

Development of Differentiated Instruction Abilities for Mathematics Teachers in the Context of Implementing New Curriculum in Viet Nam

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ABSTRACT

Since 2018 Viet Nam has been implementing the new curriculum from grade 1 to grade 12 in the whole country. The new curriculum emphasizes on development on learners' competencies. However, students have different interests, needs, and thinking level. Differentiated instruction in a classroom with mixed ability is one of the most important issues while implementing curriculum at this moment. Teachers need to select the contents, teaching methods and strategies to develop the competencies of each individual student in a classroom. Differentiated instruction brings to teachers of all subjects including mathematics teachers' difficulties and challenges. This paper presents a practical study of mathematics teachers' ability on differentiated instruction in Vietnam. This research also emphasizes the role of differentiated instruction on mathematics and the need to change mathematics teachers' understanding and practices on differentiated instruction by training to develop their differentiated instruction abilities.

Keywords: Implementation of new curriculum; Differentiated instruction; Mathematics teachers

LITERATURE REVIEW

Differentiated Instruction can be explained by different educational researchers:

“At its most basic level, differentiated instruction means “shaking up” what goes on in the classroom so that students have multiple options for taking in information, making sense of ideas, and expressing what they learn. In other words, a differentiated classroom provides different avenues to acquiring content, to processing or making sense of ideas, and to developing products so that each student can learn effectively” (Tomlinson C.A, 2001)

“Differentiation is tied to the match - the match of the curriculum and learning experiences to learners...Differentiation is not a strategy but rather a way of teaching that accommodates differences among children so that all are learning on an ongoing basis” (J. L. Roberts, and T.F. Inman, 2013).

“Differentiated instruction is a teaching philosophy based on the premise that students learn best when teachers adjust their teaching process to meet the students' abilities, interests, and learning preferences” (C.A. Tomlinson, K. Brim join and Ln. Narvaez, 2008).

“Differentiating instruction may simply be the definition of effective teaching. To be effective, teachers must familiarize themselves with individual student learning levels, learning styles, strengths, weaknesses, and overall abilities in order to plan successful lessons each day” (J. D'Amico, K. Galway, 2010).

“Differentiated instruction is a teaching strategy that offers a variety of approaches to meet the diverse needs of learners” (G.E. Smith and S. Throne, 2007).

“Differentiated instruction is to divide students into different groups according to their level of education, abilities of cognition, language and thinking, interests, needs ... Differentiated instruction is a teaching and learning approach responding to different students in the same class aimed to maximize the competency of each individual by offering the learner with the most proper teaching process” (T. Hall, 2002).

From the above-mentioned perspectives, we believe that Differentiated instruction is a teaching principle in which teachers select the teaching process to suit each individual or group of students in order to maximize the learning competencies of each student.

We also think that competency of differentiated instruction is the abilities of teachers to design and organize teaching activities to respond to the learning needs of the whole group of students and each student in order to maximize each individual student’s learning competency.

In book *Differentiated Instruction for the Middle School Science Teacher*, D'Amico and Galloway identified 11 requirements that each teacher needs to ensure in differentiated instruction as follows:

- Master knowledge and skills standards. These are the minimum knowledge and skills that teachers need to help students form and grasp. Based on standards of knowledge, skills and attitudes, the teacher then adjusts the teaching process to meet the diverse learning needs of students.

- Regularly adjust the plan and teaching activities in a flexible and effective way. By this way, on the one hand, teacher attracts and stimulates student's learning interest and on the other hand, teachers can create a certain relationship between individual student and the teaching content.

- Create a differentiated learning environment. This is a learning environment that makes students feel special, ready to face the challenges and aspirations of success, an environment where, as Ronald SB wrote, students can say, "I feel I belong to this place because there is always a place for me. Right here, I can make a difference with my knowledge and skills to change what I want to. I want to be known as an independent individual and highly regarded for being myself. I can feel that everyone cares about me. They know when I am absent and share when I am hurt. I feel like I am kind of person people need, because I am part of the classroom family, and in that family, everyone needs each other”.

- Have a positive attitude and a high sense of responsibility for the profession and teaching work they are responsible for. The teacher in differentiated instruction must be mindful of the students and make them feel their roles and responsibilities in the classroom.

