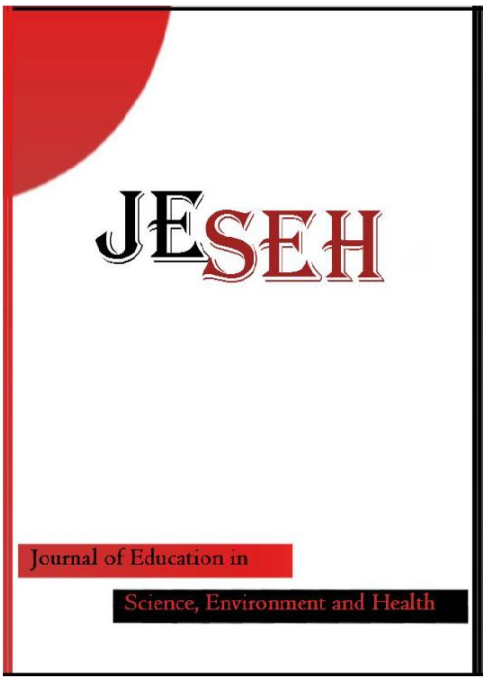

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Turkish Science Teacher Candidates Understandings of Equitable Assessment and Their Plans about It

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Abstract

This study aims to investigate how Turkish science teacher candidates understand equitable assessment and in what ways they plan to provide equitable assessment practices. 156 science teacher candidates from a teacher education program in a large university in Eastern part of Turkey participated in the current study. A questionnaire and semi-structured interviews served as data sources. All collected data were qualitatively analyzed to illustrate science teacher candidates' understandings of equitable assessment and their plans to achieve equitable assessment in their lessons. Results of the study showed that science teacher candidates mostly equated equitable assessment with fairness including fairness in grading. But most of the teacher candidates did not consider that providing equal opportunities for students to display their levels of understanding about the related concepts was not an important characteristic of equitable assessment. The results also showed that participants focused on differences in learning styles and language as reasons why to provide equitable assessment and accordingly stated some ways to achieve equality in assessment processes for these groups. While preparing teachers, teacher education programs need to emphasize more understanding of diversity and provide the knowledge and attitudes necessary for effective teaching.

Introduction

Today teachers need more to serve for all students than before because contemporary schools are different places than those schools where people attended a few decades ago. Recently almost all nations have experienced the influx of refugees, immigrants and migrants, which have changed the demographical structures of many schools and classrooms. In return, this presents challenges for teachers to understand the increased diversity in ethnics, linguistics, culture, religion and intellect which should be taken into consideration to provide effective instruction for all students. Researchers have illustrated that teaching science in equitable and contemporary ways is a complex and also difficult endeavor for teachers and even more difficult for prospective and beginner science teachers (Lawton, Philpott, & Furey, 2011; Mentz & Barrett, 2011). Therefore, as Linda Darling-Hammond has described, "teachers need a much deeper knowledge base about teaching for diverse learners than ever before and more highly developed diagnostic abilities to guide their decisions" (Darling-Hammond, 2006, p. 300).

Turkey is a multicultural country and students bring diverse cultural backgrounds into their classrooms. Turkey has seven different regions where diverse people having different cultures, native languages, religions etc. live together. These differences form a diverse student population for educational system of Turkey. Furthermore, by the influx of refugees, immigrants and migrants, the diversity of students has also been increasing at schools in Turkey as well. Particularly, the refugees and immigrants from different countries such as Syria, Iraq, Iran and Afghanistan require Turkish educational system to serve all students regardless of their cultural, linguistically, religious and ethnical backgrounds. According to the office of the United Nations High Commissioner for Refugees (UNHCR), more than 3.7 million refugees, out of whom 3.3 million are Syrian, live in Turkey according to numbers at the end of the 2017 and more than 50% of them are at school age. Thus, it is critical for Turkey to develop inclusive programs and also prepare teachers to meet the needs of these diverse groups of learners.

Teachers constitute a vital part of educational systems and are responsible for transferring planned educational programs into real classroom practices (Smith & Southerland, 2007). Thus, teachers' competences are important to meet the needs of diverse students too. Taking diversity of students into account during planning and

practicing the instruction is also highlighted by Ministry of National Education (MoNE) of Turkey and it is determined as a prerequisite for teachers according to "The General Qualifications of Teaching Profession" standards published by MoNE (MoNE, 2017). According to these standards, teachers are expected first to "Prepare a flexible instructional plan by considering individual differences and sociocultural characteristics of students." and second to "Design a learning environment by considering individual differences and needs of learners." (MoNE, 2017, p. 14) Thus, as it is required by MoNE (2017), it is important to prepare both in-service and teacher candidates for an effective teaching and assessing a diverse group of learners in Turkey.

