A proposed program based on Edmodo platform to develop differentiated instruction practices of pre- service science teachers

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Abstract

Edmodo is one of the most important educational platforms that allow students to access the course content anytime and anywhere. The current study aims at proposing a program based on Edmodo and investigating the effect of the proposed program on the development of pre-service science teachers' differentiated instruction practices. The objectives, content, implementation procedures and evaluation techniques of the proposed program have been determined. Additionally, students' worksheets have been prepared. Each of them contains the objectives, duration and some tasks in accordance with the proposed program. An observation checklist has been prepared to assess differentiated instruction practices. Thirty nine pre-service science teachers studying in4th level/ department of elementary education (science) faculty of education, Menoufia University have participated in the study. The present study is conducted in quasi-experimental design using the quantitative approach with one-group pretest-posttest design. Results indicate that a proposed program has a positive effect on the development of pre-service science teachers' differentiated instruction practices.

Keywords: Educational platform, Edmodo, Differentiated instruction practices, Pre-service science teachers

1. Introduction

The increasing interest in the use of educational platform has become a crucial feature of 21st century education. Edmodo is one of the most important educational platforms that allow students to access the course content anytime and anywhere.

Edmodo allows using the power of social media in educational environment. For teachers and students, it creates a safe environment in terms of cooperation, feedback, customized learning and several other related respects. In terms of students, it provides independence of time and place and allows exchanging ideas and information (Yunkul&Cankaya, 2017).

Through Edmodo, educators and students can share notes, links and documents. Educators also have the ability to send alerts, events, and tasks for students and may decide to send something in a timeline that can be viewed by public (Gay&Sofyan, 2017).

Edmodo can foster the combined knowledge creation of a group better than individuals' diaries and discussion, because Edmodo facilities share ideas beyond the classroom via an online platform. This allows readily available access at random times to continue such discussion, online quiz,

sharing folder options and mainly connection to the global experts of various disciplines (Balasubramanian, Jaykumar, & Fukey, 2014).

Several recent studies have proven many benefits of using Edmodo, such López, Leo, & Miyatastudy (2013). They conclude that the using of Edmodo by primary teachers is very positive due to numerous collaborative advantages centered on communication and project based learning. Enriquez (2014) indicates that Edmodo is a good supplementary tool for students because it allows students to improve their learning through active participation in online discussions and tasks.

Also, Azmi&Ashari (2017) emphasized that integrating Edmodo promotes active engagement and it was supported by appropriate subject matter learning. Similarly, many studies showed benefits of Edmodo on enhanced students' motivation as Végh, Nagy, Zsigmond& Elbert, 2017; Vania, Setiawan&Wijaya, 2018.

Alqahtani (2019) found out that using Edmodo in higher education could improve learners' attitudes with regard to Edmodo. Thus, this research confirms that the positive aspects of learning via Edmodo improve the students' attitudes. Additionally, Ngo &Ngadiman (2019) reveal the advantages and usefulness of Edmodo in learning. First, Edmodo motivates students to learn more when compared to the traditional learning approach. Students became more active to learn the materials before classes and do their assignments and quizzes as assigned. Second, Edmodo allows learner-content interaction.

In the field of teacher education, results of Ekici (2017) have shown that the Edmodo application, which provides an opportunity to create a virtual classroom, can be used in teacher education for creating connections between theoretical and practical courses. The pre-service science teachers participating in the study presented positive views about the effects of using Edmodo on their pedagogical knowledge, their ability to use technology and their skills for establishing communication and collaboration.

Due to the previous advantages of Edmodo, the researcher is interested in using it to develop differentiated instruction practices.

Differentiated instruction is a construct that enables teachers to integrate differences amongst the students in their classroom into everyday teaching practice (Smets, 2017). In a differentiated instruction, students are regrouped, frequently and flexibly based on their readiness to learn, patterns of intelligence and interest.

Goodnough (2010) indicates that teacher education programs need to focus on helping pre-service teachers develop the knowledge, skills, and dispositions that will allow them to teach in inclusive classrooms. Also, Dixon et al (2014) emphasize that learning how to differentiate instruction for mixed-ability classes is important for teachers during their teacher preparation programs.

