

| Research Article / Araştırma Makalesi |

## An Investigation of Uncertainty Intolerance and Uncertainty Management Research in Educational Institutions: Meta-Analysis Study

### Eğitim Kurumlarında Belirsizlik Tahammülsüzlüğü ve Belirsizlik Yönetimi Araştırmalarının İncelenmesi: Meta Analiz Çalışması

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#### Keywords

1. Intolerance of uncertainty
2. Uncertainty management
3. Meta-Analysis
4. Teacher

#### Anahtar Kelimeler

1. Belirsizlik tahammülsüzlüğü
2. Belirsizlik Yönetimi
3. Meta-Analiz
4. Öğretmen

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#### Abstract

*Purpose:* In this meta-analysis study, it was aimed to analyze uncertainty intolerance and uncertainty management researches in educational institutions using meta-analysis method.

*Design/Methodology/Approach:* This research was carried out as a type of group comparison meta-analysis, which is one of the types of meta-analysis. In the meta-evaluation, eight studies that met the inclusion criteria were reached. By combining these studies, a study was conducted on 2704 sample groups. In determining the meta-analysis model type of the research, first a funnel plot diagram was drawn for a general impression of publication bias, and then statistical calculations were carried out to reach a real conclusion. As a result of the diagram and statistical calculations, it was decided that there was no publication bias in the studies included in the meta-analysis. After determining that there was no publication bias, heterogeneity test was performed for model selection.

*Findings:* As a result of the analysis, it was decided to interpret the meta-analysis according to the random effects model. Title and publication type were determined as moderators for heterogeneity. As a result of the meta-analysis, it was found that research into intolerance of uncertainty and uncertainty management in educational institutions had an average effect, the moderator effect of the theses was higher in the calculations regarding the moderator effect, and the titles of teachers and education administrators did not have any moderator effect in the title variable.

*Highlights:* It was seen that the number of empirical studies on uncertainty intolerance and uncertainty management in educational institutions was few. It was determined that the studies could not provide the big picture of uncertainty management, even the effect sizes of the studies were not calculated in any of the studies, and a statistical conclusion could not be reached on whether the teachers' intolerance of uncertainty and uncertainty management perceptions work in practice. Therefore, the need to synthesize results on the effectiveness of intolerance of uncertainty and uncertainty management research emerged.

#### Öz

*Çalışmanın Amacı:* Bu meta analiz çalışmasında, eğitim kurumlarında belirsizlik tahammülsüzlüğü ve belirsizlik yönetimi araştırmalarının meta analiz yöntemiyle incelenmesi amaçlanmıştır.

*Materyal ve Yöntem:* Bu araştırma meta analiz türlerinden grup karşılaştırma meta analiz türü olarak yürütülmüştür. Meta değerlendirmede araştırmaya dahil edilme kriterlerini sağlayan sekiz araştırmaya ulaşılmıştır. Bu araştırmaların birleştirilmesiyle 2704 örneklem grubu üzerinde çalışma yapılmıştır. Araştırmanın meta analiz model türünün tespitinde önce yayım yanlılığına ilişkin genel bir izlenim için funnel plot diyagramı çizilmiş daha sonra gerçek bir kanıya varabilmek için istatistiki hesaplamalar yapılmıştır. Diyagram ve istatistiki hesaplamalar sonucunda meta analize dahil edilen çalışmalarda yayım yanlılığının olmadığına karar verilmiştir. Yayım yanlılığının olmadığına saptanmasında sonra model seçimi için heterojenlik testi yapılmıştır.

*Bulgular:* Analiz sonucunda meta analiz rastlantısal etkiler modeline göre yorumlanmasına karar verilmiştir. Heterojenlik için moderatör olarak unvan ve yayım türü belirlenmiştir. Meta analiz sonucunda eğitim kurumlarında belirsizlik tahammülsüzlüğü ve belirsizlik yönetimi araştırmalarının ortalama bir etkiye sahip olduğu, moderatör etkiye ilişkin yapılan hesaplamalarda tezlerin moderatör etkisinin daha yüksek olduğu, unvan değişkeninde ise öğretmen ve eğitim yöneticisi unvanlarının herhangi bir moderatör etkisinin olmadığı bulgusuna ulaşılmıştır.

