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AN INVESTIGATION OF PRESCHOOL INSTRUCTIONAL MATERIALS: A MIXED METHOD STUDY WITH MANY FACET RASCH AND NVIVO

Serdar ARCAGOK, Durmuş OZBASI

Abstract: This study used a parallel mixed method approach to evaluate the instructional materials that pre-service teachers developed in their Instructional Technologies and Material Development course. The study group was composed of 10 different instructional materials developed by 2nd year students enrolled in Faculty of Education during their Instructional Technologies and Material Development course during the 2018-2019 academic year. Additionally, 16 preschool education majors in their 2nd year also enrolled in this course volunteered to evaluate the instructional materials. The data collection tool used in this research was the Instructional Materials Evaluation Form. The study's data were analyzed using a Many-facet Rasch Model and NVivo. The study found there to be differences both in the instructional materials developed during the course and in the criteria used to evaluate them in terms of severity and generosity. Furthermore, both the qualitative and quantitative findings revealed that pre-service teachers experienced difficulties fulfilling some, but not all criteria while developing their instructional materials

Key words: Developing instructional materials, many-facet rasch analysis, NVivo pre-service preschool teachers, mixed method

1. Introduction

In today's fast-paced world, information and communication technologies never cease to change, and do so at increasingly fast rates. This change has left a deep and pervasive impact on how societies communicate, interact, and work (Pew Research Center, 2002) and similarly on the field of education. As the most important part of the education process (Arslan, 2007), teachers are required to improve themselves and acquire different skills based on the needs of time. One such skill that has become required of teachers is using information technology in an effective manner.

The use of technology has, in today's age, become an issue of great importance in teacher education. One of the most important things that institutions training teachers need to ensure is that pre-service teachers sufficiently acquire the technology skills required to respond to today's needs (Varank and Ergün, 2009).

Stemming from instructional technologies' positive impact on student activities and learning outcomes, the use of technology in learning environments has witnessed a remarkable increased in importance (Holcomb, 2005). Instructional technologies support teachers and students in reaching instructional aims through a variety of means (e.g., instructional design models, organization and method theories, research and assessment techniques, classroom objects and materials) (Espey, 1999).

Classroom materials used during instruction enrich lessons by supporting teachers (Yalın, 2017). Considering that classroom materials play an integral role in helping teachers sufficiently achieve the goals delineated in teaching curriculum, education quality may be improved through their use (Schwab, 2002). Instructional materials facilitate both teaching and learning (Wong, 2015). Well-designed materials positively contribute to students' learning by making the teaching process more

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efficient. Any component in the instruction process that transfers knowledge from the source to the target is considered an instructional material.

Teachers interact with instructional materials during the entire instruction process (Behm, 2008). Teachers' behaviors and approaches play a fundamental role in selecting which instructional materials will be used during instruction. In other words, instructional materials' potential impact depends on how teachers approach their lessons (Fullan, 1991). Teachers wishing to design instructional materials must consider how well students are able to conceptualize and understand the material in question, for if students are unable to conceptualize or understand it, its instructional functionality will be greatly reduced (Swan, 1994). As such, it is critical that the materials to be used during instruction be relevant, meaningful, and practical for students (Tomlinson, 2012). Instructional materials that are relevant and practical for students not only encourage them to think and act in a scientific manner but also contribute to positive learning outcomes (Short, 2006).

The materials that are used in learning environment should be appropriate for cognitive, affective and psychomotor developments of pre-school aged children. To use the materials that are used in this period at learning environment is highly important to meet the interest and expectation and the success level of learners (Hollingsworth and Hoover 1999). So, the materials that are used are expected to make important contributions to children's developments. These materials promote to realize individual capability of children, to express themselves, to behave autonomously, to discover their peers and close environments (Eristi, 2008). In other words, interactive relation between pre-school aged children and different materials will contribute to development of their creative thinking abilities and their imaginations. (Eckhoff and Spearman, 2009). Moreover, teaching materials are important tools to achieve basic and important outcomes such as perception, reasoning definition, concentration, cause and effect relation, hand- eye coordination for pre-school aged children (Tekmen, 2016). In this sense, teaching materials have helped children have concrete lives through senses (Senemoğlu, 2009), use equipment, facilitate mind and muscular coordination (Bredekamp, 2015), state emotion and idea (Eristi, 2008). In pre-school education models (Montesorri , Reggio Emillia,High Scope model et al.), it is emphasized that the materials that are used in learning environment have an important role. Among them, in Reggio Emilia model the materials that are used in learning environment provide children to discover affective and tactual experience. Also in this model, the child develops imagination and observation ability by discovering his/her environment deeply through the materials (Edwards, Gandini and Forman, 1998). In Montessori model, it is aimed to meet different learning opportunities that support children's self determination (Gardner, 2006). Within this framework, the materials form the fundamental structure of Montessori model (Greg, 2002). Montessori approach contributes individual learning of the children and discovery of their environments through teaching materials (Mallett & Schroeder, 2015). Thus, according to Piaget, the most suitable environment for a child's learning can be provided through rich materials and possessing of discovery freedom of these materials (Andrews, 2012). In High Scope model, the main aim is to develop self determination of children, making different selections, decision making skill and problem solving skill. To be able to make it real, it is essential to arrange learning environments within in the frame of this aim (French, 2012). The learning in this approach occurs with the child's direct interaction with materials (Hoffman and Weikart, 2012).

The aim of research is to use a mixed-method approach to investigate both the qualitative and quantitative data obtained pertaining to instructional materials from a product, standard, and scoring standpoint. To this end, it was developed the following several aims:

1. Following an examination of instructional materials' Many-facet Rasch Model, how are both the logit values and data calibration map distributed?
2. What are the measurement report statistics for pre-service teachers' instructional materials?
3. What are the statistics for raters' severity/generosity levels in scoring pre-service teachers' instructional materials?
4. What is the measurement report for the criteria used to evaluate instructional materials?

5. What are the statistics for raters' biasness levels while scoring pre-service teachers' instructional materials?
6. What steps did pre-service teachers have the most difficulty completing while developing their instructional materials?
7. What are pre-service teachers' views regarding instructional materials' durability and practicality?
8. What are pre-service teachers' views regarding aims and benchmarks pertaining to their instructional materials?
9. What are pre-service teachers' views regarding the appropriateness of instructional materials for students?
10. What steps were the easiest for pre-service teachers to complete during the development of their instructional materials?
11. What are pre-service teachers' views toward making use of innovative techniques in their instructive materials?

Signifance

A review of the related literature revealed that a portion of studies examining instructional technologies and material development were conducted with pre-service teachers enrolled in different bachelor's programs (Acer, 2011; Akalan, 2012; Bektas, Nalcaci and Ercoskun, 2009; Birisci and Karal, 2011; Cabi and Ergün, 2016; Çalisoglu, 2015; Cakir, 2010; Gecer, 2010; Karamustafaoglu, 2006; Kurus, 2011; Nalcaci and Ercoskun, 2005; Mumcu and Yıldız, 205; Yaman, 2007; Uyangör and Ece, 2010). Another portion of studies were conducted with current teachers teaching a variety of subjects (Behm, 2008; Ulusoy and Gülüm, 2009; Schwab, 2002; Short, 2006; Soydan, 2018; Varank and Ergün, 2009). Several studies examining instructional technologies and materials as documents were also found (Alım, 2007; Demiralp, 2007; Duman, 2013; Kablan, Topan and Erkan, 2013; Tasköprü, 2017; Yıldırım, 2015). Yet, despite the existence of these studies, no study using both Rasch and content analysis was found that investigated the instructional materials developed by pre-service teachers enrolled in a Preschool Education Department was found. Hu, Clark and Ma (2003) . Some studies about the related literature imply that teachers who teach different subjects resist against instructional technologies (Hu, Clark and Ma, 2003), problems between what is learnt and what is applied are experienced in the course of instructional technologies and material development which is taught at institutions educating teachers (Betrus & Molenda, 2002). In preschool education, child-centered materials that effectively foster children's development constitute one of the most vital instruction-enriching elements (Kara, 2018). Essentially, preschool-aged children should be provided ample opportunities to express themselves though various means and these opportunities should be appropriate to their learning styles and personal needs. Accordingly, a wide range of ancillary materials that provide Many-facet support to their development should be provided to children of this age group (MONE, 2013). Consequently, it asserts that our study will have a Many-facet impact on pre-service teachers' competencies in instructional technologies and materials, which is important because it is these individuals who will cultivate future generations.