Equitable instruction in science is crucial since learning science is dependent on cognitive and physical differences as well as other differences such as ethnicity, language and culture. Furthermore, these differences also influence how students engage in scientific practices, learn science and show their conceptual understandings (Fusco & Barton, 2001; Lyon, 2013; Siegel, 2007). One of the dilemmas which science teachers face in delivering equitable instruction is to uncover, assess and support diverse students' learning of science (Fusco & Barton, 2001; Lyon, 2017; Siegel, 2014). In order to assess and support diverse students' science learning, science teachers need to understand and use equitable assessment (EA) practices, and so, they can provide equal opportunities for all students in scientific practices. EA includes assessment practices in which students are given equal opportunities to show what they know and what they need to do to master their own learning (Hazel, Logan & Gallagher, 1997; Siegel, 2014; Suskie, 2000). It requires teachers to use most appropriate assessment forms in accordance with their students' characteristics such as their language and intellectual abilities, genders and cultures. In other words, each student should be considered as a special case and accordingly, her/his science learning should be supported through developing, applying and interpreting the assessment.

Formative assessment which is known as assessment for learning is important for science teachers to uncover, monitor and foster all students' science learning. Using EA practices in formative assessment process to collect data on students' learning and using these data to provide feedback and revising the lessons accordingly were proved to affect learning successes of all students in science (Fusco & Barton, 2001; Siegel, 2007; Siegel, 2014; Suskie, 2000). Beside of helping students to learn, EA behaves as a tool to reveal any inequalities which may occur during instruction in classrooms (Lyon, 2013); also, using EA is essential for minority students since they cannot otherwise be given any learning opportunity. Furthermore, teachers' beliefs about learning and learners influence their assessment decisions as well (Siegel, 2014).

Science teacher candidates in Turkey should be prepared to assess and support diverse student learning of science since they may teach such a diverse group of students in their professional lives. In order to make science teachers in EA practices to assess and help all students' learning, it is important for science teacher educators to provide that science teacher candidates (a) have a detailed knowledge and understanding of EA and (b) value and desire to engage EA practices to facilitate learning regardless of students' individual differences. In literature there is no study about science teachers' understandings or practices of EA in Turkey. Therefore, this study aims to investigate how Turkish science teacher candidates understand EA and in what ways they plan to provide EA practices for their students.

Conceptual Framework

The current study is constructed upon three key assumptions. First, learning is a socially-constructed and culturally-mediated activity and together with cognitive or physical differences, learning also depends upon other factors such as age, gender, language, social class, ethnicity and disability (Lawton et al., 2011; Mentz & Barrett, 2011). For that reason, since the demographical structures of many schools and classrooms are changed under influence of globalization, we should handle the problems of fairness and equality from a larger point of view.

Second, teachers' knowledge and beliefs are essential in effective learning, teaching and assessment practices (Scott & Weber, 2014; Tierney, Simon & Charland, 2011). Especially, teachers' knowledge and beliefs about diverse learners are crucial for accomplishing equality during instruction and assessment (Siegel, 2014). In order for science teachers to equitably assess and support student learning, they should know not only about EA but also about the differences among learners as well (Lee, 2001). Teachers' beliefs about diversity influence their practices (Siegel, 2014) and teachers who think that providing language, culture and learning opportunities during teaching process is not their responsibility do not tend to use EA to achieve equality (Lee, Luykx, Buxton & Shaver, 2007). Furthermore, teachers' beliefs about learning and learners also influence their assessment decisions (Siegel, 2014).

Third, teachers' knowledge, skills and their usage of EA strategies are important. Teachers should have knowledge and skills to design/choose and implement EA to facilitate diverse students' learning. Designing and using EA requires teachers to have the target science concepts and be aware of the learner differences such as culture and language and be open to them (Darling-Hammond, 2006). Teachers should also know how to modify an assessment for minority students and what kind of accommodations they should do and how they will equitably assess and support their students' learning through these accommodations (Abedi, Hofstetter & Lord, 2004). However, this is more difficult for teacher candidates because of their lack of classroom experiences (Siegel, 2014). For teachers, providing accommodations for some students endanger fairness because these accommodations make assessment task easier for them. EA is not just about fairness, however, it is about providing equal opportunities for all learners to participate in learning process and show that they are learning. Therefore, EA strategies should not just ensure fairness but they must be challenging and supportive to learning as well (Siegel, 2007; Siegel, 2014).

