reflecting on learners' feedback about their classroom experience (Karimi & Nazari, 2021).

The suitability of the strategy selection chosen by the teacher is that the teacher groups students based on learning styles, namely visual, audio, and kinesthetic groups. The learning methods used by the teacher are discussion and question and answer. In differentiated instruction, Kristiani et al. (2021) have identified five elements of differentiated instruction, namely: creating a supportive learning environment; managing the classroom flexibly; designing a high-quality curriculum; using continuous assessment to measure learners' proximity to clear objectives; and modifying instruction, or adjusting content, types of exercises, and learners' products to proactively respond to learners' diversity, such as differences in learners' readiness or interests. The results of the interviews with teachers are presented in Table 2.

In the process aspect, teacher 1 went around to check learners' understanding and assisted. Teacher 2 does not implement content-differentiated instruction, and teacher 3 assists learners who need or ask questions. Process-differentiated instruction refers to how learners understand and assimilate facts, concepts, and skills (Pozas et al., 2020). Process differentiation is concerned with how learners become 'owners' of the knowledge and skills covered in the curriculum. This can be achieved by varying the pace at which learners work and developing activities that utilize different pathways to completion. Process differentiation is based on learners' learning styles or cognitive levels, taking into account what performance standards are required for each learner's age level. In this context, learning is adapted to what methods are easiest for learners to acquire knowledge, or what challenges learners the most (Valiandes et al., 2018).

In the product aspect, only teacher 1 applies differentiated instruction, namely assigning students to make poster products to explore creativity by allowing students to make these products using markers, colored pencils, etc. Product differentiation is a way for learners to demonstrate aspects and learning objectives that have been achieved or mastered by learners (knowing, understanding, and being able to do). Product differentiation is essentially what each learner produces at the end of the lesson (e.g. tests, evaluations, projects, reports). Product differentiation means that teachers provide learners with a range of alternatives to demonstrate what they have learned from the lesson based on learners' preferences, interests, and learning abilities (Zelalem et al., 2022).

Teachers should recognize the 'importance of emotions to learners' motivation to learn, ability to work with others, and self-concept. Therefore, teachers should be responsive to their learners' emotional expressions. Teachers need to work to understand the influences that drive learners' behavior so that teachers can guide learners in a positive direction, choosing optimal strategies and approaches (Eikeland & Ohna, 2022).

The final element of differentiated instruction is the learning environment. This relates to the function of the classroom and includes the layout of the classroom, how the teacher uses the given classroom space, environmental elements, and sensitivities including lighting, as well as the overall atmosphere of the classroom. According to Smale-Jacobse et al. (2019), the environment will support or hinder learners' learning such as contributions, abilities, goals, and diversity in the classroom.

The advantages and disadvantages of differentiated instruction implemented by some teachers are that there are aspects of differentiated instruction but not focused in depth. Not all teachers have implemented all aspects of differentiated instruction such as content, process, and product differentiation. Some teachers only implement differentiated instruction on content by providing diverse learning resources.

Table 2. Data from interview with teachers that have been integrated with lesson plan analysis

No.	Aspects Observed	Analysis Result		
		Teacher 1	Teacher 2	Teacher 3
1.	Teacher knowledge of differentiated instruction	Already know	Already know	Already know
2.	Learning cell reproduction material	<ul style="list-style-type: none"> • Jigsaw • Each learner is assigned to make a poster, poster exhibition. • Breaking down the material 	<ul style="list-style-type: none"> • Lecture method • Pictures, videos provided • Learners observe the picture and video 	<ul style="list-style-type: none"> • Using video or ppt and children presenting through PPT • The teacher gives reinforcement
3.	Obstacles experienced by teachers when teaching cell reproduction material	<ul style="list-style-type: none"> • Abstract material • School facilities and media used are limited 	<ul style="list-style-type: none"> • Learners do not have prior knowledge when learning, making it difficult to understand abstract material. • Limited learning conditions 	<ul style="list-style-type: none"> • No practicum due to time constraints
4.	Application of differentiated instruction on cell reproduction material	<ul style="list-style-type: none"> • Already implemented in class • Differentiate content by dividing material into groups based on interest • Differentiate the process when they are discussing the teacher goes around to check the students' understanding and provide assistance. • Differentiated creativity poster products are free to use markers, colored pencils, etc. 	<ul style="list-style-type: none"> • Already implemented in class • Differentiate content by providing images and videos 	<ul style="list-style-type: none"> • Already implemented in class • Differentiate content by providing images and videos • Differentiate the process by providing assistance to students who need or ask questions.
5.	Teachers' views on the importance of differentiated instruction in learning	It is very important so that students can understand the material as a whole and according to their respective learning styles.	Important, because to facilitate learners' cognitive level/needs/interests to achieve learning outcomes to develop their creativity	Important, because each learner is different, cannot be equated, not 100 percent the same and not 100 percent different.
6.	Teacher expectations for learning cell reproduction material	Teachers hope that not only pictures are presented, but they can practice or observe directly, not just study literature.	The teacher hopes that not only from pictures but also practicum, for example, seeing and making preparations of onion roots, seeing firsthand how cell reproduction works, learning directly on real objects.	Because the material is abstract, the hope is that the teacher can attract attention through interesting videos and present first from concrete to abstract material.

CONCLUSION

In learning at school, teachers have implemented differentiated instruction, especially on cell reproduction material. However, not all teachers have implemented all aspects of differentiated instruction in content, process, and product.

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Acknowledgment

Researcher would like to thank the university which funded this research and the participants who were involved in this research.

Authors' Note

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

How to Cite this Article

Mardiyah, F. H., & Solihat, R. (2023). Differentiated instruction analysis on the topic of cell reproduction in 12th grade of senior high school. *Assimilation: Indonesian Journal of Biology Education, 6*(2), 109-116.