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PSYCHOMETRIC PARAMETERS OF THE TURKISH VERSION OF THE AFFECTIVE AND COGNITIVE MEASURE OF EMPATHY (ACME)

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Abstract
The concept of empathy, which consists of both affective and cognitive elements, is defined as replacing the other side and understanding their feelings and thoughts. In this study, it was aimed to adapt the Affective and Cognitive Empathy Scale, which was developed in order to measure empathy concept more comprehensively, in Turkish. In line with this goal, the validity and reliability study of the scale was conducted on 289 university students. Affective and Cognitive Empathy Scale, Basic Empathy Scale and Altruism Scale were applied to students and the scores obtained from these scales were used. Confirmatory factor analysis conducted in the study showed that the fit indexes were among the acceptable values and the three-factor structure of the scale was also valid in this study group. Within the scope of the scale's reliability study, Cronbach alpha internal consistency coefficient was calculated as .91. The internal consistency coefficients of the sub-dimensions of the scale ranged between .86 in cognitive empathy, affective resonance .85, and affective dissonance .84. According to the results of the analysis conducted for similar scale validity, there was no significant relationship between the Affective and Cognitive Empathy Scale with the Basic Empathy Scale, while there was a positive and low negative relationship between the sub-dimensions of the Basic Empathy Scale and the emotional empathy. It was also observed that there was a significant relationship between the Altruism Scale and sub-dimensions of the Affective and Cognitive Empathy Scale and helping and philanthropy**.** In addition, there are both significant and non-significant relationships between the sub-dimensions of the Affective and Cognitive Empathy Scale and the sub-dimensions of the Basic Empathy Scale. Finally, it was observed that there was no significant relationship between the Baseline Empathy Scale, which is two similar scales, and the Altruism Scale and its sub-dimensions. It was determined that cognitive empathy, which is the sub-dimension of the Basic Empathy Scale, has a significant relationship with the Altruism Scale and its sub-dimensions. In summary, the results of the study showed that the Turkish version of the Affective and Cognitive Empathy Scale is a valid and reliable measurement tool for university students.

Keywords: Empathy, Cognitive empathy, Affective resonance, Affective dissonance, Validity, Reliability.

INTRODUCTION

The word empathy is derived from the Greek work *έμπάθεια* (empatheia), meaning affection, suffering, passion, and ambition (Plutchik, 1990). This concept was expressed in German as *Einfühlung* near the end of the 19th century and was translated into English as empathy in the field of experimental psychology (Wispé, 1986). Various definitions have been proposed for empathy over the years. Dökmen (2004), for example, defines empathy as when a person places himself in the position of another, looks at events from his perspective, correctly understands the other person's feelings and thoughts, and then communicates this to the other person. Eisenberg and Strayer (1987) describe empathy as a reaction that is given in response to another person's emotional and cognitive state or condition and that is similar to what the other person actually feels. In light of these definitions, empathy is to place oneself temporarily in the life of another and, while living this life, to understand the other person's current condition without making any judgments about the person.

Empathy is composed of mutually interacting cognitive and affective elements (Chlopan, McCain, Carbonell, & Hagen, 1985). Whereas empathy's cognitive dimension refers to one's ability to understand another person emotionally, the affective dimension concerns one's ability to feel the other's emotions and to offer the most appropriate response for the other person's specific emotional state (de Kemp, Overbeek, de Wied, Engels, & Scholte, 2007; de Wied, Goudena, & Matthys, 2005). The common point in both dimensions is to understand the other person, regardless as to whether this understanding be an emotional or mental understanding.

Empathy prevents antisocial behaviors while simultaneously facilitating socialization (Jolliffe & Farrington, 2004). Individuals with high levels of empathy are able to ease the pains of others through their use of cognitive and affective empathy while also preventing behaviors that are detrimental to oneself and others. Individuals with low levels of empathy, however, have the potential to harm others around them. For this reason, individuals with a predisposition to crime, individuals exhibiting characteristics of antisocial behavior, and individuals who have committed acts of violence or rape are considered to have low levels of empathy (Miller & Eisenberg, 1988). In addition to this, empathy plays a key role in the identification of certain syndromes found in the Diagnostic and Statistical Manual of Mental Disorders, like behavioral disorders, antisocial personality disorder, and narcissistic personality disorder have (DSM-V; American Psychiatric Association, 2013). In fact, low empathy constitutes the essence of all of the personality disorders found in Section III of the DSM-V.

The current knowledge base on the concept of empathy demonstrates that an individual's ability to make use of empathic skills throughout daily life is essential in developing positive feelings, attitudes, and cognitive structures toward other living beings (Dökmen, 2003). The effective use of empathic skills helps one solve potential interpersonal conflicts by prevent different communication problems from emerging while also causing the least amount of harm to oneself and others (Ersoy & Köşger, 2016). It is believed that at the very core of the problems faced by individuals is their inability to make effective use of empathic skills. Accordingly, empathic skills are considered fundamental in people's ability to comprehend each other, as it is through these very skills that people are able even to make social compromises (Genç & Kalafat, 2010). Furthermore, Elikesik (2013) states that individuals with high levels of empathy give greater importance to protecting the environment, meaning that individuals with high empathic skills use them not only in their social relationships but also in the interactions with nature.

Studies seeking to regulate personal and social life by boosting the empathy levels of individuals with low empathy are conducted with diverse groups, and even more particularly with individuals who have committed crimes in the past (Hare & Neumann, 2008). Educational programs designed to boost empathy levels may therefore be used as treatment tools with individuals who have been sent to rehabilitation centers for acts of theft or sexual assault (Marshall, 1999). In fact, roughly 500 million dollars are spent each year in the USA on programs seeking to rehabilitate convicted sexual offenders (McGrath, Cumming, Burchard, Zeoli, & Ellerby, 2010). In addition to this, empathy is a central

concept in violence-prevention curricula and programs designed for primary school students (Grossman et al., 1997; Şahin & Akbaba, 2010), in anger management programs developed for adolescents (Pecukonis, 1990), and in programs aiming to prevent domestic violence (Fruzzetti & Levensky, 2000).

It is important to develop and adapt scales measuring individuals' empathy levels in order to determine individuals' empathy levels and then to facilitate subsequent educational programs for individuals with low empathy levels. With this end in mind, our study aims to adapt the Affective and Cognitive Measure of Empathy (ACME) developed by Vachon and Lynam (2015) to measure young adults' empathy levels. A review of the literature reveals that several scales measuring different dimensions of empathy have already been adapted to Turkish. Among these are the Cognitive, Affective, and Somatic Empathy Scales (CASES) for Children adapted by Güzel, Tok, and Güney (2019), the Basic Empathy Scale adapted by Topçu, Erdur-Baker, and Çapa-Aydın (2010), and the Empathy Quotient Scale adapted by Kaya and Çolakoğlu (2015). The difference between these scales and ACME is that ACME addresses empathy through a wider range of sub-dimensions, namely through cognitive empathy, affective resonance (e.g., empathy, sympathy, compassion), and affective dissonance (e.g., sadism, scorn, *schadenfreude*). Cognitive empathy means to understand how another person feels in the face of an event or past experience (Staub, 1987). Affective resonance refers to sharing one's feelings with others and exhibiting the appropriate response to their emotional state (Seara-Cardoso, Sebastian, Viding, & Roiser, 2016). Affective dissonance, however, means to exhibit or experience a conflicting, instead of an appropriate affective response. Taking pleasure in others' pains or feeling discomfort at others' happiness are examples of affective dissonance (Vachon & Lynam, 2015). In short, the constructs measured by ACME expound on these three concepts.

