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PLICKERS: DIFFERENTIATION IN REAL- TIME THROUGH FORMATIVE ASSESSMENT

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ABSTRACT

The purpose of this mixed methods study was to explore how Plickers, a technological tool used for formative assessment, affects preservice teachers' inclination to differentiate instruction in middle level classrooms. Data collected from a survey that included Likert scale and open-ended questions were analyzed using descriptive statistics and open-coding procedures. Findings indicated that Plickers enables preservice teachers to differentiate through content, specifically through scaffolding and levels of questions.

The National Forum to Accelerate Middle Grades Reform and Schools to Watch Focus: Academic Excellence

Preservice teachers who struggle with the implementation of differentiated instruction enter the field inadequately prepared to provide students with different avenues of learning that aid in increasing their comprehension of content. The inability to differentiate instruction becomes even more magnified for preservice teachers who are entering middle level education because intellectual development during young adolescence is individualized (Caskey & Anfara, 2014). Middle level learners experience a wide range of cognition that encompasses abstract, concrete, and metacognitive thinking; develop an interest in learning based upon content that is relevant, personal to them; and favor active learning in which they learn through peer interaction (Kellough & Kellough, 2008; NMSA, 2010, Scales, 2010).

Not only do preservice teachers at the middle level have to be concerned with the developmental stages of the middle level learner when considering the importance of differentiated instruction, but they also have to be concerned with the achievement gap as it applies to subgroups of their students. According to the National Assessment of Educational Progress (NAEP) (2017), eighth grade students who fit into different subgroups continue to score 50 points behind White students in both reading and math. The steady rate of the gaps in education at the middle level indicates a lack of leveled instruction for those students who are in the governmental subgroups. The lack of leveled instruction for these subgroups in some states translates to the state mandated end of the year test results. These test scores equate to accountability measures that to some extent indicate teacher efficacy. Seemingly, it is important for middle level preservice teachers to enter the profession with skills that enable them to differentiate instruction for the significant subgroups requiring evidence of academic progress.

Given the diverse learners at the middle level and the widening achievement gap, teachers have to be responsive in

their practices rather than employing a set of strategies that perpetuates a "one-size-fits all" approach to engage learners, especially those learners who are not functioning at grade level.

Research suggests that one such strategy, differentiated instruction, is designed to be responsive rather than sedentary. Tomlinson (2003) posits

Differentiated Instruction is responsive instruction. It occurs as teachers become increasingly proficient in understanding their students as individuals, increasingly comfortable with the meaning and structures of the disciplines they teach, and increasingly expert at teaching flexibly in order to match instruction to student need with the goal of maximizing the potential of each learner in a given area. (p. 3)

Thus, as teachers implement differentiated instruction as a responsive practice, it is imperative to find different methods to increase the responsive instructional strategy in order to increase academic achievement within middle level learners.

REVIEW OF THE LITERATURE: DIFFERENTIATED INSTRUCTION

Differentiated instruction (DI) is an instructional strategy that has come to the forefront for engaging students in learning at their ability level in heterogeneous classroom environments. Tomlinson (1999) states that DI gives students multiple options for comprehending taught material. More specifically, DI is defined as "attending to the learning needs of a particular student or small group of students rather than the more typical pattern of teaching the class as though all individuals in it were basically alike" (Tomlinson & Allan, 2000, p. 4). DI is also viewed as "...a philosophy of teaching purporting that students learn best when their teachers effectively address variance in students' readiness levels, interests, and learning profile preferences" (Tomlinson, 2005, p. 262). Recently, DI has been referred to as "responsive teaching"; Wormeli (2016)

stated:

Responsive teaching, i.e. differentiating instruction, is doing what's fair for students. It's a collection of best practices strategically employed to maximize students' learning at every turn, including giving them the tools to handle anything that is undifferentiated. It requires us to do different things for different students some, or a lot, of the time. It's whatever works to advance the student if the regular classroom approach doesn't meet students' needs. It's highly effective teaching.