2. Method

Research Model

The current study used a converging parallel mixed-method design in which qualitative and quantitative stages were conducted simultaneously with their respective data collection processes. Analyses of the qualitative and quantitative data, however, are conducted independent of these stages in this type of study (Creswell and Clarck, 2013). Since, however, both the qualitative and quantitative stages of the study were conducted simultaneously and since it was aimed to investigate the multiple

contexts composing the research in a holistic manner (Johnson and Christensen, 2014), it was adopted a converging parallel mixed-method approach.

Study Group

The study group consisted of 10 different instructional materials developed by 2th year students enrolled in Faculty of Education (Department of Preschool Education) during their Instructional Technologies and Material Development course during the fall semester of 2018-2019. Each material was developed by a different group composed of 6 to 8 students. The raters participating in the study were also students studying in the same branch during the time of the research.

The raters were selected to voluntary basis, the materials that were developed by selected raters were excluded from the study. Also, the content of criterion that were in observation form and how scoring would be were told to raters in detail. Finally, before application process it was told to both raters and the group of students who had developed different materials that raters' evaluations would not have any effect on final grades of students. So, it was aimed to avoid the evaluations of the raters and the students upon grade concern.

Data Collection Instruments

The instruments used to collect data are classified as either qualitative or quantitative data collection instruments. Composed of 5-point Likert-type questions, the 16-item *Instructional Materials Evaluation Form* was used to collect quantitative data (Halis, 2002). Responses to the questions included on said form ranged from 1 to 5, which corresponded to *Very good*, *Good*, *Somewhat good*, *Bad*, and *Very bad*, respectively. The following principles were taken into consideration while constructing the categories measured in the evaluation form: (i) meaningfulness, (ii) innovativeness, (iii) multiple examples, (iv) relativity, (v) selectivity, (vi) completion, (vii) background figure support, (viii) obscurity, (ix) connectivity, (x) constancy in perception, and (xi) depth.

The qualitative data collection instrument was developed using the acquisitions and benchmarks sought to be imparted in the course *Instructional Technologies and Material Development,* the recommendations found in the related literature, and the opinions of two experienced field expert faculty members who had previously taken this course. The questions included in the resulting interview form were asked to 5 students enrolled in said course and any technical terms that the students did not understand were changed accordingly. As a result, a total of 6 questions were included in the interview form and asked to the pre-service teachers.

Qualitative Data Analysis

Qualitative data were analyzed using thematic coding. The ensuing steps were followed while analyzing the data that composed the research questions:

1. Data Transfer**:** All responses that participants gave to each question were audio recorded, which were then transcribed verbatim. Care was taken to ensure that the opinions expressed by pre-service teachers during the interviews were not interfered with while composing the transcripts. After transcribing the recordings into a Word document, they were reexamined by two data coders and compared with the audio recordings to determine whether they were identical or not (Robson, 2015).

Code Creation*:* Using the data attained from the interview transcripts, two data coders worked separately creating meaningful groups of codes based on the interview questions (Robson, 2015).

2. Defining Themes: The codes defined by the two coders were made into a list, after which themes for the qualitative portion of the research were determined by combining codes containing similar themes (Patton, 2014).

3. Fitness Values between Data Coders: The fitness values between the themes created by the two coders were calculated using Cohen's Kappa values. The values that emerged during calculation were included in the evaluation. According to Cohen's Kappa, fitness value ranges of ≤.20 are defined as weak or negligible fit, .21-.40 as low fit, .41-.60 as moderate fit, .61-.80 as good fit, and .81-1.00 as very good fit (Sim and Wright, 2005; Viera and Garrett, 2005).

Quantitative Data Analysis

The research data was obtained using the scores that 16 pre-service teachers assigned to 10 student materials based on 13 criteria. Accordingly, three different facets (instructional material, criterion, and rater) were included in our research. It was used a Many-facet Rasch Model (MFRM) to analyze the data that it was obtained from the scores raters assigned to the materials. Using the MFRM, it was able to calculate raters' severity/generosity in scoring, respondents' abilities, and items' difficulty (Linacre, 1989; Linacre, 2014; McNamara, 1996). Because MFRMs are based on item response theory, it was required to first tested basic assumptions (undimensionality, local independence, and model-data fit). Within the this study, all assumptions were to be met.

3. Findings

Quantitative findings

Qualitative findings were analyzed according to a Many-facet Rasch Model (MFRM). The results of the analysis have been presented through figures and subsequently interpreted.

Findings for the first secondary aim

Using the MFRM to further investigate the analysis results of pre-service teachers' instructional materials, it was able to extract a total of three facets (i.e., raters, criteria, and instructional materials). The data calibration map for these facets is presented in Figure 1.

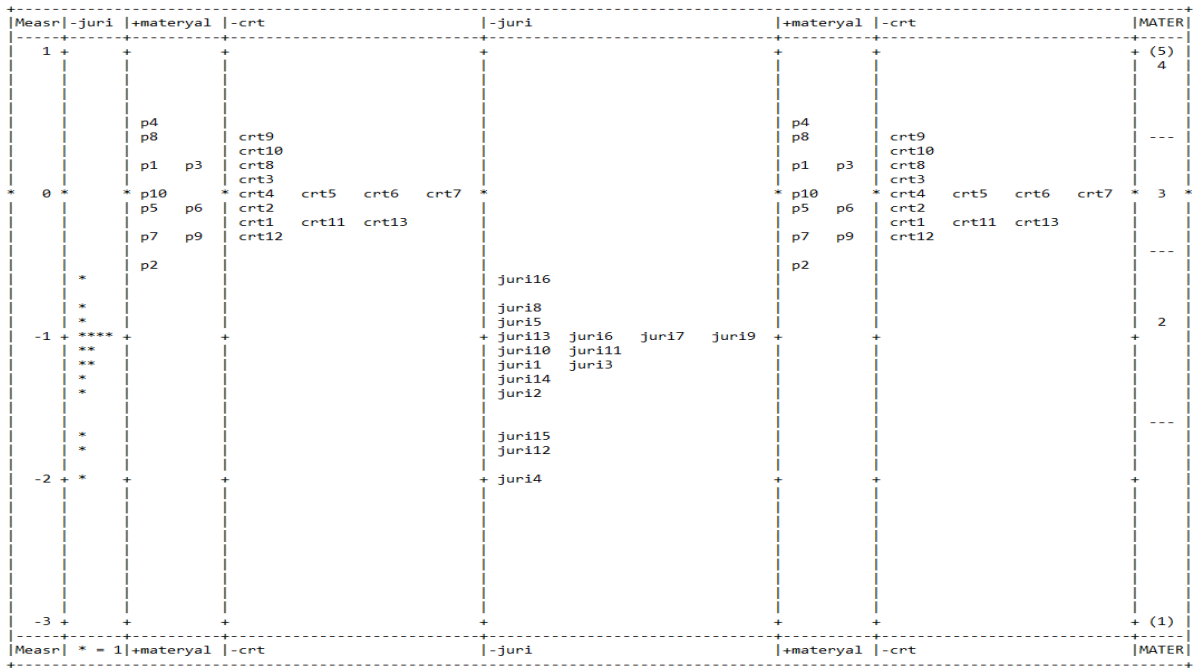

Figure 1. *Data calibration map*

According to the data calibration map presented in Figure 1, the material with the highest ability level was material 4 and the material with the lowest ability level was material 2, which also had the lowest logit value. An examination of the criteria used to evaluate instructional materials revealed that pre-service teachers had the most difficulty on criteria 9 and the least difficulty on criteria 12. An examination of raters' severity/generosity levels, however, revealed rater 16 to be the most severe and rater 4 to be the least.