According to the three key assumptions underlying the current study, this study aims to investigate Turkish science teacher candidates' understandings of EA through the following research questions;

1. How do science teacher candidates understand EA?
    a. How do participants view EA?
    b. Why is EA important for the participants?
    c. What factors influence EA according to the participants think?
2. How do science teacher candidates plan to achieve EA?

Methods

This study is qualitative in nature and uses case study design to investigate how science teacher candidates understand EA and plan to provide EA opportunities for students. Case studies have a clear advantage over other research designs because "the strategy employed is to investigate 'how' or 'why' questions asked about a contemporary set of events over which the researcher has no control" (Yin, 2009, p. 9). The study also contains multiple data sources, which researchers have identified as the unique power of the case study research design (Yin, 2009). While many studies focus on how science teachers provide EA opportunities to their language and cultural minority students (e.g., Lyon, 2013; Lyon, 2017; Siegel, 2014), this study aims to use a general perspective of equality to understand how science teacher candidates understand EA and plan to provide EA practices.

Participants

One hundred fifty six science teacher candidates studying in a teacher education program of a public university in the Eastern part of Turkey participated in the first phase of the current study. These participants were at their third and fourth year in their four-year teacher-training program. We wanted our participants to have some essential knowledge about educational assessment in order to provide rich data sources for the study. For that reason, we chose junior and senior teacher candidates since 'Educational Measurement and Assessment' course in the program was provided during the first semester of third year. Therefore, the participating teacher candidates completed their 'Educational Measurement and Assessment' course before attending to the current study. 88 junior and 68 senior teacher candidates, 80 of whom were male and 76 were female, were the participants of the study. Twelve participants, six from juniors and six from seniors, were selected for the second phase of the study to conduct interviews. Codes such as P-1 (participant-1) and P-2 were used to illustrate participants' opinions according to their responses for interview questions.

Data Sources

The current study was a part of a larger study that aimed to investigate science teacher candidates' assessment literacy. For the current study, there were two main data sources. The first, a questionnaire with ten items related to EA was used to collect data on participants' understandings of EA. The questionnaire had a six-point Likert type scale to let participants show their opinion on a completely disagree (1) to completely agree (6) line. As the questionnaire did not use any negative items, the higher average from the questionnaire meant the participants gave a higher importance to EA. All of the 156 participants completed the questionnaire. The items used in the

questionnaire are given within the tables in the result section to show participants' opinions for the importance of EA.

After all the 156 participants completed the questionnaire, 12 participants, six from juniors and six from seniors, were selected according to Teacher Conceptions of Assessment Scale survey that they completed for a larger study (Brown, 2008). The survey was developed by Brown (2008) and was used to explore teacher candidates' conceptions of classroom assessment for the larger study. Based on the participants' survey results, four high, four medium and four low scored teacher candidates were selected for interviews to increase representation ability of the group. During the interview process, we used semi-structured interview questions to understand how teacher candidates understood EA deeply and in what ways they planned to provide EA practices for their students. Each of these interviews took approximately 20 minutes. As it is shown at Appendix 1, the interview questions aimed to investigate teacher candidates' ideas and understanding of EA and their plans for EA through focusing on individual differences of learners.

Data Analysis

Data from the questionnaire were analyzed to have a general picture of all participating teacher candidates about their understandings of EA. To achieve this, we used descriptive tables in the result section to show the averages and percentages for each item according to the participants' responses to six-point likert scale within the questionnaire. Data from the twelve participants' interviews were analyzed to investigate participants' understandings of EA and the ways they planned to provide EA. We used inductive coding rather than deductive coding to develop themes that explained participants' understandings of EA (Hatch, 2002). First, open coding was used by recording data on a spreadsheet during the analysis for each participant's interview to develop categories. Second, categories were analyzed to group similar categories under a more general category for each participant. Then, the categories were compared and contrasted to see common themes that explained the patterns of participants' thinking of EA. Later, we categorized the themes according to research questions to design the findings. For instance, we coded the first interview participant's definition of EA as using assessment to provide fair grades since the participant stated, 'For me, EA is to provide ways for a student to show what exactly s/he knows to provide fair grades.' Then, we combined the participant's other statements that focused on fair grading such as 'I think teachers need to observe their students well to provide fair grades.' to develop a general category that we named as fairness in grading. Then, by comparing and contrasting similar codes that focused on fair grading from other interview participants, we used fairness in grading as a common theme that represented the participants' views of EA.

To increase the reliability of interpretation of data, we used 'investigator triangulation' (Patton, 2015) in which more than one researcher interpreted a subset of the data to accomplish agreement of themes' development. We also used notes to show number of participants who supported the same category. Participants' responses to interview questions can be found in result section.