Teachers are able to differentiate their instruction in four ways: content, process, product, and environment. The content refers to what teachers actually teach. In order to differentiate instruction, teachers adjust the content to the levels of learners who are in their classrooms. For example, a teacher who is teaching in a reading classroom with students who are functioning at a range of grade levels would need to teach the grade level standard; yet, they would also need to find reading content that is accessible to the different levels of learners. Some strategies for differentiating through content are levels of questions and scaffolding as the teacher can teach the same grade level standard to the class as a whole while adjusting the content level based on the ability levels of the students. Levels of questions and scaffolding lend themselves to the inclusion of prior learned knowledge and advanced knowledge within the same lesson.

Process is another way to differentiate instruction. DI through process is how the teacher teaches the content and how students learn the content (Levy, 2008). For instance, teachers can place students in groups based upon their ability levels, learning modalities, or learning styles. In placing a variety of students within a group, students learn to apply their skill set to the grade level standard as originally determined by their teachers. This type of differentiation lends itself to students learning through peer interaction, which is essentially Vygotskian (1978) in theory because students are encouraged to reach their zones of proximal development. Some strategies for differentiating through process are mixed ability and flexible grouping.

Product is another way to differentiate instruction. DI through product is measuring how students retain the knowledge they learned. Both formative and summative assessment are included in differentiation through product. Students are sometimes given a choice in which product they submit to demonstrate their knowledge based upon their skill sets. For example, reading teachers may have students who are performing at different proficiency levels such as advanced, proficient, and basic learners in their classrooms. In determining their comprehension of a novel read in class, the teacher may require the advanced students to write a script, the proficient students to write an essay, and the basic learners to create a poster. Student choice that allows them

to demonstrate their knowledge according to their interests or academic ability is differentiating through process.

Environment is the final way to differentiate instruction. DI through the environment is the climate of the classroom. Teachers who differentiate through the environment consider students physical and emotional needs while learning. For example, some students are kinesthetic learners. Creating a learning environment where non-kinesthetic learners understand and accept that some students are permitted to move while completing assignments is differentiation through the environment. Flexible seating within a classroom is also differentiating through the environment. For example, teachers who allow students to sit at the floor level, regular desk level, or standing height level during instructional time is also differentiation through environment. Thus, there are four ways that instruction is differentiated and understanding the intricacies of implementing strategies to differentiate instruction can be hard for a seasoned teacher let alone a preservice teacher.

Preservice teachers understand the theory and reasoning behind DI; however, they struggle with its implementation. Considering that some of them have limited experiences within classroom settings until they student teach, preservice teachers enter the field understanding that there are different levels of learners in terms of ability, but they forget to factor student characteristics such as special education, English language learners, and student interest when differentiating instruction. Chelsey and Jordan (2012) found that preservice teachers felt that they were not prepared to differentiate instruction once when they were placed for student teaching because they were unable to connect theory with practice due to the limited experience that they had in their courses. "The focus of differentiation in our college coursework was on high ability and low ability, there was never a focus on differentiation through formative assessments or student interests" (Chelsey & Jordan, 2012, p. 43). DiCicco, Cook, and Faulkner (2016) similarly found that the participants in their studies "felt a barrier was attempting to reach all the different types of learners in their classrooms" because they were not prepared to teach in a heterogeneous classroom in their teacher education program to the extent of the heterogeneity that is present in real world classrooms (p. 9).

While differentiated instruction has been adopted by large numbers of educators, it does, of course, have its antagonists as well as its advocates. In fact, there is an ongoing debate concerning the efficacy of differentiated instruction. One proponent, Subban (2006), performed a search procedure covering 25 years (1980-2005) of research on DI and cited numerous research studies supporting the use of differentiated instruction. Levy (2008), another a strong proponent of DI believes that "Through the use of differentiated instruction strategies, educators can meet the



needs of all students and help them to meet and exceed the established standards” (p. 161). Layton (2016) uncovered both pros and cons of differentiated instruction. She found that the benefits of implementing DI included children taught to their own learning styles; individualized learning plans; and flexibility of instruction.

However, Layton (2016) also found numerous sources critical of DI that state “Differentiated instruction, and its basis in learning styles has been cited as being unsubstantiated in any empirical fashion by multiple sources in educational research” and further that “There is no solid research or school evidence in support of DI” (p. 10). Finn (2014) suggested that differentiated classrooms may be nothing more than a hollow promise and challenges “proponents of differentiated instruction to supply evidence that this strategy is effective, particularly for educating children of high ability, versus approaches that entail separation, augmentation, or acceleration” (p. 19).