The literature reviewed on teacher education and classroom practices around the world suggests that developing teachers' differentiation practice and experience is crucial (Brevik, Gunnulfsen&Renzulli, 2018).

Pre-service science teachers need to understand differentiated strategies and techniques in planning and teaching, thereby helping improve learners' academic achievement (Maeng& Bell, 2015; Alghamdi&Azam, 2018). In line with this need, the present study aims to propose a program based on educational platform "Edmodo" to develop differentiated instruction practices of pre-service science teachers.

Teachers should be mentored and provided with the opportunity to observe each other's differentiated lessons, give feedback after observation as well as being given the time to collaborate resources for effective differentiation (Dixon et al., 2014). The current study is concerned with

providing these factors through the proposed program that allows practice, besides providing theoretical concepts and practical models of differentiated instruction practices through Edmodo.

2. Study problem

Providing differentiated instruction (DI) is considered an important but complex teaching skill which many teachers have not mastered and feel unprepared for (Van Geel, 2019). Previous studies found that teachers were not well prepared and insufficiently equipped with skills and knowledge about Differentiated instruction (Wan, 2017).

The researcher noticed, while supervising the field training, that the level of differentiated instruction practices among pre- service science teachers was too low. To confirm these observations, the researcher conducted a pilot study aimed at determining the level of these practices among students of the 4th level at the faculty of education/Menoufia, University, department of elementary education (science), academic year 2018/2019. The results indicated their low level.

Al-Hakimi (2015) indicates that the level of the science teachers' differentiated instruction practice was too low.

There are indications in various studies that the teachers' implementation differentiated instruction practices are not sufficient. Maeng & Bell (2015) aimed at investigating the implementation practices of secondary science teachers who differentiate instruction. The results indicated that participants implemented a variety of differentiation strategies in their classrooms with varying levels of proficiency. Evidence suggested that all participants should use instructional modifications that required little advance preparation to accommodate differences in students' interests and learning profile.

In addition, a study by Siam & Al-Natour (2016) showed that all domains of differentiated instruction practices used by teachers are low.

Also Ismajli& Imami-Morina(2018) found that instructors do not have sufficient knowledge regarding differentiated instruction to be able to implement it successfully in the classroom. Instructors do not have sufficient knowledge regarding differentiated instruction to be able to implement it successfully in the classroom.

In the same line, the results of Brevik, Gunnulfsen & Renzulli (2018) support the notion that student teachers lack confidence in enacting differentiation, despite being aware of its importance.

The low level of differentiated instruction practice may be due to the teacher preparation programs which concentrate on memorizing and retrieving information not providing opportunities to practice.

Scholars argue that in addition to providing student teachers with theories about differentiation, teacher educators should offer practical training on campus under their guidance and help student teachers relate their knowledge to their teaching practices (Brevik, Gunnulfsen&Renzulli, 2018).

The pre-service science teachers studying at the faculty of education are faced with problems in understanding and applying what they learn in theoretical lectures due to the limited hours of practical courses. So, supporting real classrooms courses with online environments, which connect theoretical and practical courses, can be useful for fixing these problems.

Edmodo can positively affect the pedagogical development of pre-service teachers by helping them make connections between theoretical and practical science teaching activities and by allowing them to share their views with each other (Ekici, 2017).

Accordingly, the problem of the present study is determined by the low level of differentiated instruction practices among pre- service science teachers. To solve this problem, the study seeks to

propose a program based on Edmodo platform as supplementary tool for developing these practices. The study questions are presented as follows:

1- What is the form of the proposed program based on Edmodo"?
2- What is the effect of the proposed program on the development of pre- service science teachers' differentiated instruction practices?

3. Study objectives
This study aims to:

- Propose a program based on Edmodo platform.
- Investigate the effect of the proposed program on the development of pre-service science teachers' differentiated instruction practices.

4. Study hypothesis
H1: The proposed program based on Edmodo platform has a statistically significant effect on the development of pre-service science teachers' differentiated instruction practices.