As it aims to measure three different dimensions of young adults' empathy levels, we expect the Turkish adaptation of this scale to help researchers evaluate young adults' cognitive empathy, affective resonance, and affective dissonance levels. Since our research deals with the scale's psychological parameters for samples in a Turkish context, we expect this scale may to be used in future studies.

METHOD

Sample

The sample consisted of students enrolled in Marmara University and Istanbul Sabahattin Zaim University, both of which are located in Istanbul, Turkey. Of the total 289 students included in the sample, 187 (64.7%) were females and 102 (35.3%) were males. Two 30-person groups, each composed of 16 females (53.3%) and 14 males (46.7%), were formed to ascertain test-retest reliability and linguistic equivalence. Participants were explained the scope of the research and gave their verbal consent; only then was data collected on a voluntary basis.

Data Collection Tools

Personal Information Form

We distributed the Personal Information Form to solicit more detailed information of the study's sample. Using this form, we collected demographic information of the participants, which included students' sex, year of study, and perceived socioeconomic level.

Affective and Cognitive Measure of Empathy

The Affective and Cognitive Measure of Empathy (ACME) was developed by Vachon and Lynam (2015) to measure participants' affective and cognitive levels. This scale allows the researcher to determine individuals' empathy levels in a more comprehensive manner by exploring three separate dimensions of empathy. While developing the scale, we first created a 126-item pool and calculated factor loadings affecting total variance. Following an analysis of the findings, a great many items were removed, which ultimately resulted in a 36-item scale composed of three sub-dimensions (i.e., cognitive empathy, affective resonance, and affective dissonance). Each sub-dimension contained a

total of twelve 5-point Likert items (1-Strongly disagree, 2-Disagree, 3-Neither agree nor disagree, 4-Agree, 5-Strongly agree). A high score in any of the sub-dimensions indicated a strong level of empathy in that particular area. The minimum and maximum scores obtainable on the scale are 12 and 60, respectively. The scale contains 22 reverse-scored items. Cronbach's alpha was calculated to determine the scale's reliability. With regard to Cronbach's alpha coefficients for the sub-dimensions of the original scale created by Vachon and Lynam (2015), cognitive empathy coefficient scored .90, affective resonance .87, and affective dissonance .87. These findings indicate that the reliability coefficients calculated for the original scale are close to those found in this study.

Basic Empathy Scale

Composed of twenty 5-point (1-Strongly Disagree, 5-Strongly Agree) items and two sub-dimensions (i.e., affective empathy and cognitive empathy), this scale was developed by Jolliffe and Farrington (2006) to measure individuals' empathy levels, and was adapted to Turkish by Topçu et al. (2010) in a study conducted with 717 participants. Possible scores on this scale ranged from 20 to 100. Whereas cognitive empathy included nine items, affective empathy included eleven. The confirmatory factor analysis (CFA) conducted during said adaptation revealed there to be a satisfactory fit between the model and data. In their own study, Jollifee and Farrington (2006) found Cronbach's alpha coefficients for the two sub-dimensions of affective empathy and cognitive empathy to be .76 and .80, respectively. Yet, we found the coefficients for the same two sub-dimensions to be .68 and .72, respectively.

Altruism Scale

This 20-item, 5-point Likert (1-Never, 5-Always) scale was developed by Rushton, Chrisjohn, and Fekken (1981). Possible scores on the Altruism Scale ranged from 20 to 100, with a high score indicating a high level of altruism. The original version of the scale included a single factor with no reverse-scored items. This scale was adapted to Turkish by Tekeş and Hasta (2015), who, as a result of their adaptation study conducted with 282 participants, found the adapted scale to contain two distinct factors that explained 35.58% of the total variance. The two sub-dimensions of this scale were helping and philanthropy. The CFA conducted during said adaptation revealed model fit to be satisfactory. With regard to reliability, whereas Rushton et al. (1981) found Cronbach's alpha coefficient to be .84 for the entire scale, .81 for helping, and .70 for philanthropy, we found Cronbach's alpha to be .81 for helping and .64 for philanthropy.

Data Collection and Analysis

Following translation and back translation, five field experts with PhDs in psychological counseling and guidance reviewed the resulting product and shared their opinions in order to help bring the adapted text to its final form. First, the researchers translated the scale from its original English into the target language (i.e., Turkish). The resulting text was then retranslated back into English, after which other specialists compared the two English versions. After establishing that the two forms resembled each other, the Turkish version was examined by a Turkish specialist, who then determined the scale to be suitable for use.

Despite the scale's theoretic base, various statistical analyses needed to be performed to prove its validity and reliability (DeVellis, 2014). As a result, data were collected during the 2019-2020 academic year from university students to identify the scale's psychometric parameters. During this period, participants were provided information about the nature of the research in question, verbal consent was sought, and those who declined to give their consent were excluded from the study.

The normality assumption was examined using the total points earned on ACME's sub-dimensions. The analyses conducted revealed the data to be normally distributed (Kolmogorov Smirnov, $p \geq .05$). Since outliers were found among the data, we calculated Mahalanobis distance value and, using a significance level of 0.001 (Büyüköztürk, 2016), were able to remove three outliers. Before subjecting data to a CFA however, we first examined the factor loadings of each item included in the scale and removed any unsuitable measurements from the data set. After completing all pre-analysis

procedures, we conducted a CFA and a t-test analysis for independent samples and calculated Pearson's correlation coefficient. We used SPSS and Mplus to conduct our analyses.

FINDINGS

The findings obtained in this study are mentioned in the following section. Specifically, findings pertaining to linguistic equivalency, structure validity, convergent validity, and reliability are subsequently discussed.

Linguistic Equivalence

Both the original English and Turkish versions of ACME were implemented with thirty participants proficient in both Turkish and English at an interval of two weeks. We calculated Pearson's correlation coefficient separately for each of the scale's sub-dimensions to determine the relationship between the two versions of the scale and performed a t-test to test whether a significant difference existed in terms of linguistic equivalency. Table 1 depicts the findings for Pearson's correlation coefficients and Table 2 illustrates the findings for the t-test analyses conducted during the course of our study.

Table 1: Pearson's Correlation Coefficient Analysis Results for the Relationship between the Original and Turkish Versions

	N	$\overline{X}$	***s.s.***	***r***
Cognitive Empathy–Turkish version	30	43.40	4.85	.50
Cognitive Empathy–English version	30	43.63	5.90	
Affective Resonance–Turkish version	30	52.10	5.00	.49
Affective Resonance–English version	30	51.40	4.52	
Affective Dissonance–Turkish version	30	53.17	4.96	.65
Affective Dissonance–English version	30	53.40	4.11	

$p \leq .05$

Table 1 reveals there to be a meaningful relationship between the scores obtained on the sub-dimensions of the English and Turkish versions of ACME (r^2 = .25, r^2 = .24, r^2 = .42; $p \leq .05$), indicating that the two scales are equivalent.

Table 2: Findings Obtained From the *t*-Test Analysis for Linguistic Equivalence

	$\overline{X}$	***s.s.***	***t***	***p***
Cognitive Empathy Turkish version	-.23	5.51	-.23	.82
Cognitive Empathy English version				
Affective Resonance Turkish version	.70	4.79	.80	.43
Affective Resonance English version				
Affective Dissonance Turkish version	-.23	3.88	-.32	.74
Affective Dissonance English version				

$p \geq .05$

Table 2 illustrates that the Turkish and English versions of the scale are equivalent. No significant difference was found ($p \geq .05$) between the Turkish and English versions of ACME.