Despite this continuing debate, differentiated instruction has gone from buzzword to practice in little over a decade. As a result, a number of technology-based tools have emerged to assist educators with what can seem like an overwhelming task – that of implementing a differentiated learning strategy. One such educational technology tool, and the focus of this study, is a smartphone-based app called Plickers. The app’s name is very likely a portmanteau of picture + clickers. In this study, Preservice middle level teachers used Plickers to conduct pre- and post- assessments as a part of their practicum experience.

Then, in learning about differentiation, the preservice teachers were asked about their perceptions of Plickers as a tool for DI. Plickers was utilized as a concrete way to help preservice teachers learn about differentiation, and put theory and pedagogy into practice. Thus, this study was designed to help preservice teachers to maximize the learning experience of the middle level students in their practicum by using Plickers as DI tool. Tomlinson, Brimijoin, and Navaez (2008) suggest that educators should factor students’ individual learning styles and levels of readiness before designing lesson plans as a primary method of differentiating instruction.

PLICKERS

“Plickers is a powerfully simple tool that lets teachers collect real-time formative assessment data without the need for student devices” (Plickers website, 2018, p. 2). Perhaps, the most attractive feature of Plickers is that it only requires one smart device to record an entire classroom. So, “no matter what the financial situation of your students, or your school district, as long as you have one smart device available, you can instantly collect student input” (Lynette, 2015, p. 4). This app can be used with any grade level K-12 to post-secondary.

Teachers use the app to ask students questions, and students respond by displaying a card that has a QR code displayed on the front. Teachers scan the classroom as students turn their cards to the either the letter A, B, C, or D to answer. The Plickers app, installed on the smart device, scans the cards via the teacher’s smartphone camera, then; the app uploads the results to a computer in real time, which can be viewed, from the smartphone, the computer and whiteboard. Plickers can be used with multiple-choice or true/false questions, for polls/voting, quizzes, and more. Teachers can “use Plickers for quick checks for understanding to know whether your students are understanding big concepts and mastering key skills” (Plickers website, 2018, p. 4) and then tailor their instruction based on the real-time feedback they receive.

METHOD

The purpose of this mixed methods study was to explore how Plickers, a technological tool used for formative assessment, affects preservice teachers’ inclination to differentiate instruction.

The research questions explored were:

1. What are the perceptions of preservice teachers about the implementation of Plickers as a method for differentiating their instruction?
2. How does Plickers affect preservice teachers’ abilities to differentiate instruction?

A sequential explanatory mixed methods was used for this study because open-ended responses were used to explain the ratings on the Likert Scale on the survey (Creswell, 2007).

Site and Participants

This study took place at a university located in the Midwest United States. It is the second largest university located in its state by having an enrollment of a little over 26,000 students. Even though it is the second largest university within the state, it houses the largest college of education. Within the college of education, there are 103 students who were enrolled in the middle level education program. The students enrolled in the program must complete at least 45 hours in professional education courses. Those who are enrolled in middle level program must complete two courses dedicated to understanding the philosophy of and instructional strategies designed for middle level learners.

Participants included forty (n = 40) undergraduate and post-baccalaureate, preservice teachers who were enrolled in a middle school instructional strategies course taught by the principal investigator (PI). The PI maintained the role as instructor/observer for the study participants.

Procedure

After obtaining IRB approval, the PI introduced the study to all

potential participants during the middle school instructional strategies course during the fall 2017 or spring 2018 semesters. Sixty potential participants were given the option to complete the consent or assent forms and return them to the PI after the class period when the study was introduced. Once consent and assent forms were returned, the PI provided instructions and demonstrations for all preservice teachers enrolled in the class about how to use Plickers. The PI also designated direct instruction and in class activities to assist students in understanding differentiated instruction.