- Provide a variety of materials, resources and different learning resources. It is important that student of different qualifications and abilities is capable of mobilizing a variety of resources to help him/her succeed in learning.

- Understand the needs and aspirations of students. By understanding their students, teachers will have better ways to help and combine with materials, facilities and teaching plans to meet the needs of each student.

- Well perform the pre-evaluation, in-school evaluation and post-evaluation. Through pre-evaluation, teacher grasps students’ existing knowledge and skills on the teaching topic. If students do not know the necessary knowledge, teachers need to review, supplement and reflect their teaching methods. The post-evaluation is used to find out what students know and how they can apply that knowledge into practice, from then to make reasonable adjustments.

- Adjust learning tasks to suit students. Because of students’ different ability, teachers need to realize that for some students a certain teaching content can be boring when they mastered the content. However, besides students who have mastered the taught knowledge and skills, there are also students who are not really reatto move to new teaching contents. Therefore, the learning task set should meet different needs of students.

- Appreciate student-centered education approach. Offer student with opportunities to choose different learning pathway and learning content that suits oneself.
- Flexibly use forms of teaching organizations. Students need to learn how to work independently as well as collaborate by using different learning styles: TAPS (T = Total groups , A = Alone, P = Partners, S = Small groups).
- Gradually get acquainted and make changes. Not all teachers are familiar with this new teaching style, but when teachers are aware of its advantages and benefits to their teaching process, they will be more motivated for their teaching career.

Teacher's competencies in differentiated instruction may include the following components as presented in Table 1.:

Table 1. Elements of Differentiated Teaching Abilities

Elements of differentiated teaching abilities	Description
Ability in assessment, classification of students and defining teaching goals	1. To design Student Survey Toolkit according to given criteria (interests, cognitive level, learning style ...)
	2. To use survey results to classify students (by group or individual).
	3. To develop teaching objectives to suit each classified group of students
Ability in design and use of learning resources for teaching process	1. To design appropriate learning materials for students
	2. To effectively use learning materials in process of differentiated instruction
Ability in development of teaching contents in the direction of differentiation;	1. To deepen core knowledge of the lesson
	2. To design suitable study contracts for different students
	3. To develop textbook programs
Ability in coordination of the use of teaching methods and forms	1. To flexibly combine whole class, group and individual forms
	2. To select appropriate teaching methods to each student in the direction of promoting learner's activeness and positiveness
Ability in management of classrooms and creation of differentiated learning environments;	1. To divide reasonable time for activities and for each student
	2. To use form of homework and task assignment for each student
	3. To exploit the activity of supporting teachers and classmates
	4. To establish appropriate classroom arrangement for differentiated approach
	5. To reduce student's non-purposeful movement
	6. To minimize noise when organizing teaching activities

Ability of testing and evaluation students and use results of testing and evaluation.	1. To design tools and forms of assessment towards the competency approach
	2. To define evaluation criteria for and publicizing criteria and indicators to learners
	3. To use evaluation results to adjust teaching and learning activities
Ability of having lessons learned from teaching practice.	1. To determine lessons learned for oneself
	2. To develop plans to overcome the shortcomings and promote the advantages in the teaching process

A SURVEY ON VIET NAM PRIMARY SCHOOL TEACHERS' ABILITIES OF DIFFERENTIATED INSTRUCTION IN TEACHING MATHEMATICS

We conducted a survey on teachers' abilities of differentiated instruction in 8 primary schools in 4 provinces in Viet Nam. The survey involved 118 primary teachers. In this study we wanted to find out the following:

- Teachers' understanding about differentiated instruction for mathematics
- Teachers' difficulty when implementing differentiated instruction for Mathematics in primary classrooms,
- Teachers' abilities on differentiated instruction for Mathematics.

For the survey we used the following methods:

- We reviewed the teachers' answers.
- We attended mathematics classroom to observe the expression of teachers and pupils (regarding awareness, attitudes, behavior) in teaching and learning activities.
- We interviewed and discussed with the teachers

In our research we found out some data and information:

Table 2. Necessity to Implement Differentiated Instruction for Math in Primary School

	Very necessary	Necessary	Not necessary
Necessity to implement differentiated instruction	89.8	10.2	0

The above table shows that 100% of the surveyed teachers are aware of the role and the necessity to implement differentiated instruction for Math. Students, right from the beginning of primary education, show a certain difference in cognitive ability, inclination, interest or need.