Structure Validity

Using a structural equivalence model, we examined how well items represented factors included in the scale's three sub-dimensions (i.e., cognitive empathy, affective resonance, and affective dissonance). Table 3 illustrates the goodness-of-fit (GFI) indices obtained through the CFA conducted on the sub-dimensions of ACME.

Table 3: GFI Indices Obtained Through the CFA for ACME

Structural models	χ^2	Sd	χ^2/sd	TLI	CFI	RMSEA	SRMR
Model 1 Level-1	1441.969	591	2.43	0.79	0.80	0.07	0.07
Model 2 Level-1 Items and Errors were correlated	1278.821	588	2.17	0.83	0.84	0.06	0.06

As illustrated in Table 3, the CFA results indicated unsatisfactory fit between the model and data (χ^2 = 1441.97, p = .000, sd = 591, χ^2/sd = 2.43, TLI = .79, CFI = .80, RMSEA = .07, SRMR = .07). However, the literature suggests correlating items' error covariances to obtain a smaller chi-square value and that such correlation can be performed to strengthen and enhance the model (Çapık, 2014). As such, we conducted a second CFA after correlating the error covariances for items 10 and 11, items 29 and 30, and items 33, the results of which showed that the chi-square coefficient decreased by 163.15 points compared to the original model. In addition to this reduced chi-square value, correlating said items' error covariances also resulted in an increase in GFI indices (χ^2 = 1278.82, p = .000, sd = 588, χ^2/sd = 2.17, TLI = .83, CFI = .84, RMSEA = .06, SRMR= .06). Taking these findings into account, Figure 1 depicts the standardized item estimates belonging to the structural model of ACME.

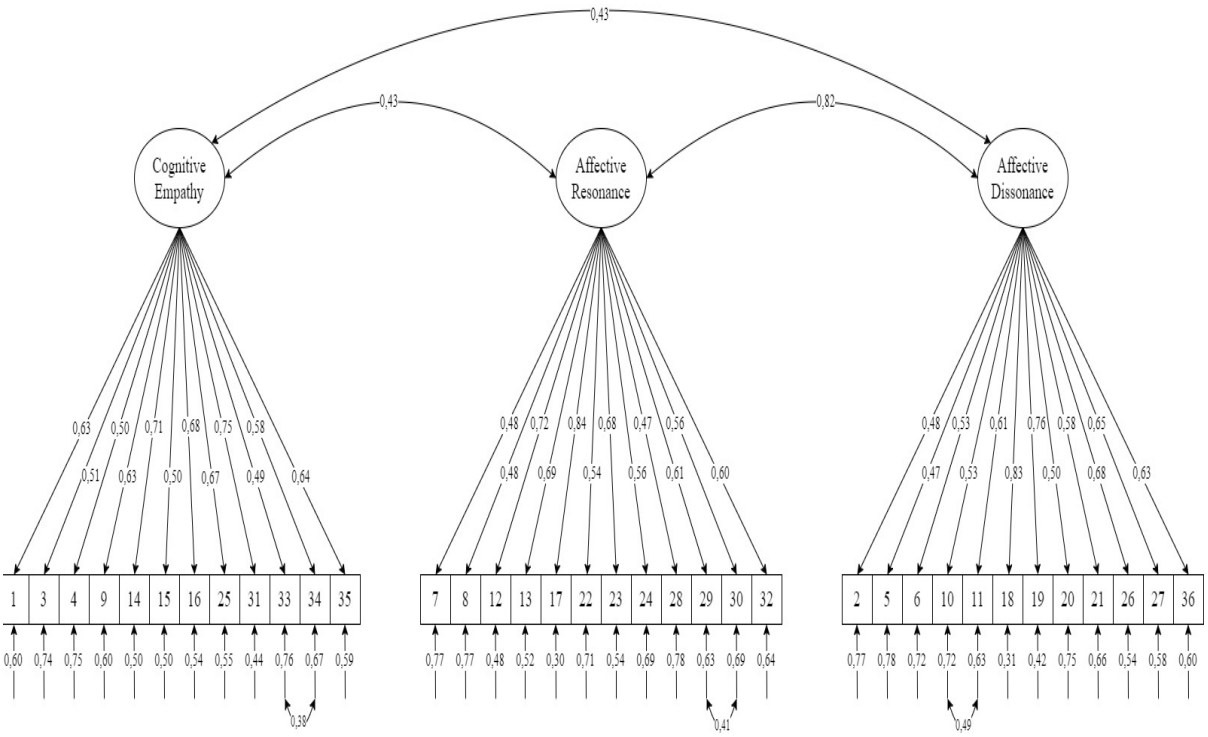

Figure 1: CFA Diagram for ACME

The CFA results reveal that each of the items included in ACME's three factors (i.e., cognitive empathy, affective resonance, affective dissonance) are statistically meaningful parameter predictors ($p \leq .05$). These findings show that the predictive value of cognitive empathy varied between .49 and .75 that of affective resonance varied between .47 and .84, and that that of affective dissonance varied between .47 and .83. Items with a predictive value of .30 or greater indicated adequate representation power (Büyüköztürk, 2018). Moreover, after correlating the error covariances for items 33 and 34, items 29 and 30, and items 10 and 11 included in cognitive empathy, we attained correlation coefficients of .38 , .41, and .49, respectively. In short, the CFA results indicated satisfactory model fit.

Convergent Validity

While calculating scale validity for ACME, we benefited from similar scales whose validity and reliability had already been established in previous studies, namely the Basic Empathy Scale and the Altruism Scale. The relationships between the total scores for these two scales and their sub-dimensions and those for ACME and its three sub-dimensions (i.e., cognitive empathy, affective resonance, and affective dissonance) were analyzed to determine convergent scale validity, the results of which are given in Table 4.

Table 4: ACME and Its Sub-Dimensions Compared with Similar Scales

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
ACME (1)									
Cognitive empathy (2)	.70*								
Affective resonance (3)	.84*	.35*							
Affective dissonance (4)	.81*	.29*	.62*						
Basic Empathy (5)	-.03	-.05	.14*	-.18*					
Basic Cognitive empathy (6)	.17*	.10	.22*	.09	.63*				
Basic Affective empathy (7)	-.14*	-.06	.02	-.30*	.87*	.17*			
Altruism (8)	.34*	.29*	.30*	.22*	.12	.23*	.00		
Helping (9)	.33*	.27*	.28*	.22*	.11	.22*	-.00	.96*	
Philanthropy (10)	.28*	.24*	.26*	.17*	.11	.18*	.01	.82*	.61*

*$p \leq .05$

Prior to calculating Pearson's correlation coefficients, we performed several tests to assure that certain assumptions were valid. First, we examined the distribution's skewness and kurtosis to test whether data were indeed normally distributed. The normality test conducted found the skewness and kurtosis values of the ACME's sub-dimensions and of the two similar scales used as comparisons to be within normal range (between -1.96 and +1.96). Moreover, the results of the Kolmogorov-Smirnov test indicated that the null hypothesis was rejected ($p \geq .05$). After verifying the assumptions were valid, we conducted our correlation analyses. Whereas we found no meaningful relationship between ACME and the Basic Empathy Scale, ACME did have a low, positive relationship ($r^2 = .03$) with the cognitive empathy sub-dimension of the Basic Empathy Scale and a low, negative relationship ($r^2 = .02$) with the affective empathy sub-dimension of the same scale. Moreover, ACME had a positive relationship both with the Altruism Scale itself and with its two sub-dimensions of helping and philanthropy ($r^2 = .12$, $r^2 = .11$, $r^2 = .08$). Moreover, ACME had both meaningful and meaningless relationships with the sub-dimensions of the Basic Empathy Scale. All of these findings are given in Table 4. With regard to the two other scales analyzed in this study, only the cognitive empathy sub-dimension of the Basic

Empathy Scale was found to have a meaningful relationship with the Altruism Scale and its sub-dimensions (r^2 = .05, r^2 = .05, r^2 = .03).