Each participant enrolled in the course completed a 30-hour practicum within middle school classrooms in the area surrounding the university. Differentiated instruction was essential to these schools because of the diverse population of learners with classes containing students who were above grade level, on grade level, and below grade level. During the 30-hour practicum, the PI observed the participants teaching one 55-minute lesson. The lesson presented had to demonstrate the implementation of differentiated instruction as a result of formative assessments. Differentiation through formative assessment was achieved in the lessons by engaging middle level learners with Plickers during pre- and post-assessment.

The PI scored each participant using a field observation rubric (Figure 1). Once it was determined that the participant engaged in differentiated instruction, a survey link to a voluntary, anonymous questionnaire hosted on Qualtrics™ was sent to the participants. Participants who responded to the survey provided their opinions about their experiences of using Plickers for pre- and post-assessment as a method to differentiate instruction.

Data Measurement & Analysis Survey

The survey consisted of four demographic questions, 16 Likert scale items, and seven open-ended questions. The demographic questions in the first section asked participants to identify their gender, enrollment status (undergraduate or post-baccalaureate), experience with using Plickers, and the content area in which they implemented Plickers.

The second section of the survey consisted of 16 Likert scale items. Participants were asked to indicate the degree to which Plickers helped them differentiate instruction to adjust their teaching methods for diverse learning needs, assess knowledge acquisition, determine learning style and modality, pace and scaffold instruction, and group students for maximum learning opportunity.

The last section of the survey consisted of seven open-ended questions. The questions were used to clarify the Likert scale items from the second section of the survey. The open-ended questions enabled participants to express their perceptions of using Plickers as a method for differentiated instruction

(See Table 1 for participant demographic information).

Qualitative analysis

Open-ended responses that were in the last phase of the survey were coded, manually, by the PI and the co-investigators (both of the co-investigators were faculty at the same university within the same department as the PI). The PI and two coders used inductive analysis to examine the responses independently by making initial marks on words/phrases deemed relevant to answering the research questions. Next, the researchers aggregated data under codes related to similar instances and formed categories (Stake, 1995).

After each researcher formed categories, they read the transcripts, again, independently to reconsider and collapse categories to form themes (Stake, 1995). Sifting through the collection of repetitive instances that occurred from the researchers' individual themes allowed for saturation points to be reached, and 10 final themes surfaced. Each theme helped explain the participants' perceptions of the implementation of Plickers as a method for differentiating their instruction.

Quantitative analysis

The data were analyzed using descriptive statistics that were collected using Qualtrics™. Frequencies for each of the responses that the participants recorded while taking the survey were displayed on a table (Table 2). The percentages from the frequencies are reported within the findings.

Limitations

As this research has the potential to affect education, particularly the ability of preservice teachers in relation to differentiating their instruction in order to increase students' academic achievement, it is limited in its sampling and scope which impacts generalizability. The sample size ($n = 40$) is relatively small, and the study was limited to middle school education majors. Furthermore, given that the PI was the instructor of the course, participants may have felt that it would be beneficial for them to speak positively about the experiences of using Plickers.

Finally, the data collected in the study focused on students' single use of Plickers within a classroom setting where they were being observed by the PI. This teaching experience was, quite possibly, the first time that any of the participants taught in an actual classroom where they planned the lesson. Because the participants are novice teachers, their perceptions might differ from those of experienced educators. Thus, subsequent studies would be necessary in order to determine how more experienced teachers perceived the implementation of Plickers in relation to differentiating instruction.



FINDINGS

The results from the study indicate that preservice teachers identified that even though there are some challenges with implementing Plickers as a tool within the middle level classroom, the application enabled them to differentiate their instruction in real time. The findings of this study address the following research questions:

1. What are the perceptions of preservice teachers about the implementation of Plickers as a method for differentiating their instruction?
2. How does Plickers affect preservice teachers' abilities to differentiate instruction?

Qualitative Analysis

The qualitative data collected in the study consisted of responses to open-ended questions. As survey responses were analyzed, they were coded, categorized, and themed independently by the researchers. When the researchers reached their independent themes, those themes were further compared to indicate repeated instances, and then, condensed to 10 final themes: Feedback, Assessment, Differentiated Instruction, Classroom Management, Technology, Engagement, Novice Teacher, Reflection, and Data Reporting.