*Önemli Vurgular:* Eğitim kurumlarında belirsizlik tahammülsüzlüğü ve belirsizlik yönetimine ilişkin yapılan amprik çalışmaların sayısının çok az olduğu görülmüştür. Yapılan çalışmaların da belirsizlik yönetimine ilişkin büyük resmin görülmesini sağlayamadığı, hatta çalışmaların hiçbirinde çalışmalara ilişkin etki büyüklüklerinin hesaplanmadığı, öğretmenlerin belirsizliğe tahammülsüzlük ile belirsizlik yönetimi algılarının pratikte işe yarayıp yaramadığına ilişkin istatistiki olarak bir sonuçla yorumlanıp yargıya varılamadığı saptanmıştır. Bu nedenle belirsizliğe tahammülsüzlük ve belirsizlik yönetimi araştırmalarının etkililiğine ilişkin sonuçların sentezlenmesi ihtiyacı ortaya çıkmıştır.

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## INTRODUCTION

When traditional organization theories are examined, it will be seen that there is a relationship between the concept of rationality and the concept of uncertainty. Taylor aimed to eliminate organizational uncertainty and to make certainty dominant by introducing scientific management. Weber tried to present the organization clearly with his bureaucratic model. For this reason, uncertain processes contradict traditional organizational theories (McPhee & Zaugg, 2001). Uncertainty is a model that fits the contingency theory. In this context, it is necessary to consider the concept of uncertainty as a structure that reveals the relationship between organizations and their environments. Although today's technological infrastructure is getting stronger, not all technological infrastructure can offer us a planned life, but it also reveals many uncertainties (Campitt & Williams, 2004). It is seen that it is not easy to draw the framework of the knowledge, skills and working conditions required by the job in today's organizations. Since the individual is frequently exposed to situations such as lack of communication, blurred information, missing data, change, and transformation, the individual also tries to learn to struggle with these, and encounters many events that he/she cannot foresee in his work and private life (Lind & Van den Bos, 2002). The individual who encounters these events, called uncertainty, tries to manage or reduce them with creativity, initiative and using the current situations more effectively and efficiently (Küçükömrürler, 2017). There are some principles and ways to be followed in the process in order to manage uncertainty. According to Smithson (2008), one should first start with the understanding of uncertainty. Uncertainty must be identified, estimated, and quantified. It must then be reduced or eliminated, and then accepted or endure against uncertainty. Finally, it must be controlled or exploited. In this way, it was revealed how uncertainty was perceived by individuals. With the diversification of the reactions shown, uncertainty was tried to be managed by the decision makers.

In the literature, it is seen that strategies and methods belonging to different disciplines regarding the ways of coping with uncertainty have been developed, but since this research was carried out in the field of educational sciences, information on the ways of coping with this field was included. In the related literature, the concepts of "flexibility, planning scenarios, awareness of patterns, leading a guide, being resistant, being agile, strategic readiness, transparency, governance, cooperation, imitative transformation" were evaluated in the related literature. Organizations that develop and consciously increase the understanding of having a flexible approach are successful. Flexible planning of organizations against innovations, changes and uncertainties they encounter contributes to the growth and development of organizations (Syrett & Devine, 2014). Studies have also shown that maintaining the flexibility of organizations does not adversely affect their functional performance when faced with uncertainty (Silva & Ferreria, 2017). Therefore, organizations that adopt the understanding of flexibility learn to optimize the processes of achieving their work purpose and adapt in the face of unexpected events (Teece, Peteraf & Leih, 2016). Apart from the flexible approach, it is also important to establish patterns that guide employees and managers in organizations and strengthen awareness. According to Syrett & Devine (2014), establishing a pattern strengthens employee awareness. Managers and employees who cannot establish a pattern are likely to make mistakes in a large number of information flows. Social economic, political trends, developments in the markets, competitors, stakeholder status etc. In almost every situation we try to make sense of it. According to Gifford, Bobbitt & Slocum (1979), establishing a pattern reduces ambiguities and confusion. The establishment of patterns also serves as a guide to employees and managers about what existing knowledge means. Even decision-making managers can make rational decisions in cooperation thanks to the established patterns.