Results

We frame the findings of the study in accordance with the themes about teacher candidates' understandings of EA. The findings are presented according to related research questions. For each theme, we first used tables to represent the results of the related items from the questionnaire and then, we provided data from participants' interviews to support each of the themes.

Views and Importance of Equitable Assessment (RQ 1a, b)

In order to understand teacher candidates' ideas about why an assessment had to be equitable, three items were used in questionnaire (see Table 1) to illustrate participants' views of EA. The first item was related to the role of assessment in supporting all students to engage them in learning. The item aimed to uncover to what extend the participants agreed on the importance of providing equal assessment to support all students' participations in learning process. As it can be seen from Table 1, the results show that about 80% of participating teacher candidates (based on the combination scores of 4, 5, and 6) think assessments should be equitable since assessment is a way to engage all students in learning. The second item in the questionnaire was about the influence of assessment on students' motivation, self-efficacy and decisions about what to learn. This item revealed what participants thought about the importance of EA regarding its influences on students. According

to the results most of the participants (84%) believed that assessment should have been equitable since it influenced students' motivation, self-efficacy and decisions about what to learn. Use of assessment to inform all students about important learning goals was the third item in the questionnaire. The implication of the item was that all students needed to be informed about learning goals through assessment; therefore, assessment should have been equitable for all students. Similarly, most of the participants (74.9%) approved this idea as a reason for EA.

Table 1. Participants' thinking about importance of EA

Views of EA (N: 156)	(1) Completely Disagree		(2)		(3)		(4)		(5)		(6) Completely Agree		Average ($\overline{X}$)
Questionnaire İtems	N	%	N	%	N	%	N	%	N	%	N	%	
Classroom assessment should be equitable because:													
Assessing students' scientific thinking and reasoning allow all students to engage in an effective science learning environment.	9	5.8	7	4.5	15	9.6	35	22.4	50	32.1	40	25.6	4.46
Classroom assessment influences all students' motivation, self-efficacy and decisions about what are important to learn.	8	5.1	5	3.2	12	7.7	34	21.8	51	32.7	46	29.5	4.61
Classroom assessment should inform all students about important learning goals.	11	7.1	9	5.8	19	12.2	32	20.5	34	21.8	51	32.7	4.41

Contrary to the results of the questionnaire, the results of interviews showed that the participants either did not have any idea about EA or they associated EA with fair assessments and fair grading practices rather than providing equal opportunities to engage all students in learning process to show their learning. For instance, some of the participants reported for EA that 'I do not have any idea' (P-2) or 'I have never thought about this before' (P-9). Many of the participants (P-1, 4, 7, 8, 10 and 11) also reported a vague understanding of EA or they often linked EA with fairness. Even if the participants were aware of the differences among learners and highlighted the importance of considering these differences during assessment processes, they tended to relate them with fair grading. For example, one of the participants highlighted the role of EA in providing fairness in grading as she reported;

> For me, EA should provide ways for a student to show what exactly s/he knows to have fair grades. However, we know each student has different abilities and speed of learning, and so teachers should observe their students very well to decide what types of assessments are appropriate for their students to show their real learning. I think, in this way, grades are being fairer.' (P-1)

One of other participants also underlined using appropriate assessment to provide fair grades as an aim of EA since, as he indicates, 'Making a fish to walk on a land and making it to swim in water are not same and not fair. So, students also should be provided proper forms of assessments to show their knowledge and abilities.' (P-3) Some of the participants (P-5, 7, 11) also linked EA with content validity by explaining the importance of asking questions from different cognitive levels and in all covered units. For instance, one of the participants emphasized, '…to be fair, teachers should ask questions from all covered units rather than some of them. Plus, an EA includes questions from all levels of difficulty because asking all easy or hard questions do not show students' real success.' (P-5) A few of the participants (P-7, 8, 9, 12) interpreted EA according to student-teacher relationships. For these participants', EA is related with teachers' fairness in grading students' works as one of them states, 'Teachers need to behave fair to all of their students. A teacher may like or dislike one of his students and this should not be a bias to give her/him an unfair grade.' (P-7) Similarly, one of the participants indicated, 'Teachers should disregard their personal opinions about a student and provide fair grades based on what s/he provided on her/his exam paper.' (P-9)

In summary, the results of the questionnaire showed that the participants mostly supported the idea that assessment should be equal for all students to show their own learning and it should equitably let students to access science content. The results of their interviews, on the contrary, displayed that participants generally understood EA as to provide fairness on letting students to show their real learning and in grading.