Feedback

Analysis of the data revealed that participants believed Plickers provided immediate feedback in assessing students. The participants described the immediate feedback provided by Plickers' implementation as "amazing, quick, and automatic" that enabled them to see where their students were performing at the beginning and ending of class. They also noted that the feedback allowed them to "prepare for future lessons" because they knew where their students were with understanding the taught concepts before the class period ended.

Assessment

Participants reported Plickers as being a "positive" assessment tool that enabled them to see students' individual achievement, while they were also able to see how students scored in comparison to other students within the same class period, "I was able to compare [students] scores side by side to see the difference between pre- and post-assessment." Pre- and post-assessment was another aspect of the theme that participants highlighted, "I got to see what my students knew before the lesson versus what they could answer after the lesson."

Differentiated instruction

"As students completed Plicker, I noticed when students missed certain questions. So, when teaching the lesson, I spent more time on the questions that were missed by most of the students." Recognizing that Plickers allowed them to differentiate their instruction, participants noted, specifically,

that the tool is most conducive to differentiation through content,

Plickers enabled me to know from the beginning of the lesson the concepts students were most and least familiar with. I was able to change the content of my instruction in order to help students understand the concepts that they were least familiar with.

Because Plickers enabled participants to differentiate instruction through content, most participants identified scaffolding and levels of questions as the instructional methods that they employed during differentiation. In regard to scaffolding, one participant noted,

I was able to see when students were not understanding particular math problems, so that signaled me to incorporate more math problems for us to work together as a whole class. Working as a class allowed me to see the steps that students missed when we completed the problems. I scaffolded information for my students to better understand the concept.

In regard to levels of questions, participants noted that Plickers "allowed them to establish a baseline knowledge and adjust the levels of questions throughout the lesson."

Classroom management

Participants indicated that Plickers impacted classroom management. The tool was described as "difficult to use" if the classroom was rowdy, and depending on the grade level, students had a "difficult time adjusting" to participating or participating correctly in the activity because they were not mature with holding the QR cards. Also, participants noted that because feedback is captured and returned immediately, there was not much time to correct those students who just flashed any answer and decided not to participate.

Technology

Participants indicated that since Plickers was a technological application there were some issues with its implementation. Plickers collects student data through quick response (QR) cards. Participants noted a delay in collecting student responses due to the fact that the "cards were easily destroyed because they were not laminated." They also reported they felt the data they collected were skewed "as [they] scanned the room to get students' answers, [they] missed some of the responses because of the students have trouble holding their cards straight or their fingers covered the code for scanning."

Another issue with the technology was the number of participants who experienced no Wifi connections during some of the time that they were assessing students. Some participants reported that the Wifi connection "shut on and off during the middle of the pre-and post-assessments." In terms of connecting or launching the application, some of the

participants noted that Plickers “worked better in the Apple IOS platform.”

The last issue that the participants noted was their inability to make “corrections to,” “copy and paste to,” or “retrieve from” the question bank because of the infrastructure of the Plickers app. Participants reported that the app took too long “to make questions appear when they returned to the post-assessment.” As well, participants felt like Plickers limited the types of questions that they could use in assessment, “[Plicker] lends itself to asking multiple choice questions only because of the options that the app gives when formatting questions.”

Even though there were issues with Plickers, participants still indicated that “overall, the app was positive.” The positives noted about the app included “easiness of seeing how students answered questions,” “students liking to be assessed by something new,” and “the ability to use technology within the classroom if the school is not a one-to-one site.”

Engagement

Participants indicated that students in their classes were engaged when using Plickers. Many participants indicated that there was “full class participation” because “students liked that their answers were anonymous.” The students felt more “confident” and “began to compare their progress from the pre- and post-test, they took responsibility for themselves.” Participants also reported, “students felt like this was a game; they were excited and engaged to understand why they were not getting the correct answers.” Most importantly, “the students liked that using [Plicker] as a pre- assessment let them know what they would be doing for the rest of the class period; they were interested to learn what they would be completing for the day.”

Time consuming

Participants reported that using Plickers was time consuming. They agreed that the tool does have a place in the classroom, but Plickers could not be used frequently “because it takes too much time to set up and get students on task.” Participants also commented that the data that they collected using Plickers would take “too much time to analyze for it to be used effectively in the classroom.”