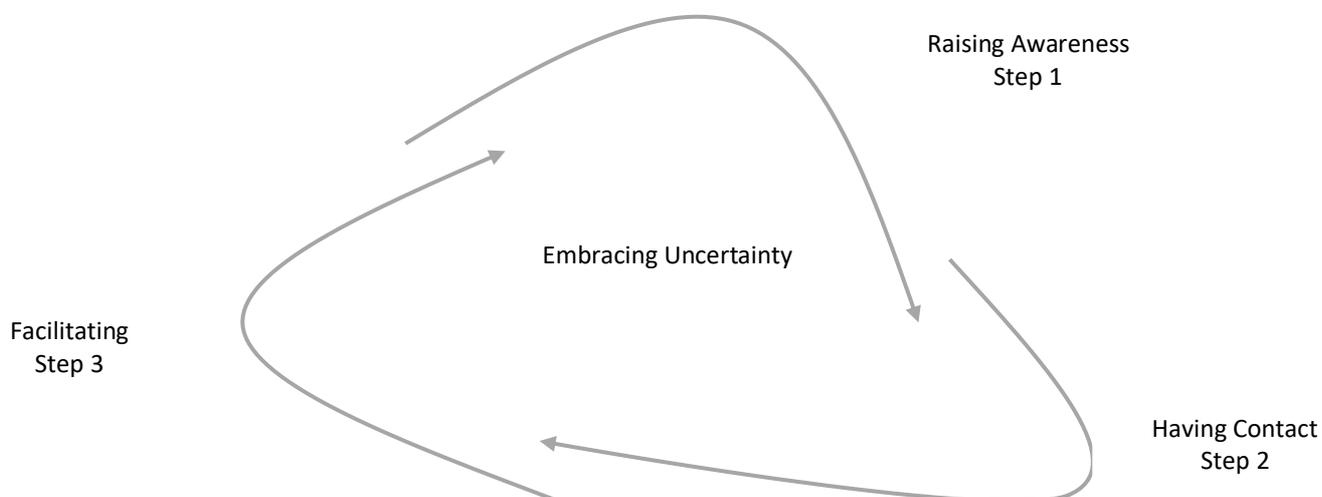
According to Syrett & Devine (2014), through collaboration, they can reach beyond the organizational boundaries and understand the sources of uncertainty. Collaboration can help create a new perspective. In situations of uncertainty, close relationships with all stakeholders and other organizations can provide important opportunities. Collaboration is a useful way to learn to live with uncertainty. It enables organizations to connect internally and externally. For this, it is necessary for decision makers to listen to individuals, to hear them, to work together and to increase their level of strategic readiness. Because time passes quickly and organizations are faced with sudden changes. According to Armenakis, Harris & Mossholder (1993), managers who can lead change need to ensure their members' strategic readiness in cooperation. Organization managers need the inspiration, energy and support they need to ensure their members are ready, and this can only be achieved through collaboration. Managers who want to ensure strategic readiness should take initiatives to realize the beliefs, goals, attitudes of their members and the behaviors expected at the end of the change.

According to Lind & Van den Bos (2002), organizations need to plan scenarios that will help them in order to capture a context in the face of unexpected emergencies and create a framework against desired situations. In order to do this, they need to create a context for the known and a tool to explore possibilities for the unknown. The main purpose here is to change and challenge the rules of the game against unexpected situations. It can be thought that if used in educational organizations, it will help to give innovative responses to future challenges. Syrett & Devine (2014) states that with scenario planning, the results and outputs to be obtained by the organization can be examined comprehensively, and then possible reactions can be determined. It is a good way to make scenario plans for organizations. Against the uncertainties to be encountered in the future, it is acted with many foresights. According to Teece, Peteraf & Leih (2016), the main purpose behind scenario planning is to reveal many unforeseen possible outcomes. Scenarios do not aim to fix the future, but they can provide opportunities for managers to avoid overlooked areas.

According to Van de Vrande, Vanhaverbeke & Duysters (2009), it is important to maintain a flexible approach and to establish a less hierarchical organizational structure in high uncertainty situations. One of the main reasons for the uncertainties

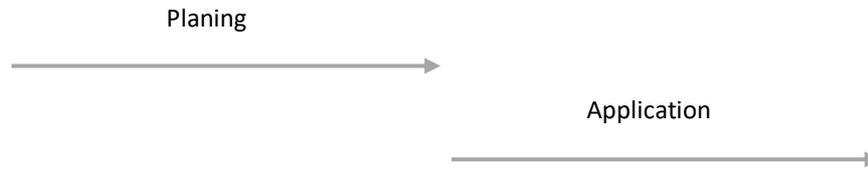
experienced within organizations is the problem of cooperation and coordination among the members. In order to overcome this, it is important to cooperate with all members as a requirement of the concept of governance, and to be transparent and accountable. As a result of transparency and cooperation, members' sense of ownership and trust in the organization will increase. According to Syrett & Devine (2014), transparency and accountability are vital not only in governance but also in uncertainty management. Misuse and misuse of the organization's functioning, money, technology and human resources will lead to misunderstanding and uncertainty among its members. Cicero, Pierro & Knippenberg (2010) state that it is important for managers to give confidence to their employees and to see them as a group member in environments of uncertainty. Rayner (2018) also states that the members of the organization should be seen in a safe environment and as a group member, and that education managers should not overlook these issues. Educational administration is not a prestige-raising profession, but an effort to reach the determined goals of the organization in the midst of uncertainty and disorder, in a calm and transparent manner. Syrett & Devine (2014) say that organizations need guiding managers. Guide managers give the organization trust, are transparent and accountable, provide good governance, encourage rational decision-making, and involve employees at all levels.