Reliability

To determine the reliability of ACME, we conducted a separate test-retest for each of the three sub-dimensions in addition to calculating Cronbach's alpha for the scale and its sub-dimensions. Cronbach's alpha for the entire scale was .91 whereas it was .86 for cognitive empathy, .85 for affective resonance, and .84 for affective dissonance. The test-retest findings may be seen in Table 5.

As seen in Table 5, after conducting a test-retest study to measure the scale's ability to provide consistent scores over time, the findings reveal there to be no statistically meaningful difference between the pre- and post-test. In light of all of the above findings, we can safely say that ACME is a reliable measurement tool.

Table 5: Findings of the *t*-Test Evaluating Test–Retest Reliability

	$\bar{X}$	*s.s.*	*t*	*p*
Cognitive Empathy Pre-test	46.00	4.59	1.93	.06
Cognitive Empathy Post-test	44.87	5.65		
Affective Resonance Pre-test	49.77	6.91	1.92	.07
Affective Resonance Post-test	48.90	7.67		
Affective Dissonance Pre-test	49.97	9.80	1.00	.32
Affective Dissonance Post-test	49.00	9.89		

$p \geq .05$

DISCUSSION, CONCLUSION, AND RECOMMENDATIONS

According to Eisenberg and Strayer (1987), empathy, being the means through which one is able to respond to another's emotional situation and cognitive state, is one of the most heavily studied concepts in the fields of psychology and psychological counseling. Previous studies have found that empathy predicts marital adjustment (Kışlak & Çabukça, 2002), that empathy and philanthropy are related in a meaningful manner (Ulus, 2015), that aggression decreases as empathic tendency increases (Özgökman, 2019), that empathic tendency and anger management are related in a positive, meaningful manner (Öztürk, 2019), and that empathy is negatively related with both aggressive behavior and bullying (Gini, Albiero, Benelli, & Altoe, 2007; Loudin, Loukas, & Robinson, 2003). In addition to these concepts, the relationships between empathy and an array of other variables were also examined. A wide variety of scales have been developed and adapted for use in studies seeking to measure individuals' empathy levels and to analyze empathy's relationship with diverse variables (Vachon & Lynam, 2015; Güzel et al., 2019; Topçu et al., 2010; Kaya & Çolakoğlu, 2015). Despite there being different instruments measuring empathy in the literature, Vachon and Lynam (2015) developed ACME, a scale able to offer a more comprehensive explanation of empathy by addressing its different dimensions. In the current study, we have aimed to adapt ACME to Turkish and then to test the resulting Turkish version of the scale in a Turkish cultural context. As a result of our rigorous translation efforts, we are able to present a useable Turkish version of this scale.

Prior to conducting a CFA to verify the three-factor structure of the original version, we needed to ensure that the sample size was adequate. For this, Kline (2015) states that the sample size should be at least ten times greater than the total number of items included in the scale or that a minimum of 200 participants be included in the sample. Since the sample was determined to be adequate, we

subjected the data to a CFA, as it is an effective statistical technique allowing researchers to measure model fit (Jackson, Gillaspy, & Purc-Stephenson, 2009). For model fit to be considered adequate, fit index values must be either good or satisfactory, with a GFI and CFI score of .90 or greater indicating good model fit (Çokluk, Şekercioğlu, & Büyüköztürk, 2014; Şimşek, 2007; Tabachnick & Fidell, 2012). In other words, the fit indices obtained ranged from 0 to 1, with acceptability increasing as values approach 1 (Çapık, 2014; Wang & Wang, 2012). Moreover, RMSEA and SRMR values of .05 and smaller indicate good fit whereas values of .08 and smaller indicate acceptable fit (Keith, 2019). We used the above-mentioned fit indices to determine model fitness in this study in addition to conducting a CFA to test the fitness of the three-factor model. The findings showed the fit indices to be within acceptable values and that the scale's three-factor structure was valid for the study group with whom this research was conducted.

While evaluating scale validity, we examined the relationships between ACME, the Basic Empathy Scale, and the Altruism Scale and the scores for these scales in their entirety and for their sub-dimensions. Altruism included several positive social behaviors, such as helping, taking responsibility, and philanthropy. Example altruistic behaviors include donating blood, displaying bravery during war or other conflicts, citizens' willingness to pay takes that serve to benefit others, sharing, generosity, volunteer work in non-profit organizations, donating money to charities, and organ donation (Onatır, 2008; Ümmet, Ekşi, & Otrar, 2013). Accordingly, the concepts of helping and philanthropy were used to measure altruism in this scale. We calculated Pearson's correlation coefficient to ascertain scale validity and compared our findings with those of other studies in the literature. The findings of Avcı, Aydın, and Özbaşaran (2013), whose study was conducted with 218 nursing students, supported our finding showing there to be a statistically meaningful, positive relationship between empathic tendency and altruism. In his study conducted with 402 pre-service teachers, Duru (2002) similarly found there to be a meaningful, positive relationship between empathy and helping. In their study with 112 psychology students, Burks, Youll, and Durtschi (2012) found there to be a meaningful, positive relationship between empathy and altruism. We can therefore safely say that our findings are generally consistent with those found in the literature.

While testing the scale's reliability, we calculated Cronbach's alpha and the test-retest reliability coefficient. To measure test-retest reliability, we implemented the scale again with the same group of participants two weeks after its initial implementation. The results revealed there to be no statistically meaningful difference between the pre- and post-test, indicating that the scale was reliable. The threshold point of Cronbach's alpha in the literature is generally considered to be .60 (Karasar, 2009; Şimşek, 2007). Since Cronbach's alpha was found to be above .60 in our study, the scale's reliability was established. Moreover, the fact that Cronbach's alpha for both the original version of the scale is similar with that of our adaptation further demonstrates scale reliability.

This study does have its limitations, however. One such limitation is the possibility that participants gave answers that they thought were desired of them and that did not represent reality. Another limitation is that the students participating in this study stemmed mostly from middle and upper socioeconomic classes. It is therefore important that future studies include students from lower socioeconomic levels in order to increase generalizability of the study's findings. Moreover, since we collected data from university students to evaluate the validity and reliability of both the original version developed by Vachon and Lynam (2015) and the Turkish adaptation, we recommend that future studies test this scale on different samples. We believe that this study will make a valuable contribution to the literature since it evaluates how well this scale was adapted to Turkish in addition to the Turkish version's psychometric parameters. This scale will allow future studies conducted with university students in a Turkish cultural context to measure empathy empirically and can likewise be used in a great many future studies that measure empathy. In conclusion, all of these findings have proven ACME to be a valid and reliable measurement tool for university students in Turkey.

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Appendix

(1) Kesinlikle katılmıyorum, **(2)** Katılmıyorum, **(3)** Kararsızım, **(4)** Katılıyorum, **(5)** Tamamen katılıyorum.