Findings for the Second Secondary Aim

In order to perform a more in-depth examination of each facet, it was needed to investigate the measurement report belonging to each facet. The measurement reports for pre-service teachers' instructional materials are presented below.

Table 1. *Measurement report for pre-service teachers' instructional materials*

Material number	Total score	Total Count	Obsvd Average	Fair Average	Model Measure	SE	Infit		Outfit	
							MnSq	ZStd	MnSq	ZStd
p4	940	208	4,52	4,55	0,47	0,1	0,98	-0,1	0,88	-0,9
p8	923	208	4,44	4,47	0,31	0,09	0,86	-1,1	0,79	-1,7
p3	909	208	4,37	4,41	0,20	0,09	0,85	-1,3	0,87	-1,1
p1	899	208	4,32	4,36	0,13	0,08	0,87	-1,2	0,85	-1,3
p10	887	208	4,26	4,31	0,05	0,08	0,98	-0,1	1,00	0,0
p6	879	208	4,23	4,27	-0,01	0,08	0,97	-0,2	1,03	0,2
p5	857	208	4,12	4,16	-0,14	0,08	1,08	0,8	1,06	0,5
p7	842	208	4,05	4,09	-0,22	0,07	1,08	0,8	1,12	1,1
p9	842	208	4,05	4,09	-0,22	0,07	1,16	1,5	1,20	1,9
P2	774	208	3,72	3,76	-0,56	0,07	1,09	0,9	1,07	0,8
Mean (Count: 10)	875,2	208	4,21	4,25	0	0,08	0,99	0	0,99	0
Model, Sample: RMSE .08 Adj (True) S.D. .29 Separation 3.53 Strata 5.04 Reliability .93 Model, Fixed (all same) chi-square: 128.0 d.f.: 9 significance (probability): .00										

Using the findings of the measurement report depicted in Table 1, it was ranked pre-service teachers' instructional materials from highest to lowest score received. Instructional material *p4* received the highest score and *p2* the lowest. Furthermore, the standard error value (RMSE, Root Mean Square Standard Error) for the quality of the instructional materials was calculated to be 0.08. Since the RMSE value shows the measurement error for all values except those most outlying, the RMSE value attained was rather low. It was also able to extract the reliability coefficient from Table 1 which demonstrated how reliably instructional materials' quality was estimated. The reliability coefficient's being so high (i.e., 0.93) indicates that this estimate was conducted at a very high degree of reliability.

The hypothesis that *there is a significant difference in pre-service teachers' abilities to develop instructional materials* (whose separation index value and reliability coefficient were 3.53 and 0.93, respectively) was rejected upon being tested using chi-squares ($x^2_{(9)}$= 128, $p < .05$), revealing there to be a statistical difference in the quality of the pre-service teachers' instructional materials.

Table 1 further depicts both the in-fit values for unexpected answers in regard to the decision-making process and the out-fit values that show the level of sensitivity to unexpected answers that were further separated. In terms of the in-fit and out-fit values, it was found that since the majority of them fell between .85 and 1.14, they did not transgress the accepted value threshold of 0.6 and 1.4.

Findings for the third secondary aim

Table 2 depicts the statistical findings pertaining to raters' severity and generosity in scoring pre-service materials instructional materials. Interpretations for these findings are presented following the table.

Table 2. *Measurement report for raters' scoring practices*

Raters	Total score	Total Count	Obsvd Average	Fair Average	Model		Infit		Outfit	
					Measure	SE	MnSq	ZStd	MnSq	ZStd
j8	506	130	3,89	3,93	-0,82	0,09	0,84	-1,4	0,83	-1,4

j5	519	130	3,99	4,03	-0,93	0,09	0,96	-0,2	0,99	0
j9	524	130	4,03	4,07	-0,97	0,09	1,11	0,9	1,03	0,2
j6	525	130	4,04	4,07	-0,98	0,09	1,33	2,5	1,33	2,3
j13	525	130	4,04	4,07	-0,98	0,09	0,73	-2,4	0,72	-2,4
j7	531	130	4,08	4,12	-1,03	0,1	0,8	-1,7	0,84	-1,2
j10	536	130	4,12	4,16	-1,08	0,1	1,06	0,5	1,03	0,2
j11	538	130	4,14	4,18	-1,1	0,1	1,03	0,2	0,96	-0,2
j16	540	130	4,15	4,19	-1,12	0,1	1,04	0,3	1,16	1,2
j3	550	130	4,23	4,27	-1,21	0,1	0,81	-1,5	0,74	-2
j1	551	130	4,24	4,27	-1,23	0,1	1,18	1,3	1,05	0,4
j14	555	130	4,27	4,3	-1,27	0,1	0,81	-1,4	0,76	-1,7
j2	568	130	4,37	4,4	-1,42	0,11	1,26	1,6	1,11	0,7
j15	586	130	4,51	4,54	-1,66	0,12	1,25	1,4	1,14	0,8
j12	593	130	4,56	4,59	-1,77	0,13	0,94	-0,2	0,93	-0,3
j4	605	130	4,65	4,68	-2	0,15	1,2	1	1,17	0,8
Mean (Count : 16)	547	130	4,21	4,24	-1,22	0,1	1,02	0,1	0,99	-0,2
Model, Sample: RMSE .11 Adj (True) S.D. .32 Separation 3.00 Strata 4.33 Reliability (not inter-rater) .90 Model, Fixed (all same) chi-square: 114.8 d.f.: 15 significance (probability): .00 Inter-Rater agreement opportunities: 15600 Exact agreements: 5695 = 36.5% Expected: 5795.1 = 37.1%										

Table 2 presents detailed data for how based on specific criteria, raters scored pre-service teachers' instructional materials. These findings indicate that the least severe rater was *juri4* whereas the most severe was *juri8*. Also related to raters' scores, an RMSE value (standard error value) of 0.11 was calculated for all pieces of data with the exception of the most outlying values. Furthermore, an adjusted standard deviation value of 0.32 was calculated, which was well under the 1.00 value taken as reference. The reliability coefficient for raters' scoring practices was found to be 0.91, indicating a high degree of reliable. Moreover, when the hypothesis that *there is no significant difference between raters in terms of severity/generosity* (whose separation index value and reliability coefficient for raters' scoring practices were 3.22 and 0.93, respectively) was tested using chi-squares ($x^2_{(15)}$= 114.8, p<.05),the null-hypothesis was rejected. Accordingly, raters were found to exhibit a statistically significant difference among themselves in terms of their scoring severity/generosity. An examination of the in-fit and out-fit values belonging to raters' scoring practices reveals that since all values remained within the accepted boundaries of 0.6 and 1.4, they were within the accepted quality control values. In other words, raters were consistent in their scoring behaviors while evaluating the instructional materials at hand.

Findings for the fourth secondary aim

Table 3 below depicts the measurement reports for the criteria used to evaluate the materials. Following Table 3 are interpretations of the reports' findings.