Today, competitive understandings and technological innovations in the world require organizations to be active and dynamic in order to survive. It is necessary to design the inside and outside of the organization in accordance with the changing market conditions, to stay ahead of time and not to fall behind (Wu, Tseng, Chiu & Lim, 2016). A dynamic organization acts swift even under conditions of uncertainty. Agility is an important feature for managing uncertainty, and even a valuable tool for competent managers in the face of high uncertainty (Teece, Peteraf & Leih, 2016). Apart from swiftness, flexibility is important for the organization. Flexibility is the work of constructing any setback or difficulty in its own way, adopting it and coping with the changes experienced. By providing flexibility, learning to live with change and uncertainties, increasing options, having knowledge about problem solving, and self-organization develops (Berkes, 2007). When organizations face uncertainty, they try to minimize the costs of seeking information and imitate other organizations (Haveman, 1993). Imitative transformation is an effective organizational response to uncertainty, but copycat mentality should be considered as a last resort. Imitation of past behaviors may also cause new behaviors to be legitimated (Henisz, & Delios, 2001). These actions, behaviors and practices can be institutionalized, and other members and managers in the organization can apply and adopt the established institutionalized course of action without thinking (Haveman, 1993). According to Dequech (2003), imitative transformation should be considered as the last resort if the organization cannot access information during periods of change and transformation, because methods and techniques in another organization may not meet the needs of another. If the imitated information is not rational, it will not go beyond sharing ignorance, and therefore the organization will not be able to develop. For this reason, managers in organizations need uncertainty management competencies. Uncertainty management competencies are given in Figure 1.



**Figure 1. Uncertainty management competencies**

When the uncertainty management competencies are examined in detail in Figure 1, according to Clampitt, Williams & DeKoch (2001), this model is to move away from the traditional decision-making approach. The first step of the model is to create awareness of uncertainty, the second step is to communicate about uncertainty, and the third step is to facilitate it with a catalyst effect. While these competencies can be learned and understood separately, their value will emerge when applied simultaneously. Therefore, managers should not only change organizational policies, procedures, behaviors, but also coordinate these activities in a meaningful way. It is the manager's ability to quickly implement the steps when it is time to adjust the competence here. The way to be an effective manager depends on the ability to cope with uncertainty and the resulting cognitive-affective response. Managers who can keep the experience of uncertainty at a tolerable level can have more choices and embrace opportunities (White & Shullman, 2010). However, in today's modern organizations, it seems very difficult for managers to strictly manage uncertainty with the traditional approach. Uncertainty management with the traditional approach is given in Figure 2.



**Figure 2. Uncertainty management with traditional approach**

When the uncertainty management with the traditional approach is examined in detail in Figure 2, according to Clampitt & Williams & (2004), this model is first planned by many managers in the traditional approach and then applied by thinking in a linear way. Organizations using this approach often lack the flexibility to adapt quickly to changing conditions. The pace of change today is quite high. The rate of change in comparison to the old centuries has increased about four thousand times today. Therefore, leaders who can solve complex issues under uncertainty are needed. Because complex things need less traditional managers (Obolensky, 2014). According to Levine & Wiener (1989), coping is the reduction or elimination of physiological responses produced as a result of uncertainty. The main function of the coping process, which includes control, feedback and predictability, is to reduce uncertainty. Therefore, we must learn to plan for possibilities in the face of uncertainty. Exploring possibilities and tolerating uncertainty is an important way of embracing uncertainty (Clampitt, Williams & DeKoch, 2001).