5. Study Importance
The study is expected to:

- Introduce a program based on Edmodo platform to develop differentiated instruction practices.
- Help develop teacher preparing programs at the faculties of education.
- Introduce students' worksheets with practical tasks which may benefit in training students on differentiated instruction practices.
- Open new horizons in employing educational platform in teacher preparing programs.
- Provide a tool to measure differentiated instruction practices.

6. Literature Review
6.1 Edmodo platform
Edmodo is an educational platform for blended learning which suits 21st century educational tool that allows participators to learn anytime and anywhere (Yin et al, 2019). It helps connect all learners with the people and resources needed to reach their full potential (Mokhtar, 2018).

Edmodo, available at www.edmodo.com, was designed and developed by Jeff O'Hara and Nick Borg in 2008 (Kongchan, 2013). It is a free Web 2.0 Communication Tool. A variety of features which makes it a perfect tool to be utilized in educational settings as a learning management system include online notes, quizzes, assignments, polls, setting deadlines for homework, grade book, dividing class into subgroups, online free as well as paid classroom resources and the opportunity to connect with teachers around the globe. This platform is equally useful for teachers, students, parents and management of educational institutions (Maryam, 2016).

Edmodo makes the educational environment accessible both for teachers and learners, and also for parents from any place at any time. The process starts with the teacher opening a course over the system. It is then made ready when learners enter their course code. Learners can carry out the tasks they have been assigned and also interact with their teacher in many ways using the application's basic features. Edmodo can be used in education in two ways: (a) executing the whole course online via Edmodo, and (b) using Edmodo to support a course taught on face-to-face basis (Durak ,Çankaya, &Yünkül, 2014).

Edmodo has 8 features that support learning: (Retnoningsih, 2017)

- Groups Teacher: Students and parents: This feature allows students and parents to join as members and participate in the activities conducted in LMS.
- File and Links: This feature allows users to send and share links, as well as various files through attachment.
- Teacher libraries and student backpacks: This feature allows teachers to upload teaching materials such as materials, presentations, pictures, videos, references, etc.
- Quiz: This feature allows the teachers to provide online evaluations to students in the form of multiple choices, short answers, and descriptions.
- Assignment: This feature allows the teachers to provide assignments online to students, equipped with a deadline that can be determined by them, so it is expected that this feature makes students have more discipline in submitting tasks.
- Gradebook: This feature allows teachers to provide assessments manually or automatically that can be seen by students.
- Badges: This feature allows teachers to reward students or groups for their achievements.
- Post, Note, and Polling: This feature is a tool provided to teachers and students to communicate in LMS.

Nurvitasari et al (2018) reviews the following features of Edmodo: Classes, Small Group, Library, Note, Poll, Assignment, Quiz, Discussion, Messages and Progress. Mokhtar (2018) revealed three significant features of Edmodo that may enhance learning experiences—namely, novelty of tasks, favorable learning environment, and mobility.

Edmodo will be used in the present study as supplementary tool to support a course taught on face-to-face basis. Most features of Edmodo will be utilized.

6-2 The Differentiated instruction and its practice

All learners do not have the same learning speed rate; therefore "the model of differentiated orientation requires that instructors be flexible in their approach towards teaching and adapt their syllabus and teaching to learners, and not adjust learners to the syllabus (Ismajli&Imami-Morina, 2018).

Differentiation can be defined as an approach to teaching in which teachers proactively modify curricula, teaching methods, resources, learning activities, and student products to address the diverse needs of individual students and small groups of students to maximize the learning opportunity for each student in a classroom (Tomlinson, 1999).

Additionally, Brevik, Gunnulfsen&Renzulli (2018) define differentiation as an attempt by the teacher to address the variation among learners in the classroom through multiple approaches that modify the instruction and curriculum to match students' individual needs.

Tomlinson et al (2003) proposed that effective differentiation should have the following characteristics: (1) is proactive, rather than reactive; (2) employs flexible use of small teaching-learning groups in the classroom; (3) varies the materials used by individuals and small groups of students in the classroom; (4) uses variable pacing as a means of addressing learner needs; (5) knowledge-centered; and (6) learner-centered.