Table 3. *Measurement report for evaluation criteria*

Criterions	Total score	Total Count	Obsvd Average	Fair Average	Model		Infit		Outfit	
					Measure	SE	MnSq	ZStd	MnSq	ZStd
crt9	625	160	3,91	3,96	0,37	0,08	1,1	1	1,1	0,8
crt10	631	160	3,94	4,00	0,33	0,08	1,26	2,2	1,19	1,6
crt8	655	160	4,09	4,15	0,16	0,09	0,96	-0,3	0,94	-0,4
crt3	661	160	4,13	4,19	0,11	0,09	1,08	0,7	1,09	0,7
crt5	669	160	4,18	4,24	0,05	0,09	0,81	-1,6	0,82	-1,5
crt7	676	160	4,22	4,28	-0,01	0,09	1	0,0	1,00	0
crt4	678	160	4,24	4,29	-0,03	0,09	1,14	1,1	1,06	0,4
crt6	679	160	4,24	4,30	-0,03	0,09	1,04	0,3	0,99	0
crt2	681	160	4,26	4,31	-0,05	0,09	0,86	-1,1	0,86	-1

crt11	693	160	4,33	4,38	-0,16	0,1	1,03	0,2	1,06	0,4
crt13	694	160	4,34	4,39	-0,17	0,1	1,03	0,3	1,09	0,6
crt1	700	160	4,38	4,42	-0,23	0,1	0,68	-2,7	0,68	-2,4
crt12	710	160	4,44	4,48	-0,33	0,1	0,97	-0,1	0,97	-0,1
Mean (Count :13)	710	160	4,21	4,26	0	0,09	1	0	0,99	-0,1
Model, Sample: RMSE .09 Adj (True) S.D. .18 Separation 1.99 Strata 2.98 Reliability .80 Model, Fixed (all same) chi-square: 62.1 d.f.: 12 significance (probability): .00										

Table 3 presents a detailed measurement report for the evaluation criteria used. The analyses depicted in Table 3 show that the pre-service teachers had the most difficulty meeting the two criteria coded *crt9* (depth principle) and *crt10* (innovativeness principal) when developing their instructional materials. On the contrary, however, they had the least difficulty meeting criteria *crt12* (desired behaviors) and *crt1* (meaningfulness principle).

The standard error value belonging to the criteria used while developing instructional materials was quite low (RMSE=0.09). Consequently, an adjusted standard deviation value of 0.18 was calculated using this error value, which was well under the maximum accepted reference value of 1.0. It was calculated the reliability coefficient to be 0.80, indicating that the criteria used to evaluate pre-service teachers' instructional materials were highly reliable.

Moreover, Table 3 presents the separation index (calculated to be 1.93) for the evaluation criteria used in this study. When the hypothesis that *there is no meaningful difference in the difficulty level of criteria used to determine the quality of instructional materials* (whose separation index value and reliability coefficient were 1.99 and 0.80, respectively) was tested using chi-squares ($x^2_{(12)}$= 62.1, p<.05) , the null hypothesis was rejected. According to this finding, the criteria used to evaluate pre-service teachers' instructional materials not only were able to measure the different characteristics observed in their performances but also exhibited a statistically significant difference in terms of how difficult it was for them to fulfill criteria.

When the in-fit and out-fit values for evaluation criteria's performance are examined in light of the information included in Table 3, it is observed these values to be within the accepted reference values of 0.6 and 1.4. In other words, all of the criteria used to evaluate pre-service teachers' instructional materials were within the expected quality control values and thus internally consistent.

Findings for the Fifth Secondary Aims

Figure 2 depicts the statistics belonging to raters' levels of severity/generosity in scoring instructional materials. Following the figure, it has been offered interpretations of the reports' findings.

The interaction analysis between raters and the scores given to instructional materials illustrated in Figure 2 allows us to ascertain whether or not raters were biased in their scoring practices. An examination of raters' t-values reveals that they behaved in a biased manner in regard to their scoring severity/generosity for those items whose values were separated by ±2 in particular. As such, while a great many of the raters acted in a biased manner when scoring instructional materials, certain raters were observed, based on the information illustrated in Figure 2, to act in a biased manner that greatly exceeded the t-value identified above. In terms of severity, rater *j9* assigned the most severe score when he gave a score of 23 to material 2 when it deserved a score of 45.03 (t=-4.83, p<.05). Similarly, rater *j6* exhibited severe scoring behaviors (t=-4.00, p<.05) by giving material 10 a score of 39 when it deserved a score of 53.33.

Based on the information given in Figure 2, the most generous in scoring practices was *j6*, who gave material 9 a score of 64 when it deserved a score of 50.02 (t=2.68, p<.05). Another rater who exhibited generous scoring practices was *j11*, who gave a score of 58 to material 2 when it deserved a score of 46.94 (t=2.70, p<.05).

