Chapter

Using Tablets for Technology Integration in Classroom Differentiation

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Abstract

Differentiation works on both individual and social levels; the immediate outcomes in the classroom have an influence on the whole life of the society. The learning process could be differentiated in terms of content, process, and product by taking students' readiness, interest, and needs into account. Our research has shown that using tablets in classrooms provides a useful implementation tool for differentiation. However, attitudes and beliefs of teachers are as important as experimental studies to understand the advantages of using tablets to ensure the differentiated curriculum and its implementation. Participants' ideas on using tablets in classrooms for differentiating the classroom were documented in a bootcamp that includes ICT, English, Math, and class teachers who use tablets, ICT experts, and academicians. Questions included topics like the need for differentiation, the advantages and disadvantages of using tablets for implementing the differentiated curriculum, and the teachers' attitudes on using tablets. They pointed out that differentiation via technology is able to meet the different needs of students. They reported that technology degradation and tablets were useful tools for differentiation. However, they all agreed that a successful organization was needed to be able to include technology to the existing practice and curriculum.

Keywords: differentiation, using tablet, technology integration, TPACK, TABLIO

1. Introduction

Today's modern world caters for a great variety in applications and practices for education. The development of technologies and the Internet has also diversified the opportunities for students and teachers in this context. The students who are attending the schools are more diverse and come from various segments of the societies. This is more demanding on the side of the schools and teachers, and one size fits them all does not work in this respect. The awareness of the learner differences has risen among all societies and educational circles, and thus curricula have been changing more rapidly. In Turkey, for example, the curricula for all levels have been changed almost every 4 years now. Previously, the curricula changes were taking place in almost every 10 years [1].

The changes of curricula are necessary because the diversity of the students and the learning styles of those students need to be recognized. However, the recognition of the learning preferences is not enough in itself and requires taking more action.

Thus, the concept of differentiation brings about an immediate answer for recognition and could readily play an important role in actionizing a proactive execution of this action. Most of the time, students and teachers are aware of the diversity taking place in the classroom, but the teachers cannot act on that due to reasons like heavy content, centralized curriculum, and school culture. They need a solid ground rooted in pedagogy to be able to address this caveat. Differentiation can bring a relief to those teachers and students. According to [2] "a key goal of differentiated instruction is maximizing the learning potential of each student" (p. 3). Differentiation could be implemented not only on an individual or classroom level but also on a curriculum level. Curriculum differentiation, which is defined as "the process of modifying or adapting the curriculum according to the different ability levels of the students in one class" [3], involves the modification of the content and presentation of information as well as variation in practice and performance on the side of the students.

The introduction of the Internet into the classrooms has enabled the use of new technologies and in particular mobile technologies like tablets in the classroom. The use of tablets in the classroom has also brought about new opportunities to recognize the differences of the students in the learning process. The awareness of this on the teacher's side is a key component in using tablets in classrooms for differentiating their classrooms and curriculum. The teachers should have a positive attitude toward technology integration and then be aware of the advantages and disadvantages of using tablets for implementing the differentiated curriculum. The variety of apps that could suit each student in the classroom and meet the different needs of different students make the technology integration and the tablets useful tools for differentiation.

2. Technology integration in education

The twenty-first century, which is defined as the age of technology, brought many requirements in the name of meaningful and permanent learning and thus necessitated new structures within the educational systems. It is aimed to design the environments where education is carried out with appropriate and various technologies and to enable students and teachers to use these technologies both in the classroom and outside the classroom.

It is easy to defend the effective use of technology in the world as technology both assists learning environments and also supports alternative learning-teaching approaches. In this context, computers, tablets, smartphones, video conferencing devices, etc. gain different usage opportunities in educational environments every day. Of course, using these technologies in learning environments to improve the quality of education can be made possible only by planning activities that support the productivity of students, not only with technology but also with pedagogy. Mishra and Koehler's technological pedagogical content knowledge (TPACK) model provides a road map for the effective integration of technology and pedagogy in learning environments [4–6].

In an era of highly valued technological knowledge, it is important that teachers develop an integrated knowledge of teaching, content, and technology, called Technology Pedagogy and Content Knowledge (TPACK); as suggested by [7], TPACK (**Figure 1**) is becoming a required area of expertise for teachers in new learning environments in the twenty-first century.

With the transfer of technology into the classroom environment, the teachers' TPACK knowledge has developed to ensure meaningful and permanent learning and the ability to use technology within the classroom.