Dimensions of Differentiation

There are Five Dimensions of Differentiation, explained as five ways to integrate differentiation into teaching practices as follows (Reis &Renzulli, 2015):

1. Content: Students have different academic abilities and interests – and teachers can differentiate the content/curriculum delivered to their students. Some students need content that matches their interests, or is more or less challenging and appropriate for their reading level.
2. Instructional Strategies: Students also arrive with different learning styles – some learn best through group work and some by working alone, some learn best by doing projects, while other learn by discussion. Teachers can differentiate by using different instructional strategies that match the preferences of individuals or groups in their classroom.
3. The Classroom: Teachers can differentiate the learning environment itself, and how they manage it. Students can have the opportunity to work in groups with other students like them, or work in groups in which every student has a chance to demonstrate their different style.
4. Products: Students express what they've learned in different ways – some students' prefer expression style is written – while others do better with technology, social action, or visually. Teachers can differentiate products by giving students options, when practical, to choose their own modes of expression to demonstrate what they have learned.
5. The Teacher: Obviously, it's hard to imagine that teachers can differentiate every lesson every day– so differentiation is about the decisions and choices that teachers make about how to differentiate the curriculum for a diverse group of students. Differentiation requires that teachers consider their students' learning styles, interests, abilities, and expression styles – and that they accept the freedom, flexibility, and creativity to implement this process in the classroom.

Differentiated instruction science practices

The present study is concerned with the development of the practices of the following differentiated science instruction skills:

- *Content differentiation*

Content differentiation includes adding depth to the curriculum of science and enrichment it in line with the students' intelligence, interests and learning style.

- *Using differentiation strategies*

Science teachers should differentiate their instruction to best meet their diverse strengths and needs. Some students learn more effectively by discussion, others learn best by simulations, doing projects or drawing mind map.

VanGeel (2019) mentioned that there is not one "successful strategy" that can be applied to differentiate properly. The core of differentiation is in teachers' deliberate and adequate choices concerning instructional approaches and materials based on well-considered goals and thorough analyses of students' achievement, progress, and instructional needs, combined with continuous monitoring during the lesson.

- *Providing differentiation educational activities*

There should be little doubt that students have preferences for the ways in which they like to express themselves: orally, visually, graphically, dramatically, or through construction, digital media, or various write genres (Brevik, Gunnulfsen&Renzulli, 2018). For example, students who like to express themselves dramatically are asked to conduct scientific theatrical activities and so on.

- *Using differentiation learning sources*

The science teachers should provide different learning sources such as photos, books and internet networks to suit different types of intelligence and learning patterns preferred by learners.

- Differentiated classroom management

In the differentiated classroom management, the science teacher should divide learners into groups according to a specific criterion (IQ style, interests, previous experiences, learning style…) and organizes the classroom (seats- tools) in accordance with the strategies of differentiated teaching.

- *Using differentiation evaluation*

The science teacher should use various forms of evaluation (note card- reports- projects......) and the evaluation techniques which address the diverse needs of individual student.

Some studies have focused on the development of differentiated teaching practices and skills like Al-Mutawa (2018) which showed the effectiveness of using smart devices in developing differentiated Instruction practices among primary school pre-Service teachers. Also, Johnston &Collum (2018) focused on the use of the Simulation based learning (SBL) tool, simSchool, as a way of increasing pre-service and in-service teachers' understanding of the use of differentiated instruction and classroom management. Additionally, Alghamdi&Azam (2018) found that the differentiated method course was deemed effective in developing pre-service science teacher' differentiated teaching skills.

It is noted from previous studies that the using of technology tools like smart devices and SBL,or providing the content about differentiated teaching, helps in the development of differentiated teaching skills and practices, so the current study is interested in using one of the technological tools and providing content about differentiated education practices through a proposed program to develop this practice.

7. Method
7.1 study Design

The present study is conducted in Quasi-experimental design using quantitative approach with one-group pretest-posttest design.

7.2 Participants

The implementation process of the study was carried out in Menoufia University, Egypt during the first semester of the academic year 2019/2020. 39 pre-service science teachers (aged 21) studying in 4th level/department of elementary education (science) faculty of education participated in the study.