Novice teacher

Many of the participants noted that Plickers was of little use to them because “they already had a game plan before they came to class.” Similar statements helped the researchers to form the novice teacher theme. Some of the participants demonstrated their lack of understanding of assessment by noting, “their assessment did not change while using Plickers.” These participants already had it in their minds how they were going to assess students, so they were not open to exploring students’ understanding of the content as a result of the data collected from Plickers during the pre- assessment.

Reflection

Participants indicated that Plickers enabled them to reflect on their instructional practices as well as allow students to reflect upon their learning. Because students were “able to see their results immediately, we, as a class, were able to discuss in a whole-group setting the mistakes that students made during the same class period.” On the other hand, participants noted that they would choose other apps such as “Nearpod and Kahoot” or “project- based learning” to assess their students because other apps/assessments enabled them to use “open-ended questions and activities” for students to demonstrate learning.

Data Reporting

Participants reported that Plickers enabled them to interpret, use, and report data immediately. Plickers “was excellent for data collection because of the ability to register a baseline and have data for comparative analysis.” Not only did it “track accurate data,” but “the reports that it generated were helpful.” Participants liked the data that Plickers gathered because it helped them to know “if they conveyed the information in the lesson correctly based upon student growth after the post-assessment.”

Quantitative Analysis

As shown in Table 2, of the 38 valid responses out of the 40 participants who began the survey, 100% agreed that Plickers helped them pre-assess students while 92% thought Plickers helped them assess student readiness as means to adjust the lesson. 73% of the preservice teachers were able to assess during the lesson to help them gauge student’s understanding of the content. Only 10% agreed that Plickers is a tool that can determine student’s learning style during a lesson and 13% responded that Plickers can help them incorporate student interest into instruction.

In terms of instruction and differentiation, 65% agreed Plickers allowed them to pace their instruction based on learners’ needs. 71% agreed Plickers allowed them to group for activities based on readiness, interests, and learning preferences. 87% agreed Plickers enabled them to scaffold instruction; 70% agreed this tool helped them adjust lessons to meet the needs of diverse learners.

In terms of asking questions to middle school students, 89% of the preservice teachers agreed that Plickers was helpful in adjusting the level of questions and 92 % felt like it assisted them to pose questions at different levels based on Bloom’s Taxonomy.

DISCUSSION AND CONCLUSION

Plickers, a technological application used for assessment in the classroom, has the propensity to allow teachers to engage in differentiated instruction in real time. The results from both qualitative and quantitative analysis indicate



that the tool enables teachers to differentiate instruction in real time through content, specifically levels of questions and scaffolding. Participant responses suggested they were novice teachers as they blamed many of the issues that they experienced with Plickers as a malfunction with the application rather than not acknowledging their lack of preparation. Their responses indicate what Ertmer (1999) calls a “first barrier” to technological implementation within the classroom, “First-order barriers are extrinsic to teachers and include lack of access to hardware and software, time, and necessary support” (p. 19). Some of the themes that emerged about Plickers, classroom management, technology, and time consuming, were not barriers within the application; they were barriers because of the inexperience of the preservice teachers. Even though implementations can be overwhelming for teachers, inexperience in preparing for such measures can dampen teachers’ attitudes toward new instructional tools to be used within their classes.

Richardson (2003) found that teachers’ attitudes toward implementations drive their actions. The participants’ statements indicated their uncertainty and disbelief in Plickers. These attitudes caused them to indicate that Plickers could have been replaced by other technological tools with which they were comfortable.

In regard to the research questions, preservice teachers indicated that Plickers allowed them to differentiate instruction through content. It does not allow for all methods of differentiating instruction such as differentiating through learning styles and interest, but the application allows the instructor to make instructional changes based on the assessment in which the application engages the learner.