The introduction of technology into schools as a product only does not provide an effective use of technology. It is important that teachers, students, parents, and the management use the technology for real aims and the technology fosters

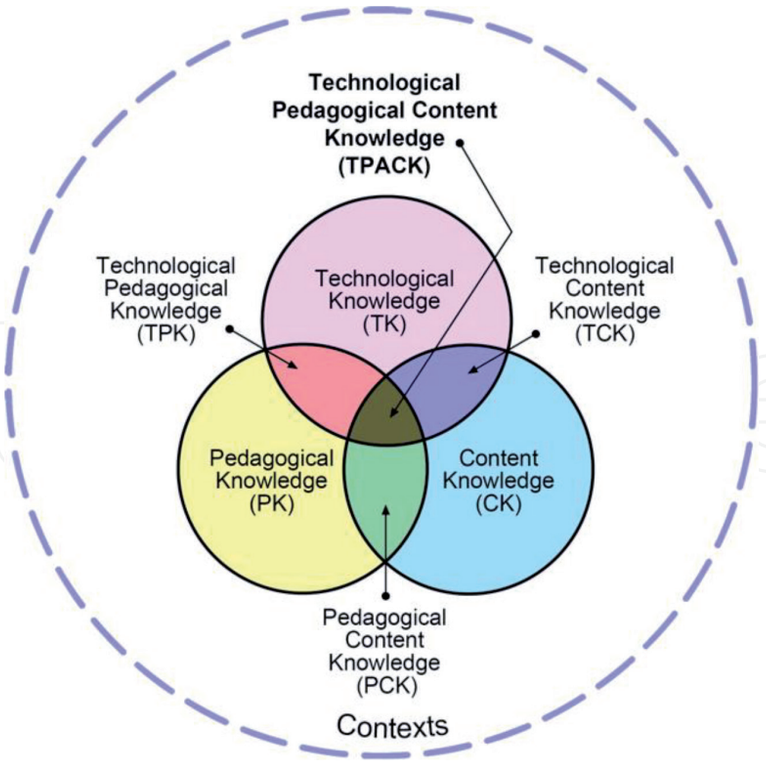

Figure 1.
TPACK framework (tpack.org).

learning in the process, that it is included in the school culture, and that it can be a premise for further innovations [8]. This is possible only with the integration of technology. To [9] technology integration is to improve students' thinking ability, whereas to Griffin it is the use of instructional technologies consciously and purposefully in the development and transfer of teaching process [10].

As the use of technology becomes widespread in institutions, better services are provided, more productive studies are carried out, and as a result more quality products are introduced; thus, technology has become an indispensable element of life as a center of attention in all segments [11]. To emphasize the necessity of technology integration in education, Alkan has defended that in order to provide quality education services to individuals, it is necessary to meet the different needs and demands of the society, using human resources effectively and ensuring equal opportunities in education as well as the use of educational technologies in the classroom [12]. However, Yıldırım argues that there should be widespread cooperation between researchers, decision-makers, and practitioners in terms of improving the learning process for the use of technology in the classroom [13].

According to [14] integrating technology into the school curriculum requires taking a number of elements into account. These elements can be summarized as the needs of learners, the availability of resources, the identification of instructional needs and technology design for technology, and the provision of technical support and guidance in the use of technology for teachers. Based on the studies, two main objectives in technology integration can be proposed for the effective use of technology in schools: one is to teach how to use technology and how to access information on the computer. The other goal is to use information technology (IT) and its facilities effectively. According to [15], in order to achieve these objectives, educators should consider the contextual factors that influence the findings of the studies in the field of educational technology, student achievement, and learning objectives. In addition, today's teachers have stated that they frequently encounter computer-based technologies in the schools they work for or in the programs they

prepare for teaching [16, 17]. The field of differentiation could also benefit from the body of information presented by the proponents of TPACK and technology integration. The knowledge from these fields can enrich the opportunities for classroom differentiation and add invaluable depth to differentiation activities. In addition, teachers who want to apply the principles of differentiation in their classrooms could find such in-depth model for the integration of technology degradation and tablets for differentiation in their classroom in the SAMR model.

3. SAMR model

Ruben R. Puentedura developed the SAMR model—which is the acronym made up from substitution, augmentation, modification, and redefinition—in 2006 as part of his work with the Maine Learning Technology Initiative [18]. The SAMR model consists of the following four classifications of technology use for learning activities [19]:

Substitution: the technology provides a substitute for other learning activities without functional change.

Augmentation: the technology provides a substitute for other learning activities but with functional improvements.

Modification: the technology allows the learning activity to be redesigned.

Redefinition: the technology allows for the creation of tasks that could not have been done without the use of the technology (**Figure 2**).

According to the SAMR model, these two dimensions (substitution and augmentation) play an enhancement role in teaching and learning processes. But when ICTs are used to transform (modify and redefine) the teaching and learning processes, we significantly realize a redesign of tasks. This model clearly describes how technology can sequentially be integrated in education without skipping any stage of development.