7.3 Materials and tools

To fulfill the purpose of present study, the following materials and tools were constructed:

7.3.1 The proposed program

To construct the program and answer the first question of the study the following were determined:

- *Objectives of the Proposed program*

The program generally aimed to develop differentiated instruction practices of pre- service science teachers. The specific objectives of every lesson were identified (see Appendix A).

- *Principles of the Proposed program*

The proposed program depended on the principles of Connectivism theory (see Siemens, 2005), so the following principles of the program were derived:

- Maintaining and nurturing connections is needed to facilitate continual skills acquisition.
- Collaboration is essential for the development of skills and practices.
- Acquisition knowledge and skills rests in diversity of opinions and performances.

- Learning of skills requires connecting information sources.
- Learning of skills requires practice besides learning theoretical concepts.
- The active role of learner is very important for acquiring skills through the educational platform.

- *Content of the proposed program*

The program was organized into six lessons, which corresponded to the practices of differentiated instruction skills. The flowing table shows the content of proposed program.

Table1. Content of proposed program based on Edmodo platform

week	lesson	subject	Duration in the real classroom
1	-	Introduction to differentiated instruction	20 minutes
1	1	Content differentiation skill	80 minutes
2	2	Using differentiation strategies skill	100 minutes
3	3	Providing differentiation educational activities skill	100 minutes
4	4	Using differentiation learning sources skill	50 minutes
4	5	Differentiated classroom management skill	50 minutes
5	6	Using differentiation evaluation skill	50 minutes

The content has been uploaded on Edmodo platform[*]

[*]https://new.edmodo.com/groups/-30149669

- *implementation procedures of the Proposed program*

Proposed program implementation procedures conducted in a real classroom and a virtual classroom "Edmodo", were determined as follows:
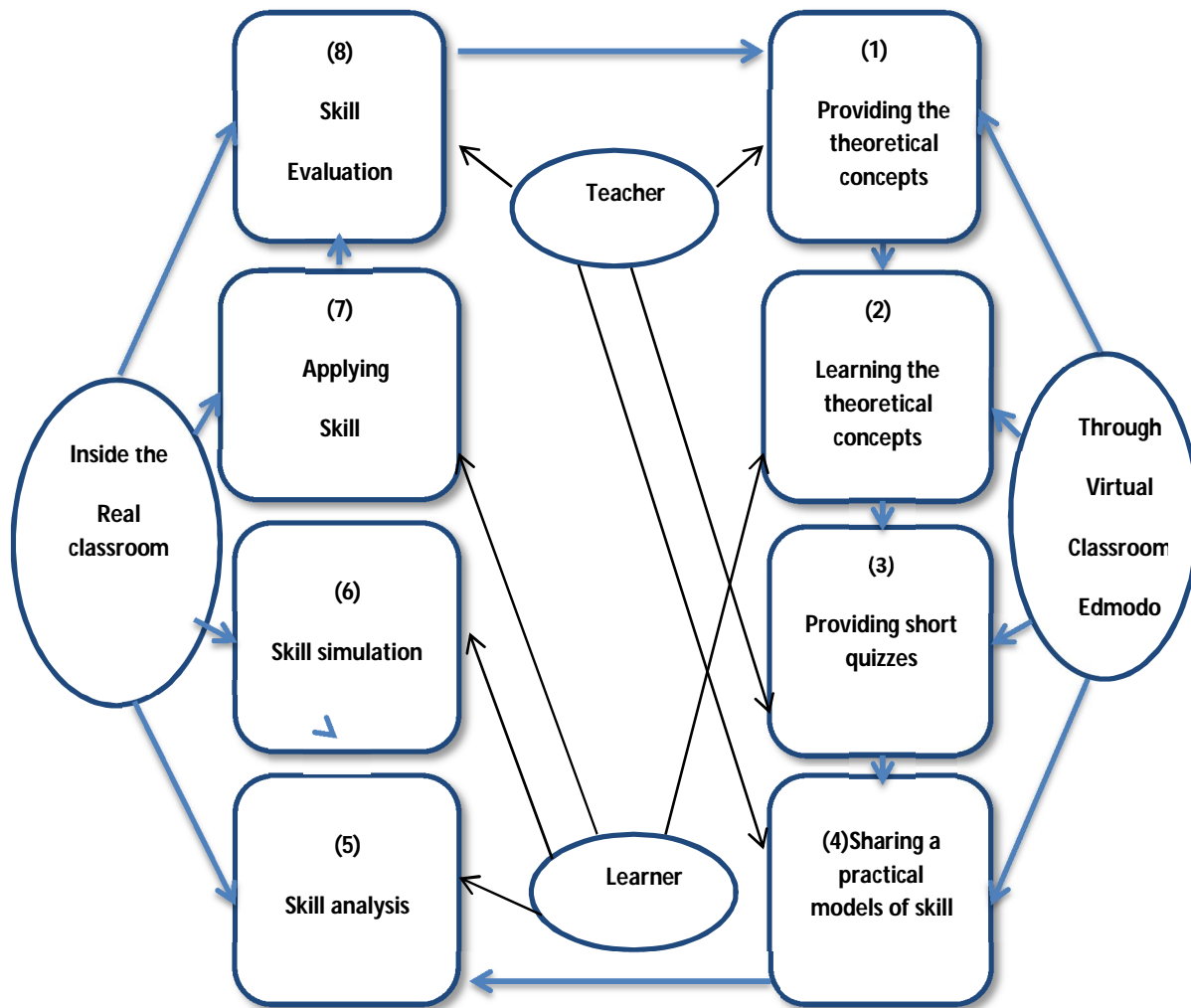