Observd Score	Expctd Score	Observd Count	Obs-Exp Average	Bias+ Size	Model S.E.	t	d.f.	Prob.	Infit MnSq	Outfit MnSq	juri Sq	juri Nu	juri	measr-	materyal Nu	mat	measr+
64	50.02	13	1.08	2.64	.99	2.68	12	.0200	.9	.8	134	6	juri6	-.98	9	p9	-.22
64	57.19	13	.52	1.97	.99	2.00	12	.0692	.9	.9	33	1	juri1	-1.23	3	p3	.20
63	51.53	13	.88	1.86	.69	2.68	12	.0199	1.8	1.9	139	11	juri11	-1.10	9	p9	-.22
64	58.59	13	.42	1.78	.99	1.80	12	.0968	.9	1.1	34	2	juri2	-1.42	3	p3	.20
62	50.72	13	.87	1.53	.56	2.73	12	.0183	.8	.8	103	7	juri7	-1.03	7	p7	-.22
64	60.23	13	.29	1.49	.99	1.51	12	.1557	.8	.6	12	12	juri12	-1.77	1	p1	.13
61	49.90	13	.85	1.32	.49	2.72	12	.0185	.7	.8	137	9	juri9	-.97	9	p9	-.22
62	54.05	13	.61	1.25	.56	2.23	12	.0460	.7	.7	91	11	juri11	-1.10	6	p6	-.01
63	57.96	13	.39	1.20	.69	1.73	12	.1088	.8	.8	115	3	juri3	-1.21	8	p8	.31
63	58.09	13	.38	1.18	.69	1.71	12	.1137	.8	.8	108	12	juri12	-1.77	7	p7	-.22
61	52.75	13	.63	1.10	.49	2.25	12	.0438	.7	.7	149	5	juri5	-.93	10	p10	.05
63	58.67	13	.33	1.09	.69	1.58	12	.1393	.8	.8	76	12	juri12	-1.77	5	p5	-.14
64	61.91	13	.16	1.08	.99	1.10	12	.2942	.9	.8	116	4	juri4	-2.00	8	p8	.31
60	51.12	13	.68	1.02	.44	2.34	12	.0375	.8	.7	77	13	juri13	-.98	5	p5	-.14
58	46.94	13	.85	1.00	.37	2.70	12	.0195	.7	.7	27	11	juri11	-1.10	2	p2	-.56
59	49.90	13	.70	.94	.40	2.35	12	.0367	.6	.6	105	9	juri9	-.97	7	p7	-.22
59	51.01	13	.61	.85	.40	2.14	12	.0537	.5	.5	73	9	juri9	-.97	5	p5	-.14
58	49.36	13	.66	.83	.37	2.23	12	.0452	.4	.5	30	14	juri14	-1.27	2	p2	-.56
46	52.95	13	-.53	-.52	.26	-2.02	12	.0668	.5	.5	131	3	juri3	-1.21	9	p9	-.22
47	53.88	13	-.53	-.54	.26	-2.06	12	.0620	.3	.3	67	3	juri3	-1.21	5	p5	-.14
49	55.56	13	-.50	-.56	.27	-2.09	12	.0585	.7	.7	117	5	juri5	-.93	8	p8	.31
47	54.23	13	-.56	-.57	.26	-2.18	12	.0497	.4	.4	13	13	juri13	-.98	1	p1	.13
52	57.73	13	-.44	-.59	.29	-2.05	12	.0632	.6	.7	55	7	juri7	-1.03	4	p4	.47
46	53.85	13	-.60	-.60	.26	-2.33	12	.0380	1.4	1.4	90	10	juri10	-1.08	6	p6	-.01
50	57.05	13	-.54	-.66	.27	-2.40	12	.0335	.4	.4	123	11	juri11	-1.10	8	p8	.31
46	54.59	13	-.66	-.67	.26	-2.61	12	.0230	.4	.4	155	11	juri11	-1.10	10	p10	.05
44	53.54	13	-.73	-.70	.25	-2.78	12	.0168	.3	.3	142	14	juri14	-1.27	9	p9	-.22
56	60.67	13	-.36	-.70	.33	-2.12	12	.0557	.8	1.0	84	4	juri4	-2.00	6	p6	-.01
51	58.09	13	-.55	-.72	.28	-2.56	12	.0249	.7	.7	140	12	juri12	-1.77	9	p9	-.22
46	55.08	13	-.70	-.72	.26	-2.80	12	.0162	1.0	1.0	130	2	juri2	-1.42	9	p9	-.22
49	57.20	13	-.63	-.75	.27	-2.79	12	.0163	.8	.8	128	16	juri16	-1.12	8	p8	.31
33	45.17	13	-.94	-.78	.26	-2.99	12	.0112	.6	.6	22	6	juri6	-.98	2	p2	-.56
42	52.95	13	-.84	-.78	.25	-3.10	12	.0092	.5	.5	99	3	juri3	-1.21	7	p7	-.22
53	59.63	13	-.51	-.79	.30	-2.68	12	.0200	.6	.7	15	15	juri15	-1.66	1	p1	.13
52	59.15	13	-.55	-.80	.29	-2.77	12	.0170	.5	.5	159	15	juri15	-1.66	10	p10	.05
48	57.04	13	-.70	-.80	.27	-3.03	12	.0104	1.1	1.1	82	2	juri2	-1.42	6	p6	-.01
43	54.00	13	-.85	-.81	.25	-3.21	12	.0074	1.0	1.0	65	1	juri1	-1.23	5	p5	-.14
49	57.89	13	-.68	-.84	.27	-3.13	12	.0087	1.1	1.0	79	15	juri15	-1.66	5	p5	-.14
52	59.55	13	-.58	-.86	.29	-3.00	12	.0110	.7	.7	100	4	juri4	-2.00	7	p7	-.22
40	52.55	13	-.97	-.87	.25	-3.48	12	.0046	.7	.7	75	11	juri11	-1.10	5	p5	-.14
47	57.25	13	-.79	-.90	.26	-3.44	12	.0049	.7	.7	111	15	juri15	-1.66	7	p7	-.22
42	54.89	13	-.99	-.96	.25	-3.83	12	.0024	.4	.4	41	9	juri9	-.97	3	p3	.20
46	57.33	13	-.87	-.98	.26	-3.78	12	.0026	.9	.9	54	6	juri6	-.98	4	p4	.47
48	58.34	13	-.80	-.98	.27	-3.68	12	.0031	.4	.4	64	16	juri16	-1.12	4	p4	.47
44	56.26	13	-.94	-.98	.25	-3.86	12	.0023	.5	.5	48	16	juri16	-1.12	3	p3	.20
53	60.59	13	-.58	-.98	.30	-3.31	12	.0062	.8	.8	44	12	juri12	-1.77	3	p3	.20
39	53.33	13	-1.10	-1.00	.25	-4.00	12	.0018	.6	.6	150	6	juri6	-.98	10	p10	.05
50	59.55	13	-.73	-1.02	.27	-3.72	12	.0029	.7	.7	132	4	juri4	-2.00	9	p9	-.22
23	45.03	13	-1.69	-1.59	.33	-4.83	12	.0004	.8	.9	25	9	juri9	-.97	2	p2	-.56
65	58.08	13	.53	2.53<	1.40	1.80	12	.0968	.0	.0	2	2	juri2	-1.42	1	p1	.13
65	61.24	13	.29	1.94<	1.40	1.39	12	.1909	.0	.0	4	4	juri4	-2.00	1	p1	.13
65	55.23	13	.75	2.87<	1.40	2.04	12	.0636	.0	.0	10	10	juri10	-1.08	1	p1	.13
65	54.12	13	.84	2.98<	1.40	2.12	12	.0554	.0	.0	31	15	juri15	-1.66	2	p2	-.56
65	61.53	13	.27	1.87<	1.40	1.33	12	.2071	.0	.0	36	4	juri4	-2.00	3	p3	.20
65	60.03	13	.38	2.21<	1.40	1.58	12	.1412	.0	.0	47	15	juri15	-1.66	3	p3	.20
65	60.14	13	.37	2.19<	1.40	1.56	12	.1446	.0	.0	50	2	juri2	-1.42	4	p4	.47
65	58.99	13	.46	2.39<	1.40	1.70	12	.1141	.0	.0	51	3	juri3	-1.21	4	p4	.47
65	62.37	13	.20	1.61<	1.40	1.14	12	.2746	.0	.0	52	4	juri4	-2.00	4	p4	.47
65	61.66	13	.26	1.83<	1.40	1.31	12	.2159	.0	.0	60	12	juri12	-1.77	4	p4	.47
65	61.24	13	.29	1.94<	1.40	1.39	12	.1909	.0	.0	63	15	juri15	-1.66	4	p4	.47
65	60.01	13	.38	2.21<	1.40	1.58	12	.1405	.0	.0	68	4	juri4	-2.00	5	p5	-.14
65	50.45	13	1.12	3.29<	1.40	2.34	12	.0372	.0	.0	69	5	juri5	-.93	5	p5	-.14
65	58.82	13	.48	2.42<	1.40	1.72	12	.1103	.0	.0	95	15	juri15	-1.66	6	p6	-.01
65	54.25	13	.83	2.96<	1.40	2.11	12	.0563	.0	.0	96	16	juri16	-1.12	6	p6	-.01
65	50.02	13	1.15	3.32<	1.40	2.37	12	.0356	.0	.0	102	6	juri6	-.98	7	p7	-.22
65	59.29	13	.44	2.34<	1.40	1.67	12	.1209	.0	.0	114	2	juri2	-1.42	8	p8	.31
65	56.04	13	.69	2.78<	1.40	1.98	12	.0708	.0	.0	118	6	juri6	-.98	8	p8	.31
65	60.58	13	.34	2.10<	1.40	1.50	12	.1606	.0	.0	127	15	juri15	-1.66	8	p8	.31
65	55.84	13	.70	2.80<	1.40	2.00	12	.0690	.0	.0	145	1	juri1	-1.23	10	p10	.05
65	54.40	13	.82	2.95<	1.40	2.10	12	.0573	.0	.0	154	10	juri10	-1.08	10	p10	.05
54.7	54.70	13.0	.00	.36	.50	-.10			.6	.7	Mean (Count: 160)						
7.7	4.02	.0	.51	1.07	.38	1.86			.4	.4	S.D. (Population)						
7.7	4.03	.0	.51	1.07	.38	1.87			.4	.4	S.D. (Sample)						

Fixed (all = 0) chi-square: 555.2 d.f.: 160 significance (probability): .00

Figure 2. *Interaction analysis between raters and the scores given to instructional materials*

Qualitative Findings

The codes and themes comprising the qualitative findings were modeled using the NVivo analysis program and each resulting model was presented in figures. Relevant statements made by pre-service teachers were also included to support each theme.

Findings for the Sixth Secondary Aim

Figure 3 presents the themes and codes of the findings pertaining to which steps pre-service teachers had the most difficulty completing while developing their instructional materials.