Factors Influencing EA (RQ 1c)

One of the enquiries in this study was to reveal the factors that the teachers believed which influenced students to demonstrate their learning during assessment process. For this purpose, we provided two different items in the questionnaire (see Table 2). First item was about the assumption that it was important to consider how it supported an individual student or groups of students since the assessment might provide inequalities for some students as a result of its nature during development of an assessment task.

According to the results, most of the participants (83.3%) favored the idea that the usage of an assessment with individual or groups of students influenced equality. The second item within the questionnaire was about the influences of students' languages, cultures, learning styles and other differences on their understandings and demonstrations of their learning on assessment tasks. The responses of the participants illustrated that more than three fourths of the participants (81.3%) supported the idea that students' individual differences influenced their engagement in assessment processes to show their own learning.

On the other hand, according to the results of participants' interviews, participants just focused on the differences on students' learning styles and languages. During the interviews no participant mentioned about nature of assessment tasks and differences in students' culture, age, gender, ethnicity, ability, socio-economic situations and disabilities as sources for inequitable assessment practices. Most of the participants reported that language differences affected students' performances on assessments. For example, P-6 stated, 'Being assessed in a language other than native language reduces students' understanding and getting low grades on assessment makes them lose their self-confidence.' Likewise, according to P-3 '…being assessed in another language requires students to spend more time to understand and respond to assessments and this generates disadvantages for them.' Besides, participants generally mentioned differences of learning styles as a source of inequality during the process of assessment. For that reason, all of them supported the usage of various assessment methods to make all students show their learning. For example P-3 stated that;

> I think we need to use different methods to assess our students since students are not robots and they have differences. Thus, I plan to use different assessment items in an exam such as multiple-choice, fill-in-the blank, true-false and open ended questions.

Table 2. Participants' ideas about factors influencing equality

Views of EA (N: 156)	**(1) Completely Disagree**		**(2)**		**(3)**		**(4)**		**(5)**		**(6) Completely Agree**		**Average ($\overline{X}$)**
Questionnaire Items	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	
In order to equitably assess student learning:													
While developing assessments, how and in what ways they support individual or groups of students should be considered.	4	2.6	6	3.8	16	10.3	25	16.0	29	18.6	76	48.7	4.90
In assessing student learning, students' cultural (regional) differences, language abilities, learning styles and other differences must be taken into consideration.	11	7.1	7	4.5	11	7.1	26	16.7	29	18.6	72	46.2	4.73

Participants' Plans to Accomplish EA (RQ 2)

In order to investigate the ways the participants thought to be successful in EA, we provided five items in our questionnaire (see Table 3). The first item focused on the similarities of assessments used during instruction and assessment processes because students feel comfortable in showing their learning on assessments especially with familiar ones. The results showed that more than 80% of the participants (82.7%) agreed on providing familiar assessments to accomplish equality. Informing students about the criteria to evaluate their assessment results formed the second item in the questionnaire. The results of the questionnaire also showed that 80.8 % participants approved informing students about the standards that they would be assessed to achieve EA. The third item emphasized the capability of an assessment to reveal students' learning in different forms including written, verbal, auditory and reading skills as indicators for EA. Based on the results, more than four fifths of the participants (86.6%) supported the idea of revealing student learning at different forms to attain EA. Utilizing different assessment methods formed our fourth item in the section. The results showed that most participants (87.8%) stuck with the idea of providing a variety of assessments to achieve EA and more than half of them (59.6%) completely supported it. The last item was related to the ways of providing EA such as usage of accommodations including visuals and basic sentences for language minorities (LM). When we look at the Table 3, it is seen that majority of the participants (85.9%) share the idea of using accommodations to provide EA.

Table 3. Participants' ways to accomplish EA

Views of EA (N: 156)	**(1) Completely Disagree**		**(2)**		**(3)**		**(4)**		**(5)**		**(6) Completely Agree**		**Average ($\overline{X}$)**
Questionnaire İtems	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	
In order classroom assessment to be equitable:													
Assessment strategies used to assess student learning should be similar to those that used during classroom instruction.	5	3.2	8	5.1	14	9.0	33	21.2	43	27.6	53	34.0	4.66
Students should be informed about the criteria that they will be assessed before the assessment process start.	6	3.8	8	5.1	16	10.3	40	25.6	32	20.5	54	34.6	4.57
Assessment process should reveal both students' written and verbal as well as auditory and reading skills.	6	3.8	3	1.9	12	7.7	24	15.4	36	23.1	75	48.1	4.95
While teachers assessing student learning, they should use a variety of assessment methods.	7	4.5	4	2.6	8	5.1	16	10.3	28	17.9	93	59.6	5.13
While students are assessed, teachers should provide accommodations such as pictures, graphs, basic words and dictionaries for the students, whose language proficiency are not so good.	6	3.8	5	3.2	11	7.1	15	9.6	29	18.6	90	57.7	5.08