The SAMR model is not a pedagogical method but a tool that guides pedagogues and shows what kind of assignments they should give in their learning process. It reveals the ways to integrate the techniques to ensure in-depth learning in

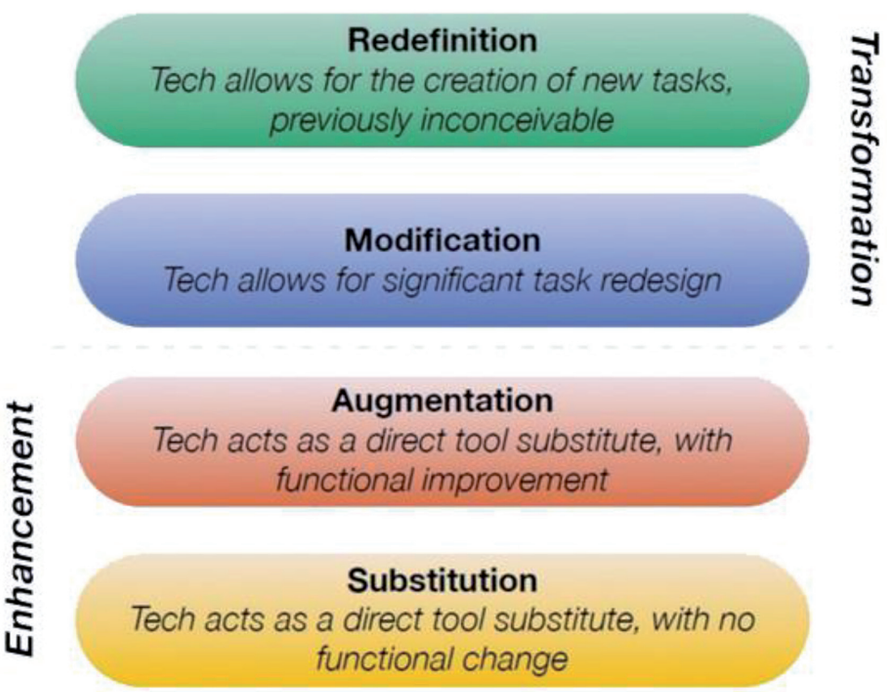

Figure 2.
SAMR model (eagleschools.net).

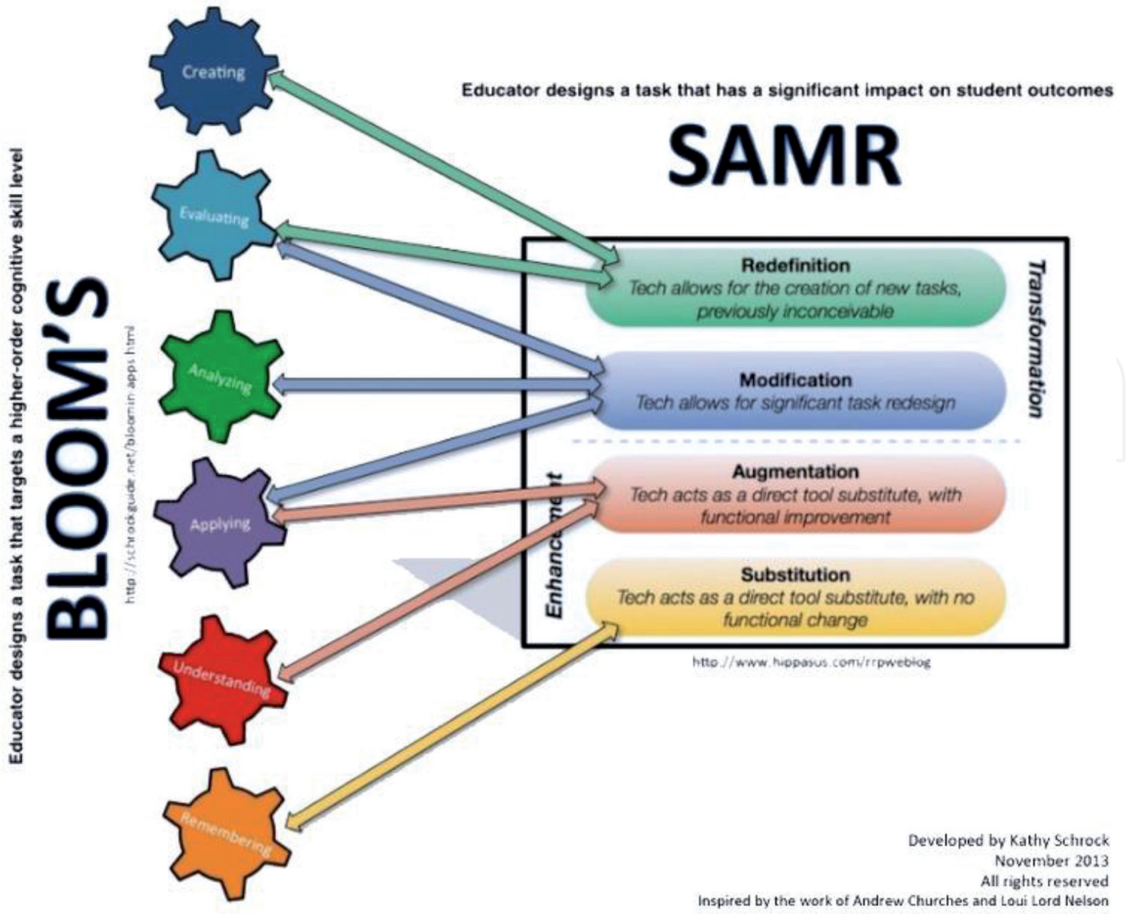

Figure 3.
SAMR model and Bloom's taxonomy (schrockguide.net).

environments where all students have access to computers and how the expectations from the students in these classrooms should change with the digital technology [20]. Teachers can integrate the technology for differentiation and find various applications for the individual needs of their students (**Figure 3**).