Maddeler	1	2	3	4	5
1. İnsanların duygularını anlamakta zorlanırım.					
2. İnsanların üzerine gitmenin eğlenceli olduğunu düşünürüm.					
3. Birisi korktuğu zaman anlayabilirim.					
4. İnsanlar mutlu gibi görünmeye çalıştıklarında bu bellidir.					
5. İnsanların sinirlenmesini izlemeyi severim.					
6. Yabancı insanların korktuğunu görmekten hoşlanırım.					
7. Muhtaç/yoksul birisine yardım etmek bana iyi hissettirir.					
8. Birisine hoşlanacağını düşündüğüm bir hediye verdiğimde heyecanlanırım.					
9. İnsanların hislerinin altında yatan nedenleri genellikle anlarım.					
10. Arkadaşlarım güzel vakit geçirdiklerinde sıklıkla sinirlenirim.					
11. Neşeli insanlar beni tiksindirir.					
12. İnsanların duygularını incitmeyi dert edinmem.					
13. Diğer insanların mutlu olup olmamasını gerçekten önemsemiyorum.					
14. Birisinin neler hissettiğini anlamakta zorlanırım.					
15. İnsanların çileden çıkmak üzere olduğunu anlayabilirim.					
16. Genelde birinin nasıl hissedeceğini tahmin edebilirim.					
17. İnsanların üzgün olup olmadığını gerçekten de umursamam.					
18. Diğer insanları huzursuz etmeyi severim.					
19. Diğer insanları aptal gibi hissettirmekten zevk alırım.					
20. Arkadaşlarım sinirlendiğinde genellikle gülesim gelir.					
21. Bazen insanları ağlarken görmekten zevk alırım.					
22. Diğer insanların duyguları beni hiç rahatsız etmez.					
23. Birisinin duygularını incittiğimde çok kötü hissederim.					
24. Diğer insanların yaşadığı talihsizlikler beni çok rahatsız etmez.					
25. Genellikle insanların nasıl hissettiklerini söyleyebilirim.					

26. Bazen insanların aşağılandığını görmek eğlencelidir.					
27. Eğer cezalandırılmayacağımı bilsem, canını acıtmaktan zevk alacağım bazı insanlar var.					
28. Eğer birisini üzen/inciten bir şey yapıyor olduğumu görürsem, hemen onu yapmayı bırakırım.					
29. İnsanlar üzgün olduklarında sıklıkla kendilerini daha iyi hissetmeleri için çaba harcarım.					
30. Diğerlerini mutlu etmekten keyif alırım.					
31. Diğer insanların duygularını anlamada iyi değilimdir.					
32. İnsanlar duygusuz olduğumu söylemektedir.					
33. Birisini neyin kızdırıyor olduğunu genellikle tahmin edebilirim.					
34. İnsanlar üzgün olduğunda bunu bana söylemek zorunda değil, üzgün olduklarını yüzlerinde görebilirim.					
35. Bir insan üzgün olduğunda bunu anlamak benim için zor.					
36. Diğer insanları sinirlendirmekten hoşlandığımı kabul ediyorum.					

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VISUAL IMAGES RELATED TO ANGLE CONCEPT IN THE 5TH GRADE MATHS COURSEBOOKS

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Abstract
There are different perspectives in the literature on the examination of visual images used in course books. In this study, illustrations from the visuals used in geometry in the lower learning area of school mathematics were examined and summarized first by researchers and then by teachers and students. For many students, the mathematics coursebook is the first material they encounter in understanding the course content and conveying the mathematics culture. In this study, the illustrations related to the concept of Angle used in mathematics coursebook, two books published abroad, two books published in Turkey, for 5th grade students were analyzed. The type of research is Document Analysis and the illustrations were examined in qualitative and quantitative terms. In this way, the study aimed to analyze the contribution of illustrations in mathematics education to the conceptualization ofgeometrical definitions through the coursebook and the contribution and effect of improving geometrical thinking. Results of the study showed that illustrations for the field of mathematics that are in coursebooks must include an algebraic representation.

Keywords: 5th Grade Mathematics textbook, Angle Concept, Virtual images.

INTRODUCTION

Geometry deals with mental beings (geometric figures) with conceptual and shapely characters (Fischbein, 1993). Concepts and images are considered to be fundamentally different categories of mental being. Pieron (1957; as cited in Fischbein, 1993) defines a concept as a symbolic representation (almost always verbal) used in the process of abstract thinking and expresses that it has a general significance corresponding to a concrete collection of representations about what they have in common. Mental imagery is mental representations of visual/ spatial information involving the physical properties of represented events and objects, but not identical to them are exemplary representations (Shepard, 1978). For example, an angle is an abstract ideal concept, but it also has figural properties. In fact, although we find many different angle contexts, the absolute perfection of a geometric angle cannot actually be found.

Fujito, Jones, and Yamamoto (2004) say that geometric figures, as they cited from Fischbein, can be related to the harmony between formal and conceptual constraints of successful reasoning in geometry. They argue that in order to be a successful problem-solver in geometry, one must develop skills in the following subjects, based on the idea that mental structures with conceptual and formal characteristics can be represented.
* Creating and changing geometric figures in mind,
* Detecting geometric features,
* Associating images with concepts and theorems in geometry, and
* Deciding where and how to start when solving problems in geometry.

Mathematics coursebooks are one of the basic elements used in the development of research and inquiry skills. Paintings, photographs, and illustrations are used in secondary school coursebooks. This situation has left teachers with interpretations of these paintings, photographs, and illustrations, as well as graphical representations.

Visualizing angles has the potential to inform and build students and teachers about the concept. The angle is the second variable we use after the concept of distance in school mathematics. It is the

concept that advances to see the length of the circle. If students use imagery to represent spatial and visual information, imagery should be closely related to educational content that contains concrete objects. In geometry, imagery can be applied by mental rotations. Illustrated images improve students' learning from texts (Carney and Levin, 2002).

The illustration is described as painting, that is, the painting that describes or decorates an article in a book. The iconography, which is 'illustration' in English, is the picture describing the subject with its shortest opening. A drawing that draws attention to the object rather than the shape is its art. Its purpose is to help explain and understand a subject, rather than art. It is to create a conceptual image on the subject.

For this purpose, , graphic representations of angle with photography and illustration were examined in four Mathematics coursebooks, two Mathematics coursebooks published in Singapore and Australia, two in Turkey used in secondary schools. In this regard, it was focused on what is the understanding of teachers and 5th-grade students about illustrations. Photographic and graphical representations were not dealt with.

In relation to the development of the concept of angle, OX and OY rays, whose starting point is common, divides the plane into two regions with respect to the process perspective, each of which is called an angle, and is an object of mathematics. Unless otherwise stated, the inner region between the rays is taken. The term representation refers to both the process and the concrete object or somehow expresses a mathematical concept or relationship and the act of understanding the form itself "(NCTM, 2000, p. 67). So representation is an important part of mathematical activity and is a tool for understanding mathematical concepts (Goldin & Shteingold, 2001). Different illustrations (eg representations can help students understand a function as a process; illustrative illustrations help students understand a function in concrete terms. Therefore, it is important to firmly understand these two perspectives (Clement and Battista, 1989) and use appropriate illustrations in different contexts (Cuoco, 2001; NCTM, 2000; 2009).

The data for this study were collected through 12 illustrations related to the angle in four 5th grade coursebooks, two from abroad, and two from our country. The books are the ones published by the Mone in Turkey and the countries that are listed in the ranking of successful countries in international examinations, one of which was published by the Mone in 2018 and the other which was used in 1974. Inductive content analysis was used to determine the frequency of observable features in notations..