Figure (1) Proposed program implementation procedures and the role of teacher and learner

Figure (1) showed that the proposed program implementation procedures conducted in a Virtual classroom **"Edmodo"** are: Providing the theoretical concepts, learning the theoretical concepts, providing short quizzes and sharing practical models of skill. The proposed program implementation procedures conducted in a real classroom are: skill analysis, skill simulation, applying skill and skill evaluation. The application of these procedures depends on a number of techniques and strategies: collaborative learning, micro-teaching and discussion.

Figure (1) also showed that the role of the teacher is: Providing the theoretical concepts, providing short quizzes, sharing practical models of skill and Evaluation of skill. The role of the

learner (pre- service science teacher) is: learning the theoretical concepts, analyzing skill, simulating skill and applying skill in new situations.

Evaluation techniques of the proposed program
Initial, formative and summative evaluation techniques were used as follows:
- Short quizzes through Edmodo to evaluate the achievement of theoretical concepts related to differentiated instruction skills.
- Observation sheets to evaluate the practices of differentiated instruction skills conducted in this situations:
    - In the real classroom every session.
    - Before and after implementation of proposed program.
- ### *Validity of the Proposed program*
The proposed program was reviewed by experts to check the suitability of objectives, the consistency of objectives to content and the suitability of the procedures conducted in a real and a virtual classroom "Edmodo" to the development of differentiated instruction practices. The program was revised in light of their suggestions and comments.

7.3.2 Worksheets
Worksheets used in a real classroom were prepared. Each of them contains the objectives, duration and three tasks (skill analysis, skill simulation, applying skill) in accordance with the proposed program. The worksheets were presented to a panel of jury. Their opinions concerning objectives and tasks were taken into consideration. Appendix B shows the final version of the worksheets.

7.3.3ObservationChecklist
Observation checklist was prepared to assess the practices of differentiated instruction skills of pre- service science teachers. The checklist included six axes: Content differentiation, using differentiation strategies, providing differentiation educational activities, using differentiation learning sources, differentiated classroom management, using differentiation evaluation. The checklist included 40 items and designed using a three-point Likert scale. The observation checklist was checked by the jury to seek validity. It was also piloted with eleven primary science pre-service teachers to test their reliability. Inter-ratter agreement was identified using the Cooper equation. The agreement percentage = (number of agreements/ (number of agreements + number of times of disagreement)) $\times$ 100. Inter-ratter agreement ranged from 79% to 85%, this indicated that the sheets had reasonable reliability. Appendix C showed the final version of observation Checklist.