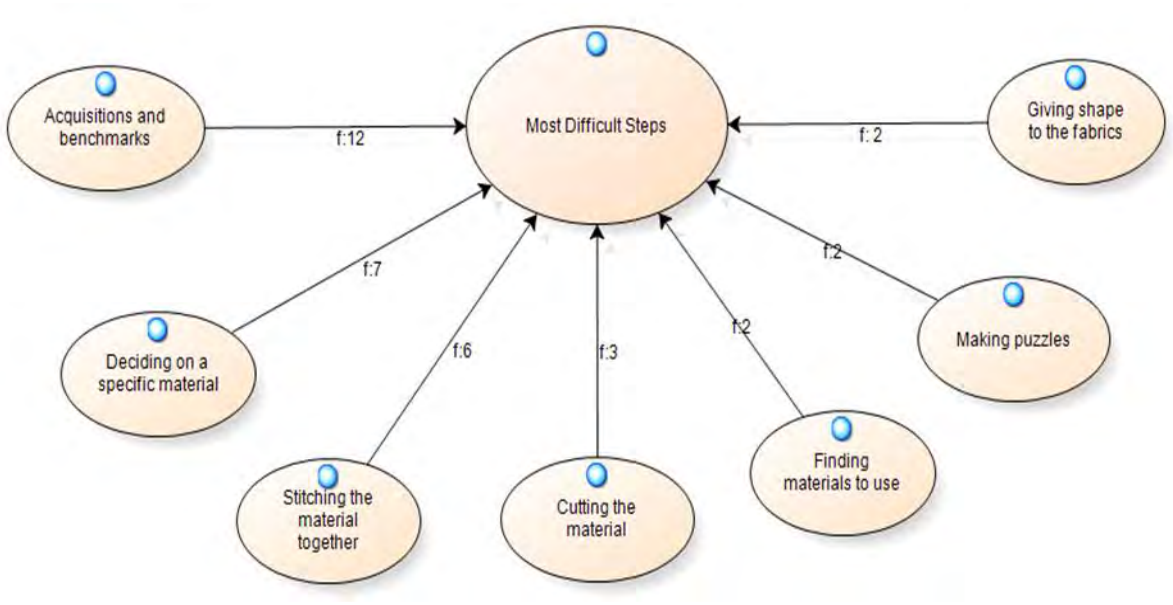

Figure 3. *Most difficult steps while developing instructional materials*

As seen in Figure 3, the areas in which pre-service teachers had the most difficulty while developing their instructional materials were: acquisitions and benchmarks (f:10), deciding on a specific material (f:7), and stitching the material together (f:6). They also had difficulty cutting the material (f:3), finding materials to use (f:2), and giving shape to the fabrics (f:2). Relevant statements made by pre-service teachers include the following:-

> The difficult thing was deciding what we were going to do and which acquisitions we were going to focus on. After coming up with a mental plan, it was pretty easy to bring it to fruition. (S_4)

> We had difficulties deciding which acquisitions and benchmarks we were going to use while trying to come up with a material suitable to our objectives. Every acquisition and benchmark that we wrote down was chosen with the utmost of care. (S_7)

Findings for the Seventh Secondary Aim

Figure 4 presents the codes and themes making up pre-service teachers' opinions concerning materials' durability and practicality.

Figure 4 illustrates how pre-service teachers addressed their instructional materials' durability and practicality, including stitching materials together (f:8), ensuring that the material is durable (f:8), using adhesive material (f:4), and using thick felt (f:3). Pre-service teachers additionally stated to have attempted to use different techniques to strengthen their materials, such as using poster board (f:2), using silicon (f:2), testing the material on the ground (f:1), and using fabric (f:1). Several of the pre-service teachers (i.e., S_3 S_{19} , S_{22} and S_{25}) expressed opinions regarding this subject:

> I wanted to make sure that the instructional material we were going to make would be durable over the long term, and so I was careful to select more resilient, sturdy, and stronger materials. (S_3)

After deciding to construct a puzzle, we then decided to use tongue depressors so that it would be more durable. We used glue as an adhesive. That way, the pictures were attached more securely and the puzzle was able to be used multiple times without receiving damage. (S_{19})

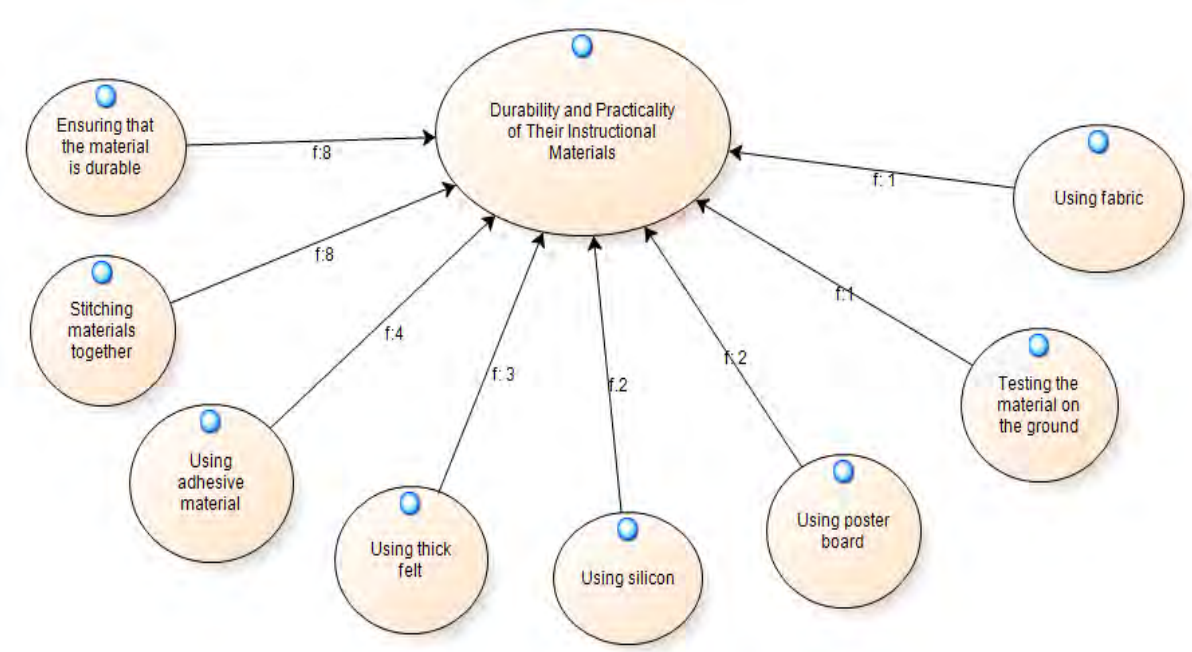

Figure 4. *Pre-service teachers' opinions regarding the durability and practicality of their instructional materials*

Findings for Eighth Secondary Aim

Figure 5 shows the codes and themes comprising pre-service teachers' opinions regarding the development of their instructional materials.

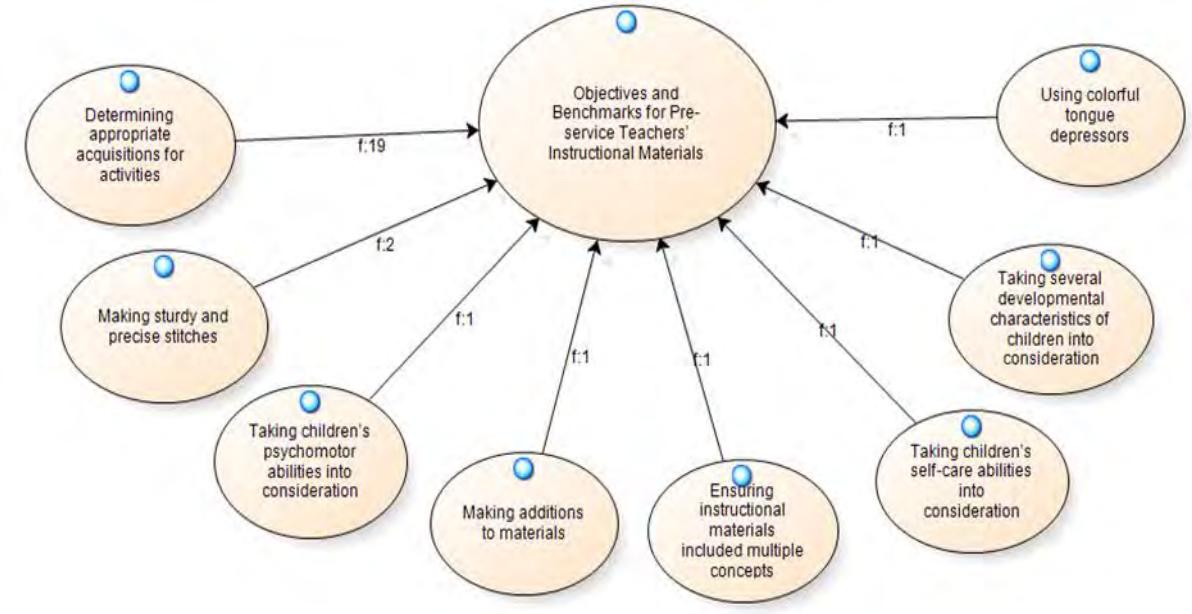

Figure 5. *Objectives and benchmarks for pre-service teachers' instructional Materials*