Research Problem

1. How are the angle-related illustrations in class coursebooks in our country and abroad in terms of accuracy, connectivity (attribution), clarity, and contextuality according to Kim (2018)'s classification?
2. What are the teachers ' views about the illustrations in 5th-grade coursebooks in our country and abroad?
3. How do the 5th grade students view the illustrations in the coursebooks mentioned?
4. Play roles to help students understand the concept of angle. For example, algebraic?

METHOD

Research Model

The conceptual framework of the research's data is stated in Table 1 and Table 2. According to this framework, each illustration used in geometry and sub-areas of learning measurement in the 5th-grade mathematics coursebooks, 2 from Turkey and 2 from abroad (Australia - Singapore), was collected from the teachers as "should be corrected, can be used, insufficient" and asking for an explanation for its reason. Likewise, according to each of the "Accuracy, Attribution, Clarity, Contextuality" analysis, it was evaluated (0; not suitable, 1; acceptable, 2; suitable) separately

(according to the criteria given in Table 2) and coded. Data were collected by a document review technique. The document review technique involves the analysis of written texts containing the fact or facts targeted in the research (Yıldırım & Şimşek, 2008).

Data Collection Tools and Data Analysis

Table 1: Criteria Regarding Teachers' Opinions About the Angle in 5th Grade Coursebook

Illustrations About the Angle	Point	Criteria	Explanation
Rating	2	Should be corrected	
	1	Can be used	
	0	Insufficient	

Table 2: Criteria for Analysis of Illustrations Related to Angle in 5th Grade Coursebook (Kim, 2012).

Status of Visual Items	**Point**	**Criteria**
Accuracy	**2**	A non-text element accurately describes the definition of a concept or is correct to show a concept based on its definition.
	1	A non-text element is meaningful in terms of the definition or meaning of a concept. However, it does not show every required mathematical situation (eg some necessary notations are missing or misleading) or some features are not suitable for explaining a concept.
	0	A non-text element is wrong for the definition of a concept (for example, it has a pronounced error). Or an inappropriate realistic object is used to present a concept. There is a big mistake or concern for using the realistic object or context for a concept. There is no mathematical concept for a non-text element.
Connectivity	**2**	A non-text element is clearly and exactly related to the mathematical content in the text. It indicates a direct concept or problem.
	1	A non-text partly relates to mathematical content in the text. A non-text item has some missing or irrelevant information. It shows the content, but not clear how it depends on the content.
	0	A non-text element has nothing to do with mathematical content. It can give some clues about the context in the texts (for example, the river when the problem is related to the length of the river).
Clarity	**2**	A non-textual element is simple to illustrate a concept or problem without any distractions or other factors.
	1	A non-text element is simple to illustrate a concept or problem with some other factors that may be useful for the concept.
	0	A non-text element has distractions or other factors that are useless in addition to the factors required to represent a concept or problem.
Contextualities	**2**	A non-text element uses a realistic object or context with a mathematical link.
	1	There are no mathematical ideas or concepts, but there is some realistic contextual information (this is used to provide context or objects to problems or to facilitate related activities).
	0	There is no real object or realistic content in the non-text item.

This assessment was made independently by a mathematics educator and a specialist teacher who went on to a doctorate. These evaluations were later calculated as the percentage of agreement suggested by Miles and Huberman (1994), namely reliability (Reliability = Consensus / (Consensus +

Disagreement). This percentage of agreement among the researchers was first calculated at 91.6%. Disagreeable points were identified and discussed and the consensus was reached.

Table 3: Criteria for Analysis of Illustrations Related to Angle in 5th Grade Coursebook (Kim, 2012).

Analysis of the visual element	Illustrations
Accuracy	**1.08**
Connectivity	**1.66**
Clarity	**1.66**
Contextualities	**1.91**

RESULTS

The illustrations in the books are 12. And 11 (eleven) are qualitative, except 1 (one). In one, only the measurement of the angle was used. 19 secondary school math teachers participated in the study. The feedback from the teachers has been in written form. They used the scores for the illustrations but did not make much of an explanation for the illustration in the desired descriptions column.

Table 4: Teachers' Views on Illustrations Used in Mathematics Coursebooks Geometry and Measurement Sub-Learning Area

Country	Visual Item	Can be used (2)		Should be corrected (1)		Insufficient (0)	
		f	%	f	%	f	%
Australia	İ1	15	78,9	4	21,1	-	-
	İ2	13	68,4	6	31,6	-	-
	İ3	13	68,4	5	26,3	1	5,3
Singapour	İ4	11	57,9	6	31,6	2	10,5
	İ5	15	78,9	3	15,8	1	5,3
	İ6	15	78,9	3	15,8	1	5,3
	İ7	13	68,4	5	26,3	1	5,3
2018 MONE Turkey	İ8	7	36,8	7	36,8	5	26,4
	İ9	17	89,5	2	10,5	-	-
	İ10	7	36,8	8	42,1	4	21,1
1974 MONE Turkey	İ11	14	73,7	3	15,8	2	10,5
	İ12	10	52,6	8	42,1	1	5,3

I1 coded illustration is the top left and top view of a table. Teachers (78.9%) said the I1-coded illustration in the book published in Australia could be used. It is teachers (21.1%) who say it should be corrected. Although the picture shows the angle between the two Rays in terms of accuracy and the counterclockwise direction as the rotation, no algebraic representation representing the angle was used. T3 (see. Table 4) interpreted the angle at the corner of the table as an acute angle according to its appearance.

Table 5 Students' Views on I1 Coded Illustration Used in Geometry and Measurement Sub-Learning Field in Mathematics Coursebooks

S1	It would be better if the right angle put a point here, and if it made the table like this, it would be better to give a bird's eye view. Since it is a beam, it is formed by combining two rays.
S2	There's a right angle here. It looks like a crooked table, not looking upright. But if some don't understand, they might call it an acute angle.
S3	They tried to show an angle, acute angle. There is an angle sign, but some students may not understand it. They could draw the table with the arrows to make it more effective.

S4	I understand this as a right angle to the corner of the table. It is among the things we use in daily life

In the I2 coded representation, the hour and over seconds representation, the angles between the hour and minute hands have been used to measure the angle in the opposite direction of the clock. When using the watch in angle notation, we can think of moving (dynamic) representation. All four books were used as illustrations. The percentage of teachers who say it should be corrected is 31.6%. It is seen that all students (See table 5) adopt the clock as a prototype in the concept of angle.

Table 6 Students' Views on I2 Code Illustration Used in Mathematics Coursebooks Geometry and Measurement Sub-Learning Area

S1	It is easier to explain the obtuse angle here, the beautiful angles here with hours. Our primary school teacher used to tell it like that. It is logical to tell with time, with a scorpion and minute hand.
S2	There is an obtuse angle in the picture. I think it may seem good. It is easy to understand that it is an obtuse angle.
S3	it's like an obtuse angle, I can't understand it because I can't measure it right now, but it should be an obtuse angle. It shows the angle and its arms are clear. So, the picture of the clock is a proper one.
S4	The second picture looks like an obtuse angle to me. They could have given it more clearly. In a way that we can understand even more. Like at the table.

For the angle coded between the ceiling and roof of a house (here, the slope can be considered) in the i3 coded illustration, teachers used the correction with 26.3%, and there was 1 teacher (5.3%) who said it was inadequate. Teachers did not provide explanations and justification for their statements that should only be corrected, sufficient, and inadequate. They stated that they did not use the coursebooks much. The students found the house illustration complicated. They wanted the shape to be a little simpler (see table 6).