However, the differentiating element that teachers pay most attention to when classifying students is student's cognitive level. Therefore, our study will select cognitive level as a basis for differentiating students.

Table 3. Teachers' perceptions of the nature of differentiated instruction

Nature of differentiated approach	Percentage
Divide the students into groups and teach each group	5.1
Design and organize teaching activities to suit each student in the class	7.6
Fostering students having math skills and help students with many difficulties in learning Math	12.7

Adjust teaching process to suit each individual or group of students to maximize their learning competency	74.6
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Some teachers are not clearly aware of the nature of differentiated instruction. The survey showed that 5.1% of teachers have a concept that differentiated instruction is just to simply divide the group of students, some equate differentiated instruction with individualized approach (7.6%) while others attach and equate differentiated instruction with two groups of gifted students and students with learning difficulty in Mathematics (12.7%).

Table 4. Level of regular to implement differentiated instruction.

	Usually	Sometimes	Never
Level of regular to implement differentiated instruction	23.7	49.2	27,1

The above results show that there are not many teachers regularly perform differentiated instruction (23.7%). There are even teachers who have never applied differentiated instruction (27.1%). The remainder has conducted differentiated approach, but not often (49.2%).

Table 5. Difficulties of teachers in differentiated instruction

Difficulties of teachers	Ratio
Unequipped with basic theoretical knowledge of differentiated approach	118/118
Untrained in pedagogical skills to deliver differentiated approach	101/118
Large class size makes it difficult to manage classes	38/118
Afraid of changes and the habit of designing and organizing lessons in the traditional way, simultaneously	32/118

Thus, difficulties of teacher are mainly due to teaching theory and pedagogical skills. Most teachers only conduct differentiated instruction based on their own professional experience, not performing in a formal way and having no process and are not trained, fostered with knowledge and skills of differentiated approach. Difficulties in class size or hesitation to innovate mentioned, but most teachers do not identify that is the biggest difficulty. This means that differentiated instruction is not really paid enough attention and implemented regardless of the importance of this differentiated instruction orientation for primary education.

To assess components of math differentiated instruction competency of primary teachers, we designed a survey toolkit based on Likert's 4-level scale, which encoded attainment level of the competency component corresponding from lowest (= 1) to highest (= 4). The content below aggregates average score that teachers self-assess of the extent to which the components of differentiated instruction competency gained for primary mathematics.

Table 6. Teachers' ability in assessment, classification of students and defining teaching goals.

Elements of differentiated teaching abilities	Description	Average score
Ability in assessment, classification of students and defining teaching goals	1. To design Student Survey Toolkit according to given criteria (interests, cognitive level, learning style ...)	2.9
	2. To use survey results to classify students (by group or individual).	2.7
	3. To develop teaching objectives to suit each classified group of students	2.5

Assessment and classification of students are important component, creating a prerequisite for the next steps in the implementation of differentiated approach. This is the foundation for teachers to set teaching objectives and to choose the methods and forms of teaching organization to suit each student. In general, this is not a difficult task and most teachers rate themselves above average in this competency component (with average scores of 2.9, 2.7, and 2.5).

Through interviews we found that teachers often incorporate a variety of ways to measure students' cognitive abilities: through tests, interviews, observations of student learning, discussion with student's parents and previous school year's head teacher of the student. Classification of students is usually divided into three groups: group 1 (including above average students); group 2 (including average students) and group 3 (including below average students). However, this classification is still relative because in the teaching process and based on student's progress or retrogression, teacher can move the children to the upper or lower group. In activity of developing teaching objectives, teacher's difficulties are mainly on the development and differentiation of different levels of demand for each group of students for the same learning objective.