Individuals' reactions to uncertainty intolerance show their tolerance levels. Tolerance of uncertainty is a powerful concept that are measured in different ways by different disciplines. Each individual's degree of acceptance, acceptance and rejection of uncertainty differs from each other (Clampitt & Williams, 2000). The opposite of uncertainty tolerance is intolerance of uncertainty, individuals who cannot tolerate uncertainty will also find they cannot accept that most aspects of life are uncertain. Such individuals experience extreme anxiety, fear and anxiety under uncertainty (Buhr & Dugas, 2002). According to Minkov & Hofstede (2014) and Huang (2008), uncertainty tolerance is a concept related to the cultural characteristics of the individual. Individuals with uncertainty intolerance are under threat from the unknown, whereas individuals with a high tolerance for uncertainty do not avoid risks. When the relevant literature is reviewed, it is seen that the number of empirical studies conducted in educational institutions on uncertainty intolerance and uncertainty management is few. It was determined that the studies could not provide the big picture of uncertainty management, even the effect sizes of the studies were not calculated in any of the studies, and a statistical conclusion could not be reached on whether the teachers' intolerance of uncertainty and uncertainty management perceptions worked in practice. Therefore, the need to synthesize the results of intolerance of uncertainty and the effectiveness of uncertainty management research emerged. According to Egger, Higgins & Smith (2022) and Rothstein, Sutton & White (2021), research syntheses are important in terms of the decision-making process about the studies. It will not be enough for people to decide with the results of the primary studies. From this point of view, it was aimed to scrutinize the effectiveness of uncertainty intolerance and uncertainty management researches with meta-analysis method. For this purpose, the following hypotheses were formed for meta-analytical analyzes.

H<sub>1</sub>=The effect size of research into intolerance of uncertainty and uncertainty management is positive.

H<sub>2</sub>=Publication type variable plays a moderator role in the effect size of uncertainty intolerance and uncertainty management studies.

H<sub>3</sub>=Title variable plays a moderator role in the effect size of uncertainty intolerance and uncertainty management studies.

## METHOD

### Model and Paradigm of the Research

With this research, it was aimed to scrutinize the effect size of uncertainty intolerance and uncertainty management researches by using meta-analysis method. Meta-analysis is a statistical method that systematically reviews studies to estimate effect sizes in the population, evaluates the results of primary studies with a quantitative approach, and combines studies on the same subject to make a general judgment (Egger, Higgins & Smith, 2022; Harrer et al. , 2022). In this research, meta-analysis studies were carried out in the axis of realism philosophy and functional paradigm. The functional paradigm is a paradigm approach that argues that the social world is relatively undeniable, and that considers and evaluates the facts objectively (Gunbayi & Sorm, 2020).

### Types of Meta-Analysis and Effect Size

Meta-analysis is divided into two groups as correlational and group comparison meta-analyses based on effect size calculations (Cleophas & Zwinderman, 2017; Stangl & Berry, 2000). This research was carried out as a type of group comparison meta-analysis, which is one of the types of meta-analysis. Effect size is the value that reflects the size of the relationship between two variables or the effect of the application in the meta-analysis study. In other words, it is the value that gives information about how much the independent variable affects the dependent variable positively or negatively (Littell, Corcoran & Pillai, 2008). The overall effect is one of the purposes of synthesizing studies and is the weighted average of study effects. The shape shown as a diamond in meta-analysis studies reflects the magnitude of the predicted sensitivity and also represents the effect size (Simske, 2019; Zoccai, 2018). In meta-analysis, effect sizes are calculated with mean differences, correlation coefficient and probability ratio (Borenstein

et al., 2019; Hangji, 2017). Since bivariate groups were considered in this study, the difference of means was used to calculate the effect size.

### Model Selection and Identification of Outliers

In the meta-analysis, the overall effect size is calculated according to the fixed and random effects model. In the fixed-effects model, there is an assumption that all studies participating in the research are the same, while in the random-effects model, all studies are different (Card, 2012). In this study, the sample size of the population of the studies included in the research, their standard deviations were different from zero and the measurement tools differed. Therefore, for model selection, it was decided whether the statistical values of  $Q$ ,  $I^2$  and  $\chi^2$  heterogeneity differed at 95% confidence interval and  $p < .05$  significance level (Ellis, 2010). Heterogeneity tests were used to determine the effect sizes of the studies included in the meta-analysis, as well as to determine the moderator variables that would affect the results of the research in the emergence of heterogeneity (Chen & Peace, 2021). The presence of outliers in the meta-analysis causes an excessive increase in the mean, variances and statistics used in other meta-analysis. Outliers are highly likely to be found in datasets of meta-analyses and in individual studies (Khan, 2020). It is extremely difficult to detect errors in primary studies, as initial studies are reported only with outcome statistics and not raw data. Because the data appearing as outliers have no obvious reason (Lipley & Wilson, 2001). Therefore, in this study, the study weights of all studies included in the study were calculated according to fixed and random effects. According to the random effects, it was found that the working weights were proportionally close to each other.