4. Differentiation

Tomlinson and Eidson define differentiation as "a conceptual approach to teaching and learning that involves careful analysis of learning goals, continual assessment of student needs, and instructional modifications in response to data about readiness levels, interests, learning profiles, and affects" [2]. The definition stresses the importance of continuous engagement with the students in the learning process as well as their cognitive and affective states. In their concept map, the TABLIO Project funded by the European Union has pointed out that differentiation aims for the inclusion of all students; the inclusion brings in a higher motivation to learn and to participate in a lifelong learning and for achieving learning outcomes more efficiently [21]. They believe that the objectives of differentiation are self-realization and self-actualization between the cognitive, emotional, and social levels and striving for harmonious and pluralistic citizens for the society and humanity. In this context, differentiation serves more than just the recognition of student differences and needs but a holistic aim. Thus, differentiation works on both individual and social levels; the immediate outcomes in the classroom affect the whole life of the society. Due to these reasons, differentiation should be considered to be a necessary aspect of all education. [22] proposes that there are certain benefits to differentiated

instruction such as effectiveness for high-ability students as well as students with mild to severe disabilities, taking on more responsibility for their own learning, more engagement in learning, and reportedly fewer discipline problems in classrooms. On the other hand, some drawbacks include ever-increasing workload while planning and executing and lack of professional development resources.

According to [22] differentiation could be reflected into the curriculum in many ways. These would include the differentiation of the instruction and presentation by changing the *content* to be learned. They can also differentiate the *learning process* in which students are participating. The outcome or the *product* of the learning process could also be differentiated as well as the classroom *environment*. IIn this effort, though, students' readiness, interests or learning profiles could also play a defining role. To [22] "in differentiated classrooms, teach provide specific ways for each individual to learn as deeply as possible and as quickly as possible, without assuming one student's road map for learning is identical to anyone else's (p. 2)." The TABLIO Project [21] has also pinpointed those aspects but added that differentiation also requires cooperation from stakeholders between the microlevel (classroom level), meso-level (school level), and macro-level (policy level). They have also stated that the differentiation can appear in two main types: organizational differentiation and educational differentiation. Organizational differentiation can be actionized in many ways like grouping strategy of the classroom, individualized programs for special needs, extracurricular acceleration programs, and remedial programs. On the other hand, educational differentiation works on a classroom level. The classroom has two important players, the students and the teachers. Student's readiness, interests, and learning profile should be taken into consideration if differentiation is to be achieved for students. Teacher-oriented differentiation works on content, process, and product aspects. There is a reciprocal influence of teacher-oriented and learner-oriented differentiation techniques. As seen above, the teacher can plan differentiation on students' needs, abilities, and interests and also by incorporating many other aspects like content, process, and product. Thus, the teachers can achieve effective curriculum differentiation as a whole. According to [23], curriculum differentiation emphasizes the need to modify and match curriculum objectives and teaching methods to the "pupil's individual abilities, educational needs and learning styles" (p. 1).

Applying differentiation in education for major gains requires the collaboration among many stakeholders. The first and foremost of those stakeholders is in *macro-level*, also defined as policy level. This is the national and/or regional policy makers' level. The educational documents and aims should reflect and include differentiation as an application in the learning process. Politicians and the Ministry of Education should support the idea and should also work toward the implementation and the evaluation of the learning process. Inspectors and teacher trainers can also work to transfer and promote the idea of differentiation into schools and classrooms and then proceed with the *meso-level* support. Meso-level means the practices and the policies in schools among principals and teachers. These parties should also recognize the need and understand the concept of differentiation; this can be defined as the school level as well. *Microlevel* requires not only the teacher and the student but also other classroom assistants and most importantly the parents to be engaged in the process of differentiation. Initially all of these levels should actively participate in the process of differentiation and also in negotiation to make the process more transparent and effective for all parties.

When the idea and the policies require the teachers to apply differentiation, they could start from *organizational* differentiation. Organizational differentiation is about implementing individualized programs for special needs, gifted students, and other

groups with different needs like learning disabilities, some disorders, and various disabilities. In this way the teachers can help students with special needs succeed personally in school and in their community. Students with these kinds of special needs are likely to benefit from additional educational services such as different approaches to teaching, the use of technology, a specifically adapted teaching area, or a resource room. Teachers can also design *remedial programs and extracurricular acceleration programs* in small groups such as developmental education, basic skills education, compensatory education, preparatory education, and academic upgrading as well as sports, music, arts, academic clubs and many other after-school activities [21].

Educational differentiation necessitates taking both s*tudents' readiness*, *interest*, and *profiles* and teachers into account. Students' readiness is about students' previous knowledge or skills. Students' interest areas could be used to increase the motivation toward learning and create links between the content and the student; finally students' learning profiles are their preferred way of learning.