Table 7. Teachers' ability in design and use of learning resources

Elements of differentiated instruction abilities	Description	Average score
Ability in design and use of learning resources for teaching process	1. To design appropriate learning materials for students	2.1
	2. To effectively use learning materials in process of differentiated instruction	2.4

The surveyed teachers showed no confidence in design ability (average score of 2.1) and using learning resources in differentiated instruction (average score of 2.4). The most used type of learning material is the study sheet as a tool for homework and task assignments to each student. Particularly for Group 3 students, some teachers use additional materials that summarize the basics or suggestions for students. The teachers also introduced reference materials and advanced textbooks for group 1. Reason why teachers self-assess this competency component low is due to the fact that most teachers are too dependent on the textbook and the use of teaching aids are mainly delivered in teaching the whole class.

Table 8. Teachers' ability in development of teaching contents in the direction of differentiation

Elements of differentiated instruction abilities	Description	Average score
Ability in development of teaching contents in the direction of differentiation;	1. To deepen core knowledge of the lesson	3.5
	2. To design suitable study contracts for different students	2.1
	3. To develop textbook programs	2.0

Teachers concern and focus on deepening core knowledge of the lesson for all student (average score of 3.5). However, it is difficult for primary teachers to design and implement study contracts for each student or to develop content and textbook programs (average score of 2.1, 2.0). As these are contents that many teachers have not accessed to and formed during training in pedagogical school. This is partly due to the rigid habits, dependencies and constraints of the school management system on the content and teaching program. In the general education curriculum after 2018, teachers will be facilitated and encouraged to develop this competency.

Table 9. Teachers' ability in in coordination of the use of teaching methods and forms

Elements of differentiated instruction abilities	Description	Average score
Ability in coordination of the use of teaching methods and forms	1. To flexibly combine whole class, group and individual forms	2.4
	2. To select appropriate teaching methods to each student in the direction of promoting learner's activeness and positiveness	2.5

Through interviews we found that although teachers organized a wide range of teaching styles (whole class, group and individual) and different teaching methods in the lesson, teachers did not really develop teaching strategies for each student.

Table 10. Teachers' ability in managing classrooms and creation of differentiated learning environments.

Elements of differentiated instruction abilities	Description	Average score
Ability in management of classrooms and creation of differentiated learning environments;	1. To divide reasonable time for activities and for each student	2.9
	2. To use form of homework and task assignment for each student	2.0
	3. To exploit the activity of supporting teachers and classmates	2.4
	4. To establish appropriate classroom arrangement for differentiated approach	1.9
	5. To reduce student's non-purposeful movement	3.2
	6. To minimize noise when organizing teaching activities	3.4

Teachers, particularly the ones who have many years of experience, do not have much difficulty in allocating reasonable time for activities and for individual students (average score of 2.9) as well as in reducing noise when organizing learning activities (average score of 3.4), and in reducing the non-purposeful movement of students (average score of 3.2). Teachers face many difficulties in calculating homework and task assignments for each group.

Teachers also do not have the habit of setting up classroom arrangement for different teaching situations that is consistent with students to save time when implementing approached activities. Teachers and classmates' support was not really exploited effectively. Teachers do this by simply arranging Group 1 seating next to Group 3 so that group 1 students can support group 3 students but fail to create a "The support Team of the Day, including the activity of some group 1 students sit on an available desk to assist others. The more students can take on the role of "The Support Team of the Day", the better; for these students can help their classmates by checking their answers, suggesting solution to the problem, or answering questions.

Table 11. Teachers' ability of testing and evaluation students and use results of testing and evaluation

Elements of differentiated instruction abilities	Description	Average score
Ability of testing and assessing students and use results of testing and ;	1. To design tools and forms of assessment	2.8
	2. To define evaluation criteria for and publicizing criteria and indicators to learners	3.0
	3. To use evaluation results to adjust teaching and learning activities	3.4

The ability to test and evaluate students and to use testing and evaluation results is assessed "fairly good" by teachers themselves and teachers do not have difficulty in designing the instrument and choosing the form of evaluation towards the competency approach (average score of 2.8) for they are well trained and educated in pedagogical school; The development of criteria and indicators is also agreed among teachers (average score of 3.0) and assessment results are served for further approach planning (average score of 3.4).