### Publication Bias

In meta-analysis studies, publication bias is a term used for the situation where the studies published in the literature do not systematically represent the population of the completed research (Cleophas & Zwinderman, 2017). Researchers may choose not to publish studies that do not yield statistically significant results. In general, journals are unlikely to accept studies with negative or unexpected results even if they wanted to publish them (Stangl & Berry, 2000). The presence of publication bias in a meta-analysis can skew the results and threaten the validity of the research Hedges & Olkin (1985). In meta-analyses with publication bias, it is entirely possible to overestimate the impact of an intervention and, more importantly, to reverse the direction of impact (Harrer et al., 2022). It can also result in an intervention that is actually harmful, but beneficial. In this study, a funnel plot diagram was drawn to determine the publication bias, and it was tried to determine whether there was a publication bias with Duval and Tweedie's trim and fill method, Egger's regression intercept and Rosenthal and Orwin's protected N method.

### Data Collection and Inclusion Criteria

In the research, it was aimed to reach the empirical studies carried out between 2012-2022 on the effectiveness of uncertainty intolerance and uncertainty management research. In line with this purpose, the criteria for inclusion in the research between 01 June 2022 and 01 September 2022 are that the studies were conducted in Turkey between the years 2012-2022, that the studies contained information that allowed the calculation of meta-analysis, that the sample groups of the studies were pre-service teachers, teachers and education administrators. A rigorous literature review was conducted with the keywords "intolerance of uncertainty, tolerance of uncertainty, uncertainty, uncertainty management, uncertainty from educational institutions" based on the fact that the studies were published in the databases of YÖK National Thesis Center, Dergi Park, Tr Index, Turkish Education Index, Academic Directory. Purposeful sampling method was used in reviewing the studies. Purposeful sampling is a sampling method that allows deep research according to the specific situation of the research and the number of samples (Creswell & Creswell, 2018). As a result of the search, 41 studies were found, but it was decided to include 6 theses and 2 articles that met the inclusion criteria of the studies in the meta-analysis. The total sample number of these included studies was determined as  $N=2704$ .

### Coding Process

The studies included in the meta-analysis were coded in line with the main purpose of the research and in accordance with the inclusion criteria of the research. Sample sizes, arithmetic mean and standard deviation values, title and publication type included in the studies were written in a coding form. In order to avoid mistakes in the coding process, the coding was repeated by two academicians who were experts in the field of meta-analysis, and kappa reliability analysis was performed between the coders. As a result of the calculation, the inter-coder reliability coefficient [ $K=.849$ ,  $t=5.576$ ,  $p < .05$ ] was found. According to Landis and Koach (1977), this value showed that the inter-coder reliability value was significantly high.

### Data Analysis

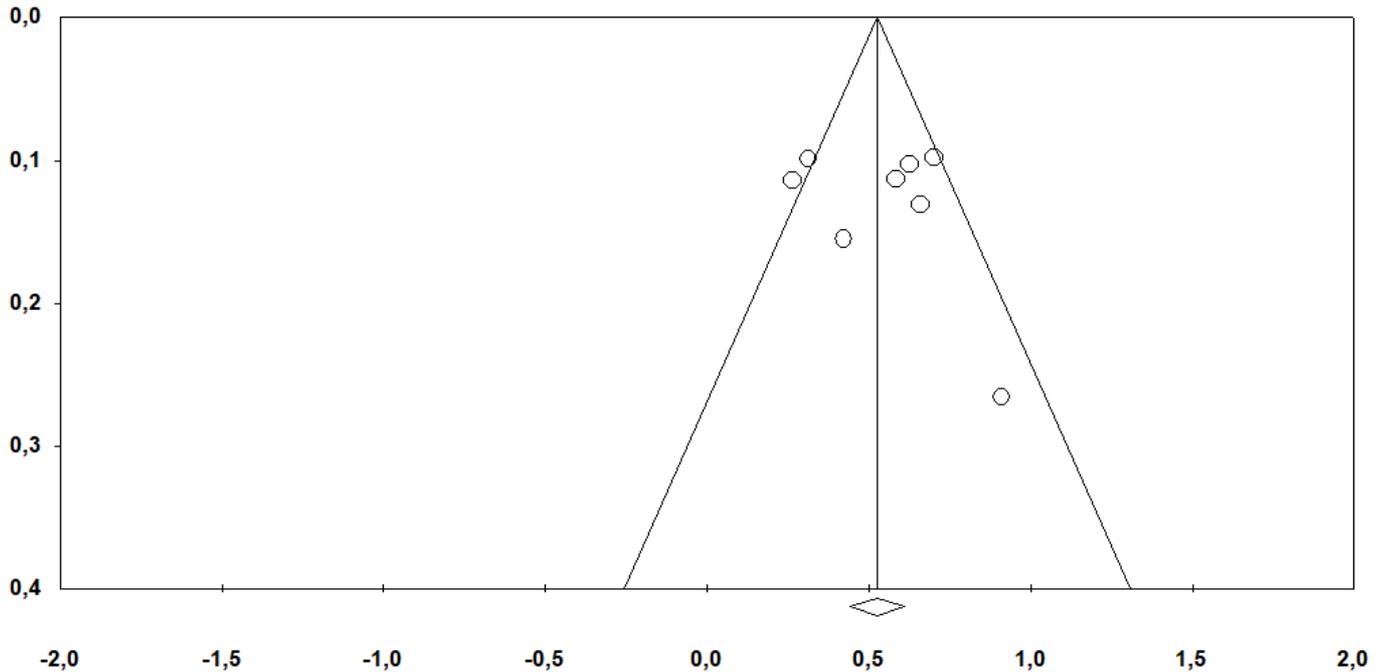
In this study, since the scores of the studies included in the meta-analysis were obtained from different scales, the effect sizes of the studies were calculated by using Hedges's  $g$  coefficient and standardizing the effect sizes. Confidence level of 95% significance level  $p < .05$  was taken as basis in data analysis. Effect sizes  $< .20$  weak effect;  $< .50$  small effect  $> .51$  medium effect and  $> 1$  large effect interpreted based on reference intervals (Cooper, Hedges & Valentine, 2019). Considering that the population sizes of the individual studies examined within the scope of the meta-analysis were different and did not represent the same population, it was decided before the analysis to calculate the overall effect size according to the random effects model. On the other hand, the effect sizes related to whether there were outliers between the effect size values of the individual studies were examined with the study weights and given in Figure 3 with the funnel plot diagram. In addition, whether there was heterogeneity in the results