Table 7 Students' Opinions about İ3 Code Illustration Used in Mathematics Coursebooks Geometry and Measurement Sub Learning Area

S1	Acute angle. It could have been a simpler visual. There are other examples of this part of the house. We need to delete unnecessary things.
S2	It may be appropriate for an acute angle.
S3	I beg your sorry. It seemed different to me. Why does this show the angle that a better picture could have been put in its place? Maybe, the kids can understand the angle between the two.
S4	there is an acute angle, so the room is fine because it's illustrated.

In the coursebook published in Singapore, teachers (57.9%) said that they can be used for I4 coded illustrations. It is the teachers (31.6%) who say it should be corrected. The teachers who say "not enough" are (10,5). In the illustration, a curved tablet was used on a ground and there was an indication that it can be considered as an angle, there was an angle indicator, but the arrow indicating the direction of rotation of the angle was not used. No algebraic representation representing the angle was used in this illustration. An intuition for measuring the angle wasn't developed. The students also described this illustration as complex (See table 7).

Table 8 Students' Opinions about I4 Coded Illustration Used in Mathematics Coursebooks Geometry and Measurement Sub Learning Area

S1	Acute angle. This is an obtuse angle, and this is an acute angle. It is confusing. There is a straight angle, too.
S2	There is an acute angle on the right and an obtuse angle on the left. So it looks like what's put on the canvases. It is not very good, just medium.

S3	I think there are two angles. I think it's beautiful like the watch. I see one acute angle and one obtuse angle.
S4	He showed the acute angle over there, and the obtuse angle over there. It seemed a little more complicated to me. It could point directly at a single angle. it is not clear. We also don't understand what this object is.

Teachers (78.9%) said that they could be used in the I5 coded illustrations. It is the teachers (15.8%) who say it should be corrected. The teachers who said it was inadequate was (5,83). The angle between the hour and minute hands on the watch was shown using the concept of a beam, but again without the concept of direction. The line is drawn at 12 o'clock and 6 o'clock were presented with three different angles that made up the perigon, and again the measurement of the angle and the variable role of this measurement were neglected. The inner and outer region of the angle, the direction to take the inner region, and the relationship that would reveal the dynamic direction of the angle, unless stated otherwise, were expressed in three unknowns instead of the emphasis on creating a reflexive with the inner and outer region. The students agreed to use watches as prototypes (see table 8).

Table 9 Students' Views on I5 Coded Illustration Used in Mathematics Coursebooks Geometry and Measurement Sub-Learning Area

S1	Here, a straight angle, an acute angle, and an obtuse angle. It can actually be difficult to describe three angles in one place, so it could be easier if it were two or more. It would be wrong to show them all at once.
S2	There is one obtuse angle, then there are acute angles at twelve completed hours. There is one right angle.
S3	I think it was aimed to show a right angle on the watch, but they drew one line because, besides the arrows, there is one angle of 180 degrees and even three angles. I think there is an angle here. What if the line was a little more clear, which is second.
S4	There is an obtuse angle. There's one straight angle there. There's a round angle over there. It showed different angles. I think it's beautiful.

In the I6 coded representation, for scissors used daily, teachers (78.9%) said it could be used, (15.8) should be corrected, and (5.83) insufficient. In this demonstration, no determinations were made to show the quantitative direction of the angle. With the open state of the scissors and two intersecting lines on it, it is desired to create an angle concept in the mind of the student. We avoid such determinations that we would call analogy in mathematics lessons. The students found the scissors sample effective (See table 9).

Table 10: Students' Views on I6 Code Illustration Used in Mathematics Coursebooks Geometry and Measurement Sub-Learning Area

S1	There are two acute angels if I am not wrong. I think there is the right angle from the crosses. To use the scissors is something useful.
S2	Acute angle. There is one on the back and one in the end. There are two obtuse angles here. The obtuse angle from right, an acute angle from left is not very suitable. The line does not appear, but it can be seen if they put it.
S3	They asked both the angle here and the angle there. Four angles
S4	There is an acute angle of scissors over there. That's an obtuse angle. The scissors attracted my attention more.

In the I7 coded illustration, the feet of a table is presented as an angle representation. In this illustration, teachers (68.4%) said that it could be used while teachers (26.34%) said it should be corrected. The teachers who said it was insufficient were (5,83%). It is an illustration on a table foot with a slope that presents angles that produce a correct angle that does not use algebraic notation,

such as in the case of scissors. In this image, teachers should only be corrected, they did not bring explanation and justification to their statements as it should just be corrected, it is sufficient and it is insufficient. Students wanted to give simpler examples in this illustration, which presents the concept of wholes tried to be explained on the feet of the table (see table 10).

Table 11: Students' Views on I7 Code Illustration Used in Mathematics Coursebooks Geometry and Measurement Sub-Learning Area

S1	Actually, it may be difficult for us. It is hard to grasp the table, to understand that there is a line here, so what is there, they can put something a little simpler. They gave some difficult examples, it would be better if they gave simpler examples from daily life.
S2	The obtuse angle from the right and acute angle from left are not very suitable.
S3	They did not put an angle indicator either. It would be more descriptive if they put an angle sign.
S4	This showed that it was an obtuse angle. If we close here, this acute angle becomes obtuse angle. it sounded a little complicated.

In the coursebook published in Turkey, teachers (36.8%) said that i8 coded illustration can be used. It is teachers (36.8%) who say it should be corrected. It is teachers (26,4) who say it is insufficient. In the illustration, cars standing in a parking lot and the way cars park in the area upright and oblique, and the angle between them emphasizes the quantitative direction 45^ ^ 0. The angle is statically there. There is a measurement of the angle, but the direction of rotation of the angle was not used. The algebraic notation representing the angle was not used in this illustration either. An intuition for the measurement of the angle was developed. Students interpreted this picture as an acute angle and 45 degrees in a quantitative way. They tried to relate it to everyday life (see. Table 11).

Table 12: Students' Views on I8 Code Illustration Used in Mathematics Coursebooks Geometry and Measurement Sub-Learning Area

S1	From daily life, the car is 45 degrees when leaving the park.
S2	Cars are at an acute angle. I think it might be appropriate because the shape they created seems to be so. They understand easily.
S3	There is one acute angle. Is that just to make it stand out? I wonder if it means that maybe 45 degrees make it easier to park.
S4	There is one acute angle here. They made it according to the positions of the cars. The existence of roads and vehicles is also different and I am interested in daily life.

Teachers (89.5%) said that they can be used in the illustrations with code I9. It is the teachers (10.5%) who say it should be corrected. The angle between the hour and minute hands on the watch wants to express obtuse, acute, and right angles with two half-lines without showing the direction and measurement without using the concept of the beam. The inner region and outer region of the angle tried to intuitively express the relationship that would reveal the inner side of the angle and the dynamic direction of the angle unless otherwise stated. The perigon angle was not highlighted. In this picture, which explains the angle types over 3 hours, the students explained the ideas in accordance with the definitions in their minds as the first prototype for understanding the angle types of the students (see table 12).

Table 13: Students' Views on the I9 Code Illustration Used in Mathematics Coursebooks Geometry and Measurement Sub-Learning Area

S1	Obtuse angle acute angle, right angle. Right angle and they always draw like this. It would be better if the dot inside the square is at the right angles. One suspects quite a lot if they put it so.
S2	Obtuse angle, acute angle, right angle about clocks. Hours are easy to understand. They may be appropriate. It would be better understood if it went as a right angle.

S3	The clocks are suitable for me. There is an acute angle, an obtuse angle, and a right angle.
S4	Here is an acute angle like this. Same way over here.