Plickers has a positive effect on preservice teachers’ abilities to differentiate instruction because the application makes them aware of the students’ learning level before instruction starts and after it ends. This awareness encouraged preservice teachers to alter some of their instruction to be responsive to the learning levels that Plickers depicted. This makes Plickers synonymous with Tomlinson (2003) definition of differentiated instruction because the preservice teachers indicated that they explored the efficiency in understanding their students in terms of individual learning needs as determined by their proficiency toward standards during pre- and post- assessments. Thus, Plickers enabled preservice teachers to engage in “maximizing the potential of each learner in given areas” (Tomlinson, 2003, p.3).

The findings of this study align with the middle school philosophy because of the manner in which Plickers enables teachers to differentiate their instruction. Plickers allows for teachers to differentiate through content. The participants noted that they were able to scaffold and incorporate levels of questions within their lessons because of Plickers.

Scaffolding and levels of questions are differentiated strategies that correlate with Sociocultural Theory (Vygotsky, 1978). Participants in this study were able to assess middle level students and determine their level of understanding. After determining their level of understanding, participants were able to revisit and incorporate knowledge from previous lessons/units in order to ensure that even the lowest level of middle level learners were engaging with the content. In the same vein, the participants, after assessment, determined the middle level students who were working at higher levels. This determination enabled participants to alter content to engage learners working on or above grade level. Plickers support enables middle level students to work within a social context to achieve desired learning targets through the facilitation of their teacher, thereby, helping them to expand their zones of proximal development (Vygotsky, 1978). Specifically, Plickers allowed for the “contingent” aspect of scaffolding because of the “moment-to-moment interaction between teacher and student” that allows for content to be altered based on learners’ needs (Hammond & Gibbons, 2005, p.23). Thus, Plickers is a viable and appropriate tool to help preservice and inservice teachers differentiate their instruction. The tool does not allow for all aspects of differentiated instruction to be implemented, but it does allow for the adjustment of content in real time.

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APPENDIX

Measurement Instrument Name: Middle School Field Observation Rubric

	Target- 4	Acceptable-3	Not Acceptable-1	N/A-
Learning Objectives/ Targets MTS- 1 AMLE- 2, 4 DPS- N/A CAEP-1.1, 1.4	<p>All of the objectives/ targets are challenging and developmentally appropriate.</p> <p>All of the learning objectives/targets are written at higher and lower levels of Bloom's Taxonomy while covering at least two different domains of Bloom's Domains of Learning.</p> <p>All of the learning objectives/targets are visible and stated in the beginning of lesson.</p>	<p>Most of the learning objectives/targets are challenging and developmentally appropriate.</p> <p>Most of the learning objectives/targets are written at higher and lower levels of Bloom's Taxonomy while covering at least two of the same domains of Bloom's Domains of Learning.</p> <p>Most of the learning objectives/targets are visible and stated in the beginning of lesson.</p>	<p>None of the learning objectives/targets are challenging and developmentally appropriate.</p> <p>None of the learning objectives/targets are written at higher levels of Bloom's Taxonomy.</p> <p>None of the learning objectives/targets are visible and stated in the beginning of lesson.</p>	<p>No Opportunity to Observe</p>
Content Knowledge MTS- 1 AMLE- 2, 4 DPS- N/A CAEP-1.1	<p>Candidate demonstrates content knowledge and academic language that is completely accurate and appropriate.</p>	<p>Candidate demonstrates content knowledge and academic language that is mostly accurate and appropriate.</p>	<p>Candidate demonstrates inaccurate or no content knowledge. Use of academic language is incorrect or not demonstrated.</p>	<p>No Opportunity to Observe</p>
Learner Engagement MTS- 2, 4 AMLE- 2, 4 DPS- N/A CAEP-1.1	<p>Candidate engages all learners within the lesson through multiple instructional strategies/methods while making multiple/ relevant real world connections to the content material.</p>	<p>Candidate engages most learners within the lesson through minimal use of different instructional strategies/methods while making some real world connections to the content material.</p>	<p>Candidate does not attempt to engage all learners within the lesson and does not make real world connections to the content material.</p>	<p>No Opportunity to Observe</p>
Assessment MTS- 7 AMLE- 4 DPS- N/A CAEP-1.1	<p>Candidate conducts formative assessment multiple times and uses results to drive the entire lesson.</p>	<p>Candidate conducts formative assessment once and uses results to drive part of the lesson.</p>	<p>Candidate does not conduct formative assessment.</p>	<p>No Opportunity to Observe</p>