Participants' interviews mostly supported the results of the questionnaire in terms of their thinking to achieve EA. Also, as it could be seen at Table 4, interview participants offered additional ways such as making students to work with their friends and parents (25%); improving students' language skills (58.3%); providing assessments in students' native language (33.3%); and providing deserved grades (33.3%). However, while participants provided the ways to achieve EA, they generally centered only upon LMs and students' learning styles to provide equality and did not think about other underrepresented groups (e.g., culture, socio-economic situation). For example, some participants (P-1 and P-3) believed that as students learned differently, they showed their learning in different ways. Therefore, 'Teachers should observe their students very well in order to decide what types of assessment their students need to show their own learning.' (P-1) All of the interview participants reported that teachers should have used multiple assessments in order to fairly assess what their students really understood to give fair grades. For example, P-4 stated;

> Using multiple assessments help me to see the levels of my students' understanding, at which content they are good and at which content they are not good. Thus, I use different assessments such as multiple-choice and open-ended questions, projects and performance-based assessments.

Similarly, one of the participants indicated '... in order to assess real learning, I would not just use a multiple-choice test to assess, I would use different types of questions including open-ended and fill in the blanks.' (P-1) However, some participants (P-7, P-10 and P-11) indicated that using one assessment task to assess all students' learning seemed fair since it was hard to use different assessment for each student because of limited time. For instance, P-11 explained, 'Usage of one assessment to assess all students' learning is fair since all students take same exam and provide their response based on their knowledge.' Besides, another participant, P-7, indicated;
In general, I think usage of one assessment to assess students' learning is fair even if students have differences. You cannot provide different assessment for each individual student and you should choose one of the most proper strategies to use and in my opinion, this is fair.

Table 4. Ways interviewed participants think to achieve EA

Ways to achieve EA	Percent of responses (%)
Using various assessment strategies (including hands-on activities, lab experiments, projects, observation, visuals and oral exams)	100
Improving LMs' language abilities	58.3
Using basic words and daily life language for LM	50
Providing assessments in LMs' native languages	33.3
Learning LMs' native language	33.3
Giving grades based on what students' deserved	33.3
Letting LMs to use dictionary during assessments	25
Providing extra time for LMs to complete assessments	25
Motivating LMs to work with friends and parents	25

In addition, the participants mostly considered LMs as underrepresented groups and they claimed improving language ability of LMs was a way to achieve EA. For example, one of the participants stressed that LMs should have improved their language abilities since 'they do not just compete with their friends in classroom, they also compete with other students nationally as well.' (P-3) Likewise, P-6 reported that 'Even if improving language skills of LMs is in the responsibility of language teachers, I would teach LMs meaning of essential terms to be successful in my lesson.' One of the common themes emerged from the results was the usage of visuals and hands-on activities to assess LMs' learning (67%). P-1 stated, 'Most probably if we used hands-on assessments, LMs can understand since they are visual.' One of the participants also indicated, 'Using more visuals and lab activities can be useful for LMs since our field (science) is appropriate for this. Besides, language is not a limitation for LMs in this way.' (P-5) Another way to achieve EA for the participants was to use short and familiar words and sentences during instruction and assessment. In order to decrease the influence of language on LMs' learning P-4 indicated that 'I avoid using complex sentences and terms during my instruction and assessment and try to use daily life Turkish rather than rarely used words.' One of the other participants also stated, 'It will be difficult for LMs to understand long paragraphs and complex sentences so I can shorten and simplify them and avoid using terms.' (P-8) Other participants offered scaffolding of language as a way and stated, 'If you used a high level Turkish, it will be hard for LMs to understand so we need to express our ideas at a simple level by using clear sentences, avoiding to combine ideas and providing subtitles.' (P-3) On the contrary, some participants (P-6, 7, 11) did not agree to make changes on assessments for minorities because using adjustments on assessment for minorities decreases cognitive level of assessment and makes assessment easy for other students. P-7 indicated, 'For minorities, I do not think to modify assessment task to assess them because it causes undesired situations within classroom as you need to apply the modified task to all students.' Following of the comments of P-7, we asked him to explain the undesired situations he indicated. Then, he stated, 'For instance, you simplify language of a task and this task may help LMs but for native Turkish students, this task does not reveal higher level learning since it seems easy for them.' Similarly, P-6 stated, 'Giving extra time for LMs does not seem reasonable to me since it endangers fairness.'