It wants to develop the concept of angle based on intuition in a park environment in the I10 coded illustration. Teachers (36.8%) said that it can be used, (42.1) should be corrected, and (21.1) insufficient. Instead of intersecting lines, an intuition that can lead to the definition of curvature and curvature can be developed with this illustration. The students stated that they did not understand the illustration trying to explain the angles on the roads in a park (See table 13).

Table 14: Students' Views on I10 Coded Illustration Used in Mathematics Coursebooks Geometry and Measurement Sub-Learning Area

S1	I did not understand anything. In fact, this example was wrong. I do not understand.
S2	It is a bit complicated. They can not understand. it is difficult to understand.
S3	There may be an angle here or there can be an angle there. it is not understood. You don't know what it wants.
S4	Here is an acute angle like this. Same way over here. It is nice but not a good example from daily life.

Two illustrations were used in a mathematics coursebook approved by the ministry of education and published in Turkey in 1974. The illustration, code I11, is the angle created between the arms of a broken meter. Teachers (73.7%) said it could be used, (15,8) it needed to be corrected, and (10,5) inadequate. Angle was marked in the notation, direction and measurement were not specified. (See fig. table 14).

Table 15: Students' Views on I11 Coded Illustration Used in Mathematics Coursebooks Geometry and Measurement Sub-Learning Area

S1	Here, it explains the acute angle. Nobody is using those meters in daily life right now. Now there are more technological things. It was necessary to use the meter as t was broken very often.
S2	By using a ruler, an acute angel was formed. It is good.
S3	Acute angle. what is this ruler for?
S4	I did not understand much if a ruler was put. it is not clear.

The illustration, which has the code I12, attempts to intuitively describe the angle on the clock, as in the other three books. Although the region between the two rays is treated as thinking, the region is not marked and the measurement is not emphasized. (See fig. table 15).

Table 16: Students' Views on I12 Code Illustration Used in Mathematics Coursebooks Geometry and Measurement Sub-Learning Area

S1	Angles are right angle, acute angle obtuse angle, straight angle, and perigon. They give the exercises in the coursebook, Eighty percent of the exercises have answers right next to or on the other page. They answer whatever they say. There are very few exercises in the coursebook. So all teachers use smart notebooks or test books.
S2	It has also given some examples of clocks. There are right angles, acute angles, obtuse angles, perigon. It has given five angles. There are two arrows. In a row, perigon.
S3	They did not use the angle symbol here. Right angle, acute angle, straight angle. It can at 180 degrees or a perigon. It is related to illustrating. I couldn't understand where the other line is? Or is there just such a line? They are in a row. It can be 0 degrees.
S4	When describing fort he the first, it should be more understandable. There are right and acute, obtuse angle. This is a perigon. I couldn't understand that. The situation where the hour and minute hands overlap.

DISCUSSION AND CONCLUSION

The concept-oriented acquisition of the mathematics education program that was put into practice in 2018 in Turkey, is as follows: "M.5.2.1.4. It creates acute, right, and obtuse angles, referring to an angle of 90 °; determines whether a created angle is acute, right, or obtuse. a) Studies are done on checkered, dot paper, etc. b) When determining or creating angles, it may be required to use the corner of a paper, square or protractor as a reference. c) Angles are expressed by the name".

On the other hand, in 2018, the 4th grade curriculum, M.4.2.3.4. It determines the angles as acute, right, obtuse, and straight by measuring them with standard angle measuring tools. a) comparison is made by taking the right angle reference. b) when examining angle models, it is considered that they are not larger than the straight angle. For these reasons, the students also showed a straight angle in the illustrations. They were even able to speak of zero degrees and perigon. In fact, the students are from a high-economic secondary school in a major city. But even so, the consistency in the curriculum still needs to continue. The use of clock examples in four books is well thought out in terms of revealing the dynamic structure of the angle. In addition, it was determined that in the 2009 and 2013 educational programs published by MONE, the types of angles and contextual studies for obtaining the angles dynamically were not mentioned ln 5th grades and the straight angle and the perigon were not given in the program.

Schunk (2009) states that the most important concern in research on first sample theory is that they take up more space in long-term memory than rules as a result of storing thousands of first samples. The other concern is that individuals may create false first examples if they store non-identifying features, rather than useful ones. For this reason, the visuals in the book should also be discussed by the teacher and students.

In the study, students and teachers accepted high rates of illustrations in the concept of angle overclock. The clock appears to be a prototype adopted by students. It should not be overlooked in the studies that the watch forms a perigon as this prototype, for example, between 1-2 and 300 on the clock. It should be added to the acquisitions.

The clock in 12/360 is an important prototype. According to the classical theory approach (Gagne, 1985; Smith & Medin, 1981), it is stated that different examples of a concept should be remembered at the same speed because each example makes judgments about examples based on their distinctive qualities. However, this is not always the case. Many people find it more difficult to confirm some examples of a category (for example, the angle measured in degrees) than others (for example, the angle is also measured in radians in trigonometry). This highlights the problem that many concepts simply cannot be identified with a set of distinguishing features. The importance of teachers discussing illustrations with students is clear.

Illustrations in coursebooks can be used to improve students' learning. Verbal narrators and two-dimensional illustrations are used, but real models of shapes are much more useful in terms of efficiency in learning. In I12, it may be easier for students to understand the concept of angle with collapsible meters, for example, to allow them to make shapes in their hands. This example is manipulatively among the mathematics lesson tools in our schools. Highly qualified contextual problems can be created from the angle-related positions of the apparatus attached behind a tablet to stand on the table or a telephone apparatus standing on the table (example I4 in the Singapore mathematics coursebook). In this way the angle switches from static to dynamic. This is true within the hour used in I2, I5, i9, I12. Examples of manual skills, audiovisual devices, and educational tools such as computer graphics make learning easier. While concrete tools are arguably more important to younger children than they lack the cognitive capacity to think over abstract concepts, students of all ages benefit from information represented by multi-modes.

Today's cognitive computing theories offer valuable information to use in classrooms. One of them is mental imagery. While mental imagery is used in the representation of spatial knowledge, this imagery must be clearly understood in long-term memory. There are also individual differences in terms of vision and developmental periods. Long-term memory, according to Paivio, stores two types of information in the form of a verbal system that combines information expressed in a word and an imaging system that records visual-spatial information, and these are related to each other. There are verbal descriptions of video code in every 4 coursebooks, but contextually these cases are different from the conversion of verbal code into video Code. The visual code is used to represent concrete objects or events, while the verbal system is suited to abstract information. Verbal code in the use of representations from process skills in mathematics teaching should also be supported as algebraic notation. Binary code theory (functioning memory - long-term memory) means that concrete words can be explained by verbal and visual codes, while abstract words can only be explained verbally. During recall, people run both memory systems for concrete words but only the verbal system can be used for abstract words. The verbal system related to the concept of angle should be used in 5th class coursebooks.

That the algebraic expression of the angle (AOB) is supported by the use of (AOB) = 〖0〗^0=c as an unknown is perhaps a state that should be in geometry after algebraic expressions in 6th class but not used.

For this reason, the use of the angle related to the angle concept in the first unknown form should also be considered in illustrations. The keywords in the student-teacher interaction of these illustrations are name, draw, and label due to the structure of geometry. Similar research should be done in terms of other concepts related to geometry in coursebooks. Geometry is as much about algebra as it is about numbers and number sense. Research should also be continued in terms of these linked areas.

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Abbreviations

MONE : Ministry of National Education
S1 : Student 1
S2 : Student 2
S3 : Student 3
S4 : Student 4

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