When teachers are considered in the differentiation process, what they can differentiate first is *content*. Content-oriented differentiation reflects the ways of modifying the content and also varying methods of presentation. Content is dependent on subject, text, and age of the learners. Content information should be provided through a variety of sensory inputs, e.g., audio, visual, or kinesthetic. To differentiate the content, [22] recommends designing activities around Bloom's taxonomy including remembering, understanding, applying, analyzing, evaluating, and creating. Some students can prefer to learn in certain ways. Thus, delivering the content materials by taking the learning preferences such as visual, auditory, and kinesthetic into account makes up a successful *process* differentiation. The process-oriented differentiation could be achieved by letting students explore the content in pairs, in small groups, or individually. The students should be given multiple options for taking in information and making sense of concepts to be learned. In the end of the learning process, students are expected to produce outcomes to evaluate their takeaway from the content. This *product* could be differentiated as well. These products could be in the form of tests, projects, reports, portfolio, performance assignments, concept maps, structured grids, self-evaluation, or peer evaluation.

Terwel views schools as places where the task of guiding students to learn to think for themselves and creating conditions for developing this "disciplined intelligence" as a habit of mind are emphasized. This of course necessitates different approaches to the function of the curriculum that emphasizes one fit for all. Thus, offering different curricula to different groups of students is becoming more and more common in modern education. In Germany and in many other European countries, students from the age of 10 are selected into different school types or streams according to ability and career perspectives. Streaming, tracking, and ability grouping are the most persistent issues in curriculum theory and practice [24]. Furthermore, in the context of gifted students, [25] identified four ways that the curriculum can be modified to address the needs of learners:

- Acceleration: adjusting the pace of learning
- Enrichment: allowing for more depth and exploration within the content area
- Sophistication: bringing more complexity and abstraction to the subject
- Novelty: providing for learning opportunities not generally included in the curriculum, often through self-directed, interest-based projects

5. Pedagogical design principles on classroom differentiation with tablets

Tablets could be a very practical way for differentiation in the classroom. Pedagogical implications relating to the tablets are that they can work on all content, process, and product differentiation phases. The apps that can be used on tablets are various, and this very nature of the tablets enables a diverse use in the classroom. Differentiation needs to be proactive and should allow many stakeholders in the process to be successful. Differentiation with tablets is student-centered in nature, and being aware of the many differences in the group could be considered a significant influencer in achieving inclusion of all students. Thus, differentiation entails quality rather than quantity. This is not a static concept but rather an organic, dynamic process.

The tablets could be used to differentiate the *content* by using a varied set of learning materials, such as various apps for various presentation types. It will also be wise to use materials that are meaningful for the students and are also reflecting authenticy. Student-generated content as learning materials for other students or classes could also help in varying the content and to break the course book domination. When *process* is taken into account, the teachers should approach the students with a coaching attitude and should support their students where needed. Moreover, peer teaching can also be part of the classroom as well as streaming, and different grouping techniques could be used variously. Teachers can vary the learning environment by changing places around the school as well as outside the classroom in real-life environments and even virtual environments. Students should be stimulated to assess themselves and their peers; the teachers should also give timely and concrete feedback to students and therefore integrate ICT tools as a solution. *Product* differentiation across the learning process could encompass the use of alternative assessment techniques in addition to traditional assessment techniques in order to adapt more to individual needs, changes, and differences. The products need to enable the students to use higher-level thinking skills. These can be made apparent by using transparent evaluation rubrics. The final products of the lessons should reflect students' different characters, needs, levels, and preferences, and the teachers should be prepared to allow for a variety and perform summative and formative assessments interchangeably. Teachers should take advantage of the available ICT tools for assessment as well. Teachers should be aware of differences between students based on special needs, gender, culture, linguistic preferences, strengths and weaknesses, confidence, self-awareness, and self-efficacy [21].

When tablets or other mobile devices are planned to be used for differentiation in the classroom, teachers should be aware that implementing those devices requires some considerations to be taken. The first of those could be the security of the devices; the use of mobile devices for differentiated learning should comply with the policies, legalities, guidelines, protocols, and structures that are aimed at protecting the health and well-being of both the learner and the teacher. Both the students and the teachers should be media and digital literate, and if they are not, they should be given previous training. In all levels, teachers should inform the parents and the school management and get permissions for profiles and other online accounts and shares. The teachers should provide secure online and digital environments. If a school decides to use tablets, a clear policy on privacy, security, and storing/deleting user content has to be ensured. A multi-platform approach should be adopted, and apps that function platform independently should be favored.