of the studies included in the meta-analysis was determined by calculating with the heterogeneity test. Trim and fill, protected N numbers, regression intercept values were calculated to determine the publication bias. CMA (Comprehensive Meta-Analysis V<sub>3</sub>) package program was used in data analysis.

## FINDINGS

### Findings on Publication Bias

In the meta-analysis study of uncertainty intolerance and uncertainty management research, a funnel plot diagram was drawn to test the reliability and validity of publication bias, and Rosenthal and Orwin's protected N, Duval and Tweedie's trim and fill and Egger's regression intercept were used to reach a statistical general conclusion. The funnel plot diagram of the standard error and effect size values of the studies included in the meta-analysis is given in Figure 3.



**Figure 3. Funnel plot diagram of the effect sizes and standard errors of the studies included in the meta-analysis**

The most commonly used method in revealing publication biases in meta-analysis studies, in terms of creating a first impression for the researcher, is drawing the funnel plot diagram (Cumming, 2012). However, although funnel plot diagrams are useful in theory, the assessment of publication bias in the graph is purely subjective and in most reviews there are not enough studies to make a visual assessment (Hartung, Knapp & Sinha, 2008). On the X-axis of the graph in Figure 3, there were Hedges's *g* effect sizes of the included studies on the effectiveness of uncertainty intolerance and uncertainty management research, and on the Y-axis standard errors of the studies included in the meta-analysis. The studies at the peak of this graph were studies with a large sample in terms of sample number. In case of publication bias in the funnel plot diagram, the points in the diagram turn into an asymmetrical funnel shape (Leandro, 2005; Patole, 2021; Sterne, 2009). This indicates that there are missing studies in the studies included in the meta-analysis (Dias et al., 2018). When the funnel plot diagram for this research was examined, it could be indicated that the distributions of the studies included in the meta-analysis showed a symmetrical distribution and this distribution did not create publication bias. After examining the funnel plot diagram, statistical analyzes on publication bias were made in order to reach a final decision. Analysis results of Rosenthal's fail-safe N method are given in Table 1, Orwin's fail-safe N method analysis results are given in Table 2, Duval and Tweedie's trim and fill method analysis results are given in Table 3 and Egger's regression intercept is given in Table 4.

**Table 1. Rosenthal's Fail-Safe N Analysis Results**

Gözlemlenen Çalışmalar için		Alfa	Z for Alfa	Tails	Observed number of research	Number of research ( $p > .05$ )
Z Value	p Value					
12.40887	.000***	.0500	1.959	2.000	8	313

\*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$

When the results of Rosenthal's fail-safe N method analysis on the effectiveness of uncertainty intolerance and uncertainty management researches on publication bias were examined in Table 1, it was found that at least 313 studies were required for this research in a zero or negative direction. In Rosenthal's fail-safe N method, the *p* values for each study were converted to the *z* value and the *z* value was found to be 1.959. The fact that this value is  $>1$  indicates that the results of the meta-analysis were also resistant for future studies and that there was no publication bias in the study (Rosenthal, 1987).