Discussion and Conclusion

There are serious discrepancies and gaps in terms of educational opportunities and outcomes in schools of many countries and some of them have much more inequalities than others (Carnoy & Rothstein, 2013). These include

students' academic achievement, skills and other aspects of learning which should be improved through schooling (Duncan & Murnane, 2014). These gaps in learning of diverse learners are critical problems in many countries while the scope and forms of the problem vary from country to country. Thus, it is important to find ways to close these gaps and one of these ways is to provide equitable instruction with EA practices. Successful practices of equitable instruction and EA mainly depend on how teachers understand and apply these practices since teachers are responsible for the transition of an instructional practice into classrooms (Smith & Southerland, 2007). That is to say, preparing science teachers to apply equitable instruction and assessment practices is critical for promoting science learning of all students regardless of their backgrounds such as ethnicity and culture. Nowadays, this is more critical for Turkish science teachers because the diversity of students in Turkey has been growing rapidly. Thus, Turkish teachers including science teachers need to be ready to provide EA practices to support all their students' learning if they want to fulfill their responsibility towards their students. Furthermore, in order to effectively teach and assess science for diverse groups of students, we, as teacher educators, must provide teacher candidates with the knowledge and beliefs about diverse learners, with knowledge and beliefs about EA, and with skills and confidence in providing and modifying assessments for diverse learners.

This study investigated Turkish science teacher candidates' understanding of EA and their plans for EA and tried to find out whether they were ready to fulfill the responsibility. The results of the participants' surveys showed that the science teacher candidates mostly supported the idea of providing equal opportunities to make all students participate in learning process and to show their own learning while their interview results showed that some of the participants did not have any idea of EA and others associated EA with fairness including fairness in grading and fairness in student-teacher relationship. The results of their survey also showed that the participants considered the individual differences including age, culture, ethnicity, gender, ability, learning styles, language, socio-economic situations and disabilities as reasons to provide EA while their interview results pointed out that participants mostly focused on learning styles and language differences as sources for providing EA. Moreover, participants provided different ways such as providing diverse assessments and accommodations for LMs to achieve EA. We believe that the differences between participants` survey and interview results arise from the unfamiliarity of EA for them and as a result they supported the ideas provided within the survey while they could not provide a rich explanation for EA during their interviews.

Teachers' understandings and their perceptions are influential factors for their various instructional practices, about how they plan to incorporate the diverse backgrounds of students in their lessons, about how to elicit and improve their learning and about which ways should be used to meet the needs of their diverse students (Blachard & Muller, 2015; Siegel, 2014). The reasons of teachers' negative perceptions regarding students with diverse backgrounds can be that they do not see meeting the students' needs as their responsibilities (Cheathan, Jimenez-Silva, Wodrich, & Kasai, 2013). Because of the negative perceptions, teachers may not also make any effort to understand their students' backgrounds or find ways to meet their needs. This, in turn, affects their decisions about their instruction and students' learning (Cheathan et al., 2013; Wong, Indiatsi, & Wong, 2015). Thus, it is important for teachers to know their students' backgrounds and take these backgrounds into consideration during their instructional decisions to meet students' needs to enhance their learning. The results of participants' surveys showed that they recognized the individual differences such as age, culture, ethnicity, gender, ability, learning styles, language, socio-economic situations and disabilities for reasons to provide EA. However, their interview results showed that they only identified learning styles and language differences as the main reasons to provide EA and accordingly, they provided detailed information about how to address differences in learning styles and language during assessment process to achieve equality. Similarly, the results of Siegel's (2014) and Lyon's (2013) studies showed that science teacher candidates' focused on learning styles and language as individual differences in their studies when they explained benefits of EA. Yet, it is important for teachers to consider a larger views of student diversity because students convey diverse cultures (including language, gender, ethnicity, socioeconomic status), epistemologies (including learning styles and views) and experiences to classrooms that affect how they interpret and learn science content and how they show their understandings of science concepts (Solano-Flores, & Nelson-Barber, 2001). Thus, teachers need to know and understand the individual differences broadly and consider them to provide equal contexts for their students to reach a high quality learning of science and engage in it. In this way, teachers can handle students' individual differences by (a) providing instruction and assessment within culturally, epistemologically, and cognitively meaningful contexts, (b) letting students work on appropriate tasks to reach rigorous science content and (c) using culturally and cognitively sensitive assessments to learn about students' weaknesses and strengths to modify instruction and help all students' learning (Abedi, Hofstetter, & Lord, 2004; Lyon, 2013; Siegel, 2014).