When apps are selected to be used, there has to be previous consideration on app availability and access; the choice of the right app for learning should be influenced by the differentiated needs of the learners. It is suggested to use the apps that work well

on all devices. Flexible approach to apps is also advisable as when an app is getting old-fashioned, teachers should consider a change. Initially free apps should be preferred, and if they do not meet the differentiation needs, paid apps can be selected as well. A group of teachers can come together to decide what the common educational needs are and adapt the apps that will be used. A "line of apps" could be an interesting approach in order to have alignment within a grade and across grades. The school can provide the tablets and the apps as well as BOYD approach. The Internet and Wi-Fi infrastructure should be reliable and robust. Students and teachers should take account of the restrictions associated with individual mobile devices such as screen size, memory to save apps, and outputs such as images and infrastructural limitations, e.g., bandwidth, availability of Wi-Fi, etc. There has to be clear statements about what student may and may not do with the tablet, during classes, but also in between classes [21].

6. Differentiation examples

The differentiation scenarios have been designed according to the deficiencies teachers who attended the 3-day TABLIO Project Bootcamp have observed in their classrooms, schools, and curriculum. The practical workshops included three full-day meetings with classroom, English, and mathematics teachers. The first meeting introduced the TABLIO Project concept map about the integration of tablets for differentiation. The second meeting was held a month later and required the teachers to work in groups and design their own lesson and action plans based on their needs and contexts. The last meeting that was held a month later was about reporting, evaluation, and reflection on their experience with their lesson plans. The differentiation scenarios which the classroom, English, and mathematics teachers have designed and organized during the TABLIO Project Bootcamp have been included in this section.

6.1 Differentiation examples for classroom teachers

6.1.1 Learning objectives

Topic: fractions

- The teacher shows the whole, half, and quarter with suitable models and explains the relationship between whole, half, and quarter.
- The students use fractional representations of all half and quarter models.
- The students identify simple, compound, and integer fractions and models.
- Students show the whole, half, and quarter with suitable models and explain the relationship between whole, half, and quarter.
- Students compare and sort the unit fractions.
- Students make adding and subtracting with fractions with equal denominators.

6.1.2 Student profiles

Grade 2, Grade 3, and Grade 4 students.
Group work will be done since there is no tablet in each class.

6.1.3 Process differentiation: learning activities

- An animation prepared with "Scratch" will be used in the teaching process.
- "Fraction for Kids" and "Simply Fractions 2" will be used as an activity. Both applications can work without an Internet connection.
- "Kahoot!" and "Learning Apps" applications will be used in the evaluation process.

Space adventure animation will be prepared with "Scratch" by coding. In the animation, two characters are going into space. There is a problem about the food. They have little bread and try to share the bread. In this process, the characters who use the concepts of full, half, and quarter will try to teach these concepts. At the same time, concepts such as equality and justice will be emphasized.

In the practice phase, Kahoot!, Plickers, and Learning Apps will be used to reinforce the concepts of full, half, and quarter.

During the evaluation process, a test created by the teacher on Kahoot! will be used to measure the learning outcomes. The teacher will make observations during the application and perform video recordings. The teacher will note down the important events and situations.

Applications that are going to be used during the application will be announced to the parents via WhatsApp, and the apps will be uploaded to the tablets in advance. Applications vary depending on the versions or brands of some tablets. It is important for the teacher to make checks before the class to avoid any problems during the course. During the teaching-learning process, videos that are uploaded to the "Padlet" will be monitored. Then, the link for the "Padlet" will be shared with the QR code. The animation that is prepared with Scratch will be watched in the class. "Dot Day" coloring page 2 will be used in the Quiver application (I say - you guess). The special information given in the videos will be repeated. Because of slow Internet speed, "Fractions for Kids" and "Plickers" (instant student evaluation) will be used for individual study. "Learning Apps" will be used as a group work in the classroom with the multi-connection tool. The game pins and extensions of "Kahoot!" and "Learning Apps" work will be announced to parents for use at home and to perform evaluation again. Students will be asked for a product like movie posters, etc. (any application that the students prefer can be used) during the evaluation process. The products that are delivered to the teacher will be shared on "ClassDojo" as an example to other students and parents. Each student will be asked to express his/her understanding. The goal here is not to prepare a homework but to learn in a fun way and self-realize themselves.

6.1.4 Content differentiation: teaching materials and educational technologies

- Technological devices: tablet
- Tablet applications:
  - Scratch
  - Fraction for Kids
  - Simply Fractions 2
  - Kahoot!
  - Learning Apps
  - Padlet
  - Plickers
  - Quiver
  - Inigma

6.1.5 Content differentiation: accessibility and availability

Applications (Fraction for Kids, Simply Fractions 2) are downloadable and executable to Android devices.

Fraction for Kids and Simply Fractions 2 applications are available without an Internet connection.

The course content produced with the Scratch application will be output as video.

Kahoot!, Flickers, and Learning Apps are applications that can be used on all devices because they are applications that are open on the web.

The applications are designed so that the elementary school students can easily adapt and use them.

6.1.6 Product differentiation: evaluation and progress control

Kahoot! will be used during the evaluation phase. The students' achievement as a group will be determined with the Kahoot!, and additional activities will be done with the groups that cannot reach the desired level.

Evaluation will also be done using videos and "Learning Apps." The videos will be used as a tool for the students to transfer their learning as individual homework.