Figure 5 reveals that in terms of aims and benchmarks, pre-service teachers paid the most attention to ensuring that appropriate acquisitions were determined for activities (f:19). They also mentioned the

following aims and benchmarks during interviews: making additions to materials (f:2), using colorful tongue depressors (f:1), taking children's self-care abilities into consideration (f:1), making sturdy and precise stitches (f:1), ensuring instructional materials included multiple concepts (f:1), taking children's psychomotor abilities into consideration (f:1), and taking several developmental characteristics of children into consideration (f:1). Several of the pre-service teachers (i.e., S_2, S_4, S_{13}, and S_{27}) expressed relevant opinions pertaining to this subject:

> Following curricular objectives and benchmarks, we first of all determined the acquisitions we wanted to impart on students and tried to design our instructional material accordingly. We decided to focus on self-care abilities. We also tried to design an instructional material that would be beneficial to students with special needs. (S_2)

> Before we began using objectives and benchmarks to design our instructional material, we needed to ensure our target acquisitions were level appropriate. So we produced an age-appropriate puzzle stuffed with polyester fiberfill on which numbers and shapes made out of fabric were to be matched. After that, we stitched the numbers and shapes onto the puzzle pieces so that they could be matched. (S_4)

Findings for the Ninth Secondary Aim

Figure 6 shows the codes and themes comprising pre-service teachers' opinions regarding the appropriateness of instructional materials for students.

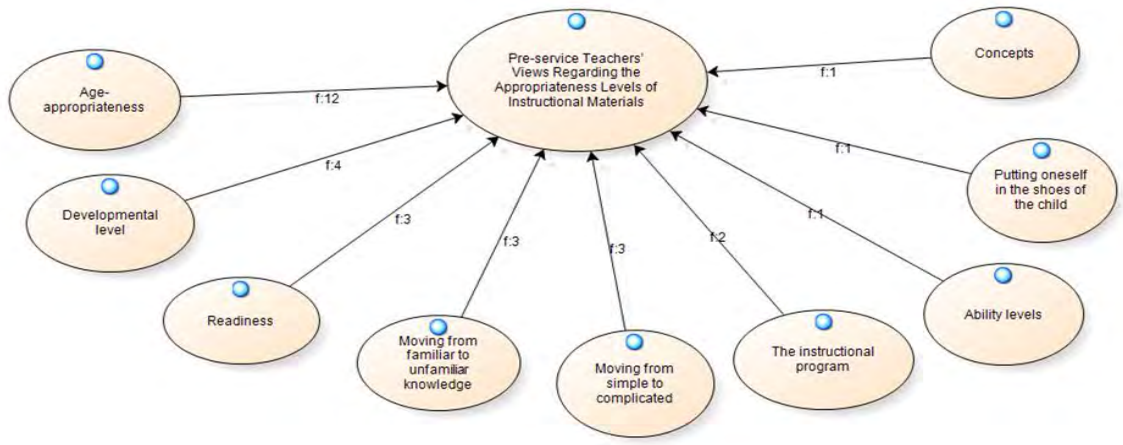

Figure 6. *Pre-service teachers' views regarding the appropriateness levels of instructional materials*

Figure 6 reveals that the majority of pre-service teachers stated to have focused on whether the instructional material were age appropriate (f:12). Following this, they stated having paid attention to children's developmental levels (f:4), readiness (f:3) , and ability level (f: 1). Other principles mentioned were moving from the familiar to the unfamiliar (f:2) and from basic to complicated (f:1). Pre-service teachers also expressed that they used concepts (f:1) and the instructional program (f:1) to base whether or not their instructional materials were appropriate for students. Several pre-service teachers (i.e., S_6, S_{19}, S_{21}, and S_{27}) expressed relevant opinions pertaining to this particular subject:

> We scanned through a lot of different resources. In addition to doing this, we sat down and discussed whether the instructional material was appropriate to students' level of development. We additionally tested the instructional material on three groups of children of different age groups and then determined a specific age group. (S_{21})

> We used contrasting colors that would attract students' attention. As for the numbers, we used numbers that they knew. We touched on several objects that they have encountered

in real life. In general, we based our approach on the principle of moving from the familiar to the unfamiliar. (S_{27})

Findings for the Tenth Secondary Aim

Figure 7 shows the codes and themes regarding which steps pre-service teachers completed with the greatest ease while developing their instructional materials.

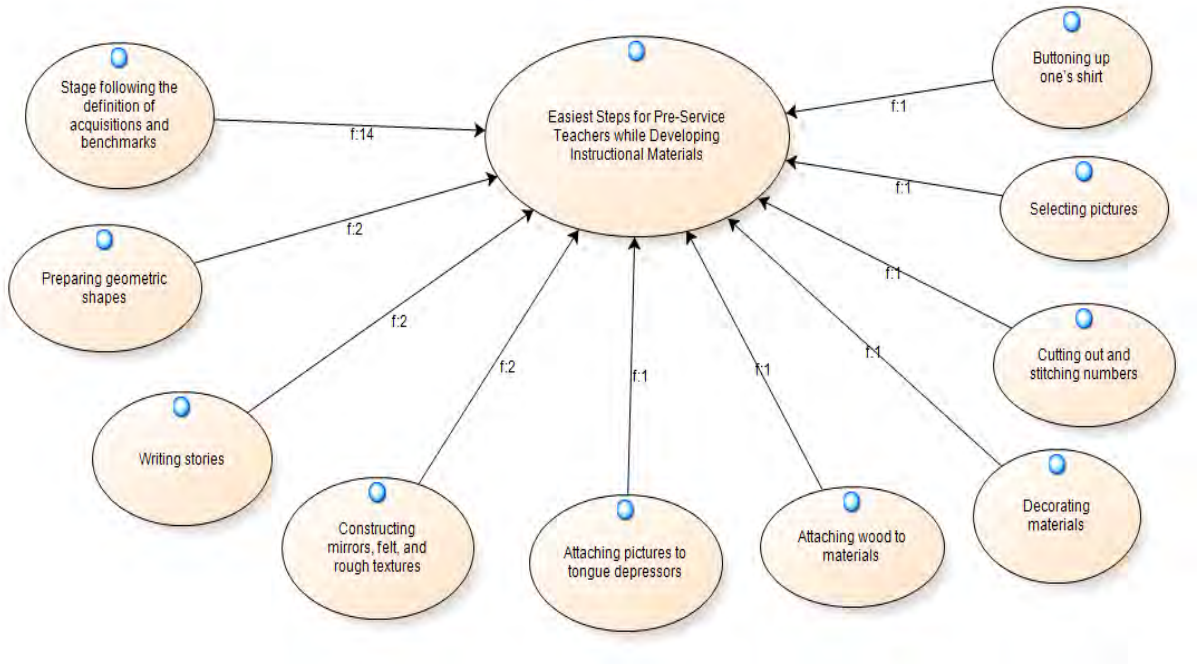

Figure 7. *Easiest steps for pre-service teachers while developing instructional materials*

Figure 7 reveals that the easiest step for the majority of pre-service teachers was the stage following the definition of acquisitions and benchmarks (f:14). Some pre-service teachers also mentioned that developing geometric shapes (f:2), writing stories (f:2), and constructing mirrors, felt, and rough textures (f:2) were easily completed. In addition to these, several pre-service teachers stated that buttoning up one's shirt (f:1), attaching wood to instructional materials (f:1), attaching pictures to tongue depressors (f:1), cutting out and stitching numbers (f:1), and decorating materials (f:1) were among the easier steps. Several pre-service teachers (i.e., S_3, S_7, S_{11}, and S_{17}) expressed relevant opinions with regard to this subject:

> There wasn't really any stage that I had difficulty while dealing with the instructional material. After determining what we should do, all of the subsequent steps that we followed while developing the instructional material were easy. (S_7)

> It was drawing and cutting the shapes that we were going to sew or glue on to fabrics so that students would be able learn the skill desired of them by using our instructional material. (S_{17})

Findings for the Eleventh Secondary Aim

Figure 8 shows the codes and themes that made up pre-service teachers' views about using innovative techniques in developing their instructional materials.