Through interviews we found that despite such self-assessment results, there are still limitations. In primary school, teachers are not interested in pointing out evaluation criteria for student. As a result, students may think they have done well while teachers do not think so. Teachers can also create a list of students studying attentively and add a positive (+) mark beside their names. Likewise, teachers can also make a list of students less focused on their work, even with teacher's supervision and reminder and adding a negative (-) mark next to their name. These markings will be added more day by day. Teachers should allow students to see teacher's observation on students during a week or a month. This helps students know how teacher has evaluated their concentration while studying. At the same time, the observation also tells teachers that students who failed to concentrate because of too easy or too hard task. It also shows that these students' seating need to be re-arranged or those students are really studying attentively.

In addition, teacher's specific assessment results should be accurate and provide students with opportunity rightly demonstrating what they achieve. Those suggestions should include several parts to evaluate each learning objective with clear indications and criteria development for the evaluation system. At the same time, teacher's assessment should provide insight valid at the time of the assessment. In order to do that, teachers should make their own assessments by prioritizing certain assessment aspects, sorting the items from easy to difficult to ensure that students are not stuck early and discouraged.

Table 12. Teachers' ability of withdrawing lessons learned from teaching practice.

Elements of differentiated instruction abilities	Description	Average score
Ability of understanding lessons learned from teaching practice.	1. To determine lessons learned for oneself	2.5
	2. To develop plans to overcome the shortcomings and promote the advantages in the teaching process	2.3

Teachers find many difficulties to draw lessons learned from teaching practicality and planning for the next teaching period. Many teachers proposed to promote exchanges and sharing of the teaching process of differentiated instruction for primary math. Teachers need to reflect themselves:

- When and how can students share their existing knowledge and understanding with other classmates?
- What is the best method to organize student participation in specific activities?
- Are there many ways through which students can access and gain knowledge?

- When do students have time to prepare for their own activities?
- How can students save their learning goals as well as their gained achievements to learn from experience?
- Can student be evaluated by other classmates? When and how?

There are many different ways to create and develop a classroom encouraging all students to work and think. Teachers should share their experiences with colleagues so that the teaching process always achieves the best effectiveness.

During the study we have organized a deep discussion with a group of 8 mathematics teachers to find what difficulties and challenges they faced while teaching in the mixed ability classrooms. The teachers we interviewed agreed on the same type of difficulties with mixed-ability classes:

- It is hard to keep every student's attention, hard to motivate every student.
- The teacher feels that he/she does not have enough time to help all students,
- The teachers found that students can be easily bored,
- Planning the lesson to meet all students' different needs is time consuming:

During discussion we wanted teachers to tell their opinion about the effectiveness of the training courses on differentiated instruction they had attended and their needs for training to enhance their instruction abilities in future, Teachers who attended our discussion agreed that: there had been very few trainings on differentiated instruction for them and their understanding about differentiated instruction came from some teacher's guidebooks. They all wished having more training on differentiated instruction in short future focusing on the followings: organizing and focusing curriculum on essential information, understandings and skills ; seeing and reflecting on individuals as well as the group ; peeling back first impressions ,looking beyond actions, erasing stereotypes ; thinking of and using time flexibly ; thinking of many ways to accomplish a goal ; organizing materials and space ; giving directions ; teaching for success and building a sense of community in the classroom.

From the research of Ann- Christine Svard (Sweden) 2006 and of Rema V. (India) 2016 on challenges for teachers on differentiated instruction we found that teaches in many countries have the same problems and desires for training on differentiated instruction.

CONCLUSION

It can be said that the goal of effective education must be towards the development of each individual learner. Differentiated instruction is one of the best ways to develop an individual learner. In differentiated approach teachers need to determine who is at what level, who needs help, how to maximize individual student's learning potential. However, the effectiveness of differentiated instruction depends very much on the teachers. Our study discovers mathematics teachers' understanding and abilities on differentiated instruction as well as the challenges they are facing while teaching the new curriculum in mixed ability classroom. Our study also found that almost all mathematics teachers have desires to be trained on differentiated instruction focusing on the followings : organizing and focusing curriculum on essential information, understandings and skills; seeing and reflecting on individuals as well as the group ; peeling back first impressions ,looking beyond actions, erasing stereotypes ; thinking of and using time flexibly ; thinking of many ways to accomplish a goal ; organizing materials and space; giving directions ; teaching for success; building a sense of community in the classroom.

Our study confirms the necessity of development of teachers' differentiated instruction abilities as one priority in professional development for mathematics teachers in Viet Nam.

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