6.2 Differentiation example for English teachers

6.2.1 Learning objectives

1. To increase the participation of students in speaking activities
2. Minimizing errors in pronunciation

3. To address the concerns of shy students in the field of speaking

4. To reach the synthesis step by using higher cognitive skills

5. Integrating existing knowledge into everyday life by speaking

6.2.2 Student profiles

Primary, secondary, and high school students. Not every student has a tablet. Therefore, group studies can be done. Each tablet has access to the Internet.

6.2.3 Process differentiation: learning activities

1. Brainstorming: students read the code with the QR code and connect to Menti.com as a group. As a group, they create a word cloud.

2. The following activities are used at different age and language levels:

    a. Students use the cards (color classification) to stand up and produce a sentence.

    b. Students are divided into groups by the group organizing application or ClassDojo.

    c. Students use QR code to connect to Padlet and color their sentences and write anonymous sentences without writing their names.

3. For the elementary-secondary school level, the "Toontastic 3D" and for high school level "Voki" are used to create the digital stories, and the students voice over their characters/avatars.

4. Students share their video products on "Padlet" page by linking with a "QR code reader."

5. Students should watch and comment on at least one video on "Padlet" (these can be evaluated as an instant feedback or homework according to the atmosphere of the class).

6. Assessment and evaluation of the content can be done by using "Plickers" application. 5 × 3 (true-false and multiple choice and visual use and question type) is prepared with five questions in three different areas.

7. Students are asked to use their favorite word in a sentence to express and illustrate how they feel on a Dot Day page by using "QuiverVision" app. The application also offers them the opportunity to record in their own voice; the students experience their products in a concrete way.

8. High school students complete the activity with the "Flipgrid" app. By using their favorite word in a sentence, they record their voice or video recording into the application.

9. Using the "QuiverVision" Dot Day app, students are expected to write a sentence using place prepositions and phrases and then visualize it. Then, the products are animated, and the students record their voice.

6.2.4 Content differentiation: teaching materials and educational technologies

- Worksheets
- Computer
- Projection
- Wi-Fi
- Smart board
- Tablet
- Tablet applications
  - QR code creator
  - QR code reader
  - Mentimeter
  - Padlet
  - Toontastic
  - Voki
  - Flipgrid
  - Quiver
  - Plickers
  - Wordwall
  - ClassDojo
  - VoiceTooner

6.2.5 Content differentiation: accessibility and availability

Applications are compatible with different operating systems (iOS and Android), and students can use them easily when they have Internet and tablets.

6.2.6 Product differentiation: evaluation and progress control

Applications created with "Toontastic" or "Voki" are shared in the classroom with the "Padlet" app, and students are allowed to comment and like. In this evaluation, it is aimed not to repeat the mechanical errors.

"Quiver" or "Flipgrid" can also be used for the evaluation phase.

Students can use "Toontastic" to produce a film of their own and to practice language more self-confidently.

6.3 Differentiation example for mathematics lesson

6.3.1 Learning objectives

- Students can understand that the integer fraction is the sum of a natural number and a simple fraction.
- Students can convert an integer fraction into a compound fraction and a compound fraction into an integer fraction.
- Students can make calculations of simplification and expansion on integer fractions and compound fractions.
- Students can perform addition and subtraction of fractions with or without equal denominators.

6.3.2 Student profiles

Differentiation scenarios were prepared for the 4th, 5th, and 6th grade students. Students are experiencing problems in Grades 5 and 6 because they cannot conceptualize the concept "full-half-quarter" that they learned in the Fractions Unit in the 4th Grade. Not every student has a tablet. Therefore, group work can be done. Each tablet has access to the Internet.

6.3.3 Process differentiation: learning activities

1. With the "Edpuzzle" program, students are given quizzes. Students watch a question-and-answer video, and students' quiz results are presented as a graphic.
2. Stories are combined in the "Storybird" editing program and turned into a book.
3. The mind map of differentiated education is created with the "Xmind" or "MindMeister" programs. Students create a concept map on fractions.
4. An activity is gamified and applied within the class.
5. An animation is created on "Morpho" program.
6. Course feedback is taken with the "Plickers" program.

7. Objects are shown in augmented reality via "Quiver" program.

8. Students draw a 3D object on the subject with the "GeoGebra" program.

9. The word cloud of the delivered lesson is prepared with "Tagul word cloud art creator" program.

10. Storyboard stories about the subject are prepared in the graphic design tool "Canva."

11. Stories are combined in the "Storybird" editing program and turned into a book.

12. The story is combined with the LEGO educational tools and turned into a cartoon with the "LEGO Stop Motion" program; thus it is conceptualized.

13. The story is improvised in the classroom. Students are videotaped. The captured video is turned into a film with the "Apple iMovie" program.

14. Virtual materials are prepared and animated with augmented reality application "HP Reveal," and interactive panels are created. Filmed video is prepared and recorded in HP Reveal application.