7.3 Procedures
Prior to the implementation, a group with the title "Differentiated instruction practices" was formed by the researcher based on the group name, group level and area of topic in Edmodo platform. The researcher clarified a purpose of the study and procedures of implementation proposed program to participants. Then, Pre observation was conducted. Participants used their mobile phone or laptop to register in Edmodo and create their profile. A specific group code was given to the participants. The program procedures were implemented through virtual class Edmodo and real class for 5 weeks, starting from September 24, 2019 to October 29, 2019. Finally, post-observation was conducted. Data of differentiated instruction practices observation checklist were analyzed by T-Test, and the value of effect size was calculated.

8. Results

To answer the second question and test hypothesis of the study, the researcher analyzed the data of primary science pre-service teachers' performance in the pre-post observation of differentiated instruction practices using T test, and calculated the value of ETA squared ($\eta 2$) to determine the value of effect size. The following Table 2 summarizes the results:

Table2
T-test mean scores between pre-post observation of differentiated instruction practices, and value of effect size

Measurement	N	Mean	S.D.	T	Level	($\eta 2$)	size effect
Pre-test	39	75.23	7.94	7.79	Sig. at level 0.01	0.61	2.52
Post-test		86.28	6.66				

Table 2 shows that the value "T" equals 7.79 and is statistically significant at level 0.01. The value of effect size equals 2.52 (more than 0.8) showing that the effect size of the proposed program is large on develop differentiated instruction practices. Therefore, hypothesis of study was accepted.

9. Discussion

Results indicate that a proposed program based on Edmodo platform a positive effect on the development of differentiated instruction practices among pre-service science teachers. This may be due to the following factors:

- The possibilities provided by Edmodo for the development of differentiated instruction practices as follows:

  - Edmodo expands the learning environment far beyond the walls of the classroom and provides opportunity for pre-service science teachers to discover the theoretical concepts of differentiated instruction practices outside of regular classroom, thus allowing classroom time for practice and application.

  - The teacher can easily share practical models of differentiated instruction skills through Edmodo, which helps in acquiring these skills.

  - Edmodo fosters a collaborative learning environment where the experiences of participants about differentiated instruction are integrated.

  - Edmodo can facilitate participants' submitting their works, knowing their progress and interacting with each other. This helps in exchanging experiences about differentiated instruction practices.

  - With Edmodo, the teacher can provide resources, readings, activities and assignments, create discussion groups, organize surveys and give different badges to his students for their active participation.

  - The participants can upload videos, generate and share their ideas about differentiated instruction practices through Edmodo.

- Edmodo promotes independent learning environment and allows participants to actively engage in understanding differentiated instruction.

- The proposed program implementation procedures, conducted in a real classroom, contribute to the development of differentiated instruction practices as follows:
  - The skill analysis procedure helps participants divide the differentiated instruction main skill into sub-skills and practice each to master the main skill.
  - The skill simulation procedure assists participants to practice differentiated instruction skills as learned from practical models on Edmodo.
  - The applying skill procedure facilitates the practice of skills in new situations. This helps pre-service science teachers to teach different various science subjects in differentiated ways.
  - The skill evaluation procedure helps teachers to have accurate differentiated instruction practices, support the valid practices and provide appropriate feedback.

- The proposed program depends on Connectivism. Thus; the program is interested in providing collaboration, connecting information sources, diversity of performances, and the active role of students. These factors may help develop differentiated instruction practices.

- The proposed program provides theoretical experiences besides applying performance, which are essential for skills and practices development.

The results agree with Al-Mutawa (2018), Johnston&Collum(2018). They show the effectiveness of using technology tools on the development of differentiated teaching practices. Also, Ekici (2017), Hursen (2018) refer to the importance of Edmodo to Prospective Teachers.

9. Conclusion

Results reveal that the proposed program based on Edmodo platform has a positive effect on the development of differentiated instruction practices among pre-service science teachers. Edmodo as supplementary tool can be used effectively to support learning environment in teacher preparing programs. Hopefully, the findings of the present study will encourage the expanding of using Edmodo to benefit from its full potentials in meeting the desired learning outcomes.

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