Teachers' understandings and beliefs of EA are important because they shape teachers' instructional and assessment practices to meet the needs of diverse learners (Abell & Siegel, 2011; Siegel, 2014; Siegel et al.,

2014). EA is not just a way to measure students' learning fairly, but more importantly, it is a way to reduce biases to support all students' learning (Siegel, 2014). According to the results of the study, while the survey results showed the science teacher candidates agreed on the importance of equally engaging all students in learning and the importance of assessment processes to show their own learning, the interviews showed that teacher candidates mostly perceived EA as a way to provide fair grades rather than providing ways to make students equally access and participate in learning processes to enhance their learning. This is aligned with what Siegel (2014) has found in her study that science teacher candidates mostly equate EA with fairness if method courses do not focus on EA purposefully. Providing fairness in grading is critical, however, it is more important for teachers to comprehend EA as a way to make all students equally participate in a learning context to learn and display their own learning (Abell & Siegel, 2011; Siegel, 2014). Thus first, a more sophisticated understanding of EA requires teachers to view diversity as an opportunity to understand each student's culture and identity which underpin each action of the student; second, it requires teachers to think about ways to provide greater access to rigorous science content and display opportunities for all students to show their conceptual learning (Kusimo et al., 2000; Abell & Siegel, 2011; Lyon, 2013).

Providing ways to make all students learning visible is an important aspect of EA and this requires teachers to consider individual differences of their students while planning teaching and assessing them (Lyon, 2017; Siegel, 2014). As teachers beliefs and views influence their practices, their views about diversity and individual differences also shape how they plan to provide EA opportunities for their students (Carter, 2008; Siegel, 2014). The results of the study showed that the teachers generally considered learning styles and language proficiencies as individual differences to address and provide EA practices. Thus, they planned to use different strategies and accommodations to achieve EA by addressing differences in learning styles and language abilities of students; but they did not consider other differences such as gender and culture in their plans to achieve EA. Similar to findings of other studies (Abedi et al., 2004; Cranford, 2018; Lyon, 2013; Siegel, 2014), usage of multiple assessments to assess student learning was found as one of the important ways to address differences in learning styles by participants. Besides, different ways such as usage of daily life and basic sentences, providing extra time, and providing assessment in students' native languages were found to achieve EA for language minority students by the participants. While the obtained ways in planning to provide EA are useful, we, as teacher educators, should prepare teachers to consider diversity from a larger point of view to provide EA to assess and support all students' learning. In addition, teacher candidates need to be engaged in EA practices to see which ways are more effective to address a specific minority group (Cranford, 2018).

Implication

Providing equitable science assessment is a tough issue because there are challenges to consider and address a diverse group of students to find out what they know and what can be done to support their science learning. Although there are more to be done to prepare teachers sufficiently to assess equitably, the findings of the study have some suggestions as the followings to prepare teachers to achieve EA. Teacher education programs should provide ways for teacher candidates to recognize diversity from a larger point of view and teacher candidates should be aware of the diversity of students whom they are being prepared to teach. Furthermore, the knowledge and attitudes necessary for effectively teaching and assessing diverse learners must be provided for teacher candidates to make them ready for providing EA. In order to practice EA, teacher candidates should be provided with tools and guidance to overcome the difficulties that they may face within the real teaching practices.

On the other hand, two different concerns emerged according to the results of the study to take into consideration while preparing teachers to assess equitably. The first one is about the belief that using same assessment for all students' learning is fair and that it is difficult to use different assessments for each student because of limited time. The second concern was about that while the participants think making adjustment on assessment for minorities is useful, it decreases the cognitive level of assessment and makes it easy for other students. It can be concluded that both concerns can shape the teacher candidates' decisions to provide EA. Similar concerns were found by Lyon (2013) in his study that the teacher candidates were worried about reducing or scaffolding language demand of an assessment which was shaped by teachers' beliefs about language minorities. Thus, as educators, we need to provide ways and try to convince teacher candidates about; (a) various formative assessments can be easily used in a short time to elicit and assess students' learning without increasing their workload and (b) assessments can be scaffolded for minority students without reducing content demands of the assessment tasks.

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Appendix. Interview Questions

1. Can you define equitable assessment?
2. What does it mean for you to assess students equitably?
3. As a teacher candidate, do you think to use more than one way to assess your students' learning? Why? How does it help?
4. How do you assess a student's learning, having low Turkish language ability, of a topic you taught?
5. Do you think a student with native Turkish language and a student with non-native Turkish language should be assessed in the same way? Why?
6. If you are being assessed in English instead of Turkish language in your science lessons, will it affect your achievement in these lessons? Why?
7. What other differences do you think influence students to show their real learning?
8. In what ways do you plan to equitably assess your students' science learning?