15. The augmented reality projects are saved as links with the "QR code reader" program. With "HP Reveal" projects and "QR code reader," a treasure hunt game is prepared, and the event is created, where students can play outside the classroom.

16. The subject of the lesson is animated with "Powtoon."

17. A "YouTube channel" is created. The story created with "Powtoon" is shared in the "Youtube channel."

18. Students watch the story shared on the "YouTube channel," and they are asked to draw conclusions from the video. In order to get the feedback about the story, students are asked to brainstorm in the "Padlet" program that is used to create the online virtual board.

19. To reinforce the subject, students are asked to prepare an online presentation on "Prezi."

20. Class evaluation is performed with "Kahoot!"

21. A quiz is given to students with the "Edpuzzle" program. Students watch a question-and-answer video, and students' quiz results are presented as a graphic.

22. A 3D code game is created on the Code Game Lab program developed by Microsoft. Students from different grade levels are asked to try the coding game related to the subject, and feedback is requested. A report of whether the desired goal has been reached is created.

23. A 3D animation about the subject is created on "SketchUp."

24. A site with Blogger is created. Applications that are learned and acquired information are shared.

25. A 3D design work is carried out on the subject with 3D modeling program "Tinkercad" application.

26. The 3D design project is printed from the 3D printer. 3D designs made within the school are offered for sale. The income of the projects sold is donated to the Spinal Cord Paralytics Association.

Each teacher selects one or more of the programs above on the basis of the subject and performs their applications in the classroom.

6.3.4 Content differentiation: teaching materials and educational technologies

- Technological devices: table, PC, and smartphone
- Tablet applications:
  - Xmind
  - Tagul
  - Morpho
  - Plickers
  - Quiver
  - GeoGebra
  - LEGO Stop Motion
  - iMove
  - HP Reveal
  - QR code reader
  - Powtoon
  - Padlet

- Prezi
- Kahoot!
- Edpuzzle
- Kodu Game Lab
- SketchUp
- Weebly
- Tinkercad

6.3.5 Content differentiation: accessibility and availability

The platforms to be used were chosen as teacher, student, and course oriented. Because each student has different interests, the applications are selected with "what kind of a lesson students want" point of view of and from among the ones that they will enjoy according to their age level. An enjoyable lesson should be considered as an efficient lesson. Platforms that can be used in future life and contribute to their individual lives have been selected.

6.3.6 Product differentiation: evaluation and progress control

Each teacher will make an assessment of how successful the learning of the subject is through the use of digital platforms, graphics, and feedback:

- The success of the lesson outcomes will be assessed by the questions and answers in the "Edpuzzle" program; the students' answers to the questions will be turned into graphs and charts.
- Students will be asked to take a working video for themselves and share them with their friends so that both subject gains and technology skills will be measured.
- The students are asked to form a group of 5 with their friends and to create a story about fractions and to visualize this story using the "Storybird" program. Stories are combined in the "Storybird" editing program and turned into a book. Thus, both the topic gains and the skills of using technology will be measured.

7. Conclusion

This chapter aims at bringing the use of tablets and classroom differentiation together. Recognizing students' needs and making use of the best resources to enable the students achieve the best they can for their society is the aim of the differentiated instruction. The integration of technologies into the classroom practice has become a mainstream approach in many educational contexts now, and making use of those new approaches for differentiation should add a depth to the activities. According to Hilton [26], both of the "educational technology integration models, SAMR and TPACK, provide important directions for ways that teachers can think specifically about how to integrate technology into their classrooms to maximize their use of resources and the learning possibilities of their students." In this respect, the learning process can be

enriched by differentiation and integrating technology into the classroom. The learning process could be differentiated in terms of content, process, and product by taking students' readiness, interest, and needs into account. Teachers who apply differentiated instruction should be aware of what kind of opportunities the mobile technologies like tablets could bring to their classrooms. The lesson design principles for successful integration of tablets for differentiation have been developed in the course of the TABLIO Project, and these principles have been presented to ICT, English, math, and class teachers from Turkish schools during a boot camp. Our experience has shown that using tablets in classrooms provides a useful implementation tool for differentiation. These teachers developed lesson plans and applications to differentiate their classrooms and reported beneficial results and comments from their students. They pointed out that differentiation via technology is able to meet the different needs of different students. They reported that technology degradation and tablets were useful tools for differentiation. However, they all agreed that a successful organization was needed to be able to include technology to the existing practice and curriculum. Integration of technology into education is one of the multiple paths to reach a learning goal that addresses students' learning styles, interests, needs, and readiness levels; thus, the teacher can engage all students in differentiated instruction that is appealing, developmentally appropriate, and motivational [27]. In fact, technology integration serves as differentiation globally for education and locally for the classroom.

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Differentiation Example 1 available from https://youtu.be/gwrb5AYfbRA
Differentiation Example 2 available from https://youtu.be/uri9FKe4r2w
Differentiation Example 3 available from https://youtu.be/W_MSZQqSap8
Differentiation Example 4 available from https://youtu.be/B5OIJ1xLlYU

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