Diverse Learners MTS- 5 AMLE- 2, 4 DPS- 3, 6	Candidate successfully differentiates the lesson based on all characteristics of classroom context to include identified Focus students.	Candidate successfully differentiates the lesson based on some characteristics of classroom context.	Candidate does not differentiate the lesson based on characteristics of classroom context.	No Opportunity to Observe
CAEP-	Candidate includes at least three elements of social justice learning theories or practices within the lesson.	Candidate includes at least two elements of social justice learning theories or practices within the lesson.	Candidate does not include elements of social justice learning theories or practices within the lesson.	
Lesson Alignment MTS- 1, 2 AMLE- 2, 4 DPS- N/A CAEP-1.1; 1.4	Candidate aligns the entire lesson to indicated framework within the written lesson plan.	Candidate aligns most of the lesson to indicated framework within the written lesson plan.	Candidate does not align the lesson to indicated framework within the written lesson plan.	No Opportunity to Observe
Classroom Management MTS- 5, 8 AMLE- DPS- CAEP-1.1	All the classroom management strategies the candidate demonstrates are effective.	Candidate demonstrates several effective classroom management strategies and a few ineffective classroom management strategies	Candidate demonstrates no effective classroom management strategies	No Opportunity to Observe
Technology MTS- 1 AMLE- 2, 4 DPS- N/A CAEP-1.4	Candidate use of technology is completely effective in creating meaningful learning experiences that meet student needs.	Candidate use of technology is mostly effective in creating meaningful learning experiences that meet student needs.	Candidate use of technology is ineffective and does not create meaningful learning experiences that meet student needs.	No Opportunity to Observe
Effective Feedback MTS- 6 AMLE- 5 DPS- N/A CAEP- 1.1	Candidate communicates effectively with students; provides clear feedback; and treats students with respect all of the time.	Candidate communicates effectively with students; provides clear feedback; and treats students with respect most of the time.	Candidate does not communicate with students; does not provide feedback; does not treat students with respect.	No Opportunity to Observe
Effective Use of Instructional Time MTS- 8 AMLE- 5 DPS- N/A CAEP 1.1	Candidate effectively utilized all of the instructional time.	Candidate effectively utilized most of the instructional time.	Candidate does not effectively utilize instructional time.	No Opportunity to Observe
TOTAL				

Figure 1. Field observation rubric to determine differentiated instruction implementation.



GENDER	
Male	N=7
Female	N=33
CLASSIFICATION	
Undergraduate	N=35
Post-Baccalaureate	N=5
PLICKERS EXPERIENCE	
Used Previously	N=9
Never Used	N=31
CONTENT AREA	
Math	N=21
Social Studies	N=9
ELA	N=6
Science	N=5

Table 1. *Summary of participants' demographic information*

The information obtained from using Plickers enables me to:	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Pre-assess students.	0	0	0	19	19
Pre-assess students' readiness in order to adjust my lesson.	0	1	2	23	11
Assess during the lesson to gauge students' understanding.	0	4	6	19	9
Assess at post lesson to determine knowledge acquisition.	0	3	0	18	17
Determine students' learning style and/or learning modality during the lesson.	2	12	14	9	1
Know students' interest and incorporate that interest into the instruction.	1	12	12	10	3
Understand students' life situations and how it may impact their learning.	5	15	9	7	1
Pace the instruction based on the individual learner needs.	1	4	8	17	7
Scaffold instruction.	0	2	3	21	12
Group students for learning activities based on readiness, interests, and/or learning preferences.	0	2	9	16	11
Adjust the levels of questions used during the lesson.	0	1	3	16	18
Post questions at the different levels of Bloom's Taxonomy.	0	0	3	16	18
Implement tasks that require students to apply and extend understanding.	0	5	12	14	7
Adjust for diverse learning needs.	1	4	6	18	9
Ask questions based on major concepts and generalizations.	0	0	5	18	15
Ask questions that would inform students of what they were supposed to know and be able to do by the end of the lesson.	0	0	3	14	21

Table 2. Summary of participants' responses to differentiated instruction



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