Figure 8 reveals that pre-service teachers expressed having used several innovative techniques while developing their instructional materials. For example, several mentioned adding sound effects (f:6), increasing the number of activities (f:5), adding seasons and numbers (f:2). Other innovative techniques mentioned by pre-service teachers were using wooden materials instead fabric and felt (f:1), adding different stories (f:1), using hand-drawn pictures (f:1), adding songs, stories, and fables

(f:1), adding extra story cards (f:1), introducing numbers (f:1), increasing the among of numbers (f:1), and adding clouds or stars (f:1). Pre-service teachers S_4, S_{15}, S_{19}, and S_{26} made the following statements in regard to their use of innovative techniques on their instructional materials:

> We could have prepared small activities where awards were handed out to those students able to open the cube up and, by opening it up, to complete all the activities on its surface. (S_4)

Were I to make any additions, I would have designed an activity after teaching children the planets where they would use some scrap materials to make their own planets and then attach them to the pieces of wood instead of giving them pre-printed pictures. (S_{19})

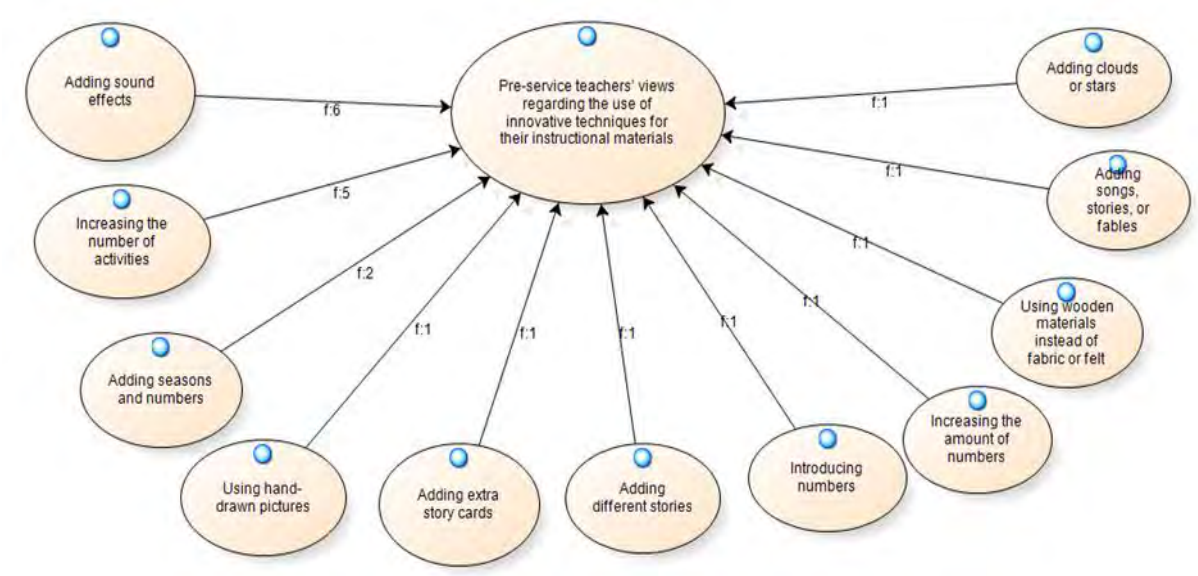

Figure 8. *Pre-service teachers' views regarding the use of innovative techniques for their instructional materials*

4. Conclusion

In this study, it is evaluated the instructional materials that pre-service teachers enrolled in the Preschool Education Department developed as part of their Instructional Technologies and Materials Development course. Taking as basis both the raters' severity/generosity and the *Instructional Materials Evaluation Form*, pre-service teachers' instructional materials were determined using the MFRM. In addition, it is attempted to shed light on pre-service teachers' opinions toward their instructional materials using semi-structured interviews and non-leading questions. The study's findings reveal that instructional materials P_4 and P_2 were the most and least successful materials developed, receiving scores of 940 and 774 from raters, respectively. Likewise, rater J_{16} was the most severe, and J_4 the most generous in assigning scores to the instructional materials.

Another noteworthy element of the study is that the criteria used to evaluate instructional materials were themselves assessed by pre-service teachers in terms of ease and difficulty of completion. An examination of the study's findings reveals that pre-service teachers had the most difficulty fulfilling the two criteria of *depth* and *innovativeness*. These findings are directly related to certain acquisitions and benchmarks of the instructional materials in question. In short, these findings support the qualitative data attained in the study, which reveal that pre-service teachers had the most difficulty determining the acquisitions, benchmarks, and specific materials they wanted to use while developing their instructional materials. Findings of other studies conducted with pre-service teachers from other departments support this finding (Bektas, Nalcaci, & Ercoskun, 2009; Calısoglu, 2015). Highlighting this point, Alım (2007) asserts that while pre-service teachers learn theoretical knowledge, like the place and importance of their instructional technologies and material development course within the greater instructional process, they are not provided with ample examples of use. One of the basic principles in the effective selection and preparation of instructional materials is that they be able to facilitate the behavior sought to be fostered (Alkan, 1996; Nalcaci and Ercoskun, 2005; Tekmen,

2016). Instructional aims and teacher attitudes impact the classroom materials in the learning environment (Yalın, 2017). Instructional materials should support the cognitive, affective, and psychomotor skills sought to be imparted during classroom procedures (Tekmen, 2016) and should also held to render learning permanent (Yalın, 2002; Simsek, 2002). That assert here that pre-service teachers have difficulty defining the cognitive, affective, and psychomotor skills made use of by students while developing their instructional materials. It is, however, possible for pre-service teachers to identify acquisitions and benchmarks appropriate to students' levels by offering their students the opportunity to examine and administer a wide variety of example instructional materials during this specific course (McKean, 2001). The two criteria that pre-service teachers had the least difficulty fulfilling were making their instructional materials both *meaningful* and in line with *desired behaviors*.

That the study's quantitative findings emerged in the manner they did indicates that pre-service teachers had difficulty determining target acquisitions and benchmarks, demonstrating that they were able to determine appropriate instructional materials for a variety of students' skills (cognitive, affective, and psychomotor) and further determine target behaviors with these materials. In other words, the fact that pre-service teachers strove to ensure their instructional materials included appropriate target behaviors can be interpreted as their awareness as to how such materials aid in the development of students' cognitive, affective, and psychomotor skills. This specific notion is further supported by the study's qualitative findings. Pre-service teachers stated that the easiest step of the process was the step following the identification of target acquisitions and benchmarks. The pre-service teachers furthermore stated that they were careful to consider students' age, readiness, and level of development while developing their instructional materials. In light of these findings, it may state that although pre-service teachers had difficulties assigning target acquisitions and benchmarks, they acted in a conscious and careful manner.

Pre-service teachers were observed to have difficulties defining target acquisitions and benchmarks while developing their instructional materials. As such, it is recommended that instructors present more examples of instructional materials in this course and allow pre-service teachers to test the materials themselves by performing their own administrations of them. In addition to this, since the scope of this study was limited to three facets (i.e., criteria, instructional materials, and raters), a fourth facet, namely instructors, could be added in future research.

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Authors

Serdar ARCAGOK, Canakkale Onsekiz Mart University, Education, Faculty of Education, Turkey, e-mail: serdar_arcagok21, ORCID ID: 0000-0002-4937- 3268.

Durmuş OZBASI, Canakkale Onsekiz Mart University, Education, Faculty of Education, Turkey, e-mail: : dozbasi@comu.edu.tr, ORCID ID: 0000-0001-5078-477X.