**Table 2. Orwin's Fail-safe N Analysis Results**

Average effect size of observed studies	.525
The level at which the effect size will be reduced	.00001
Mean effect size of missing studies	.000
Number of studies required for non-significant effect size	613

\*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$

Orwin's fail-safe N method calculates the number of new studies that should be added to the meta-analysis study in order to zero the effect obtained in the meta-analysis studies (Schmid, Stijnen & White, 2021). In Rosenthal's approach, the studies are evaluated only according to their p-values, while the observed effect size is taken into account in the Orwin approach. For this study, the effect size value of .525 was taken into account. When the results calculated by Orwin's fail-safe N method analysis were examined in Table 2, 613 studies with effect sizes were needed to change the results of the current meta-analysis study, which consisted of eight studies, from positive to negative. Accordingly, it could be said that the current meta-analysis study conducted with eight individual studies was quite reliable and did not have publication bias.

**Table 3. Trim and Fill Analysis Results by Duval and Tweedie**

Observed effect size value	.533
Adjusted effect size value	.513
Number of trimmed studies	0

\*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$

When Duval and Tweedie's trim and fill method analysis results were examined in Table 3, the observed effect size value was .533 and the adjusted effect size value was .513. Both the observed effect size value and the adjusted effect size values were close to each other. Therefore, in this meta-analysis research, there was no need to trim any studies that may create publication bias. This finding was an indication that the overall effect size calculated in this study was reliable and there was no publication bias.

**Table 4. Egger's Regression Intercept Analysis Results**

Intercept	SE	df	t	p	LLCI	ULCI
1.459	2.429	6	.600	.569	-4.484	7.403

\*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$  LLCI= Lower Confidence Interval; ULCI= Upper Confidence Interval

When the analyzes of Egger's regression intercept were examined in Table 4, the intercept value was calculated as 1.459 standard error 2.429. The fixed value is in the lower and upper bound confidence intervals. On the other hand, the calculated t value was .600 and the significance value was .569 [ $t_{(6)}=.600, p>0.05$ ]. Since this calculated value satisfies the  $p>.05$  condition, it showed that there was no publication bias in this meta-analysis study.

### Findings on Heterogeneity and Effect Size

After it was understood that the effectiveness of uncertainty intolerance and uncertainty management researches was not affected by publication bias in the calculations related to publication bias and the funnel plot diagram drawn, the calculation of the heterogeneity test was started. Heterogeneity is an assumption of the random effects model, as the presence of heterogeneity among the effect sizes of primary studies indicates the presence of moderator variables, and testing heterogeneity is one of the main goals of meta-analysis (Kulinskaya, Morgenthaler & Staudte, 2008). In meta-analyses, the Q statistic is used to determine the presence of heterogeneity, and the  $I^2$  statistic is used to determine the amount of heterogeneity. For model selection, it was calculated whether the statistical values of Q,  $I^2$  and  $X^2$  heterogeneity differed at 95% confidence interval and  $p<.05$  significance level. The results of the analysis are given in Table 5.

**Table 5. Analysis Results Regarding Heterogeneity of Effect Sizes of Studies Included in Meta-Analysis**

Type of Model	ES	df	Q	$X^2$	SE	$I^2$	LLCI	ULCI
Random Effects Model	.534	7	17.842	14.07	.069	60.768	.398	.670

\*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$  LLCI= Lower Confidence Interval; ULCI= Upper Confidence Interval

When the analysis results regarding the heterogeneity of the effect sizes of the studies included in the meta-analysis were examined in Table 5, the heterogeneity value of the studies included in the meta-analysis was found to be  $Q=17.842$ . This value exceeded the critical value in the chi-square ( $X^2$ ) table according to a certain degree of freedom and significance level. In addition, the calculated significance value was found to be  $p=.013$ . These findings could be considered as a sign that the effect sizes of the studies included in the meta-analysis showed a heterogeneous distribution. On the other hand, the calculated  $I^2$  value showed that the variance between studies was not due to chance and was due to heterogeneity (Cooper, 2017). According to the calculated  $I^2$  reference intervals,  $I^2<.25$  indicates "small heterogeneity",  $I^2<.50$  "moderate heterogeneity" and  $I^2>.75$  "high heterogeneity" (Borenstein et al.,2019; Hangji, 2017). The fact that the  $I^2$  value calculated in the meta-analysis study was 60.768%

indicates a high level of heterogeneity for this meta-analysis study. The funnel graph (funnel) regarding the effect size values and weights of the studies is given in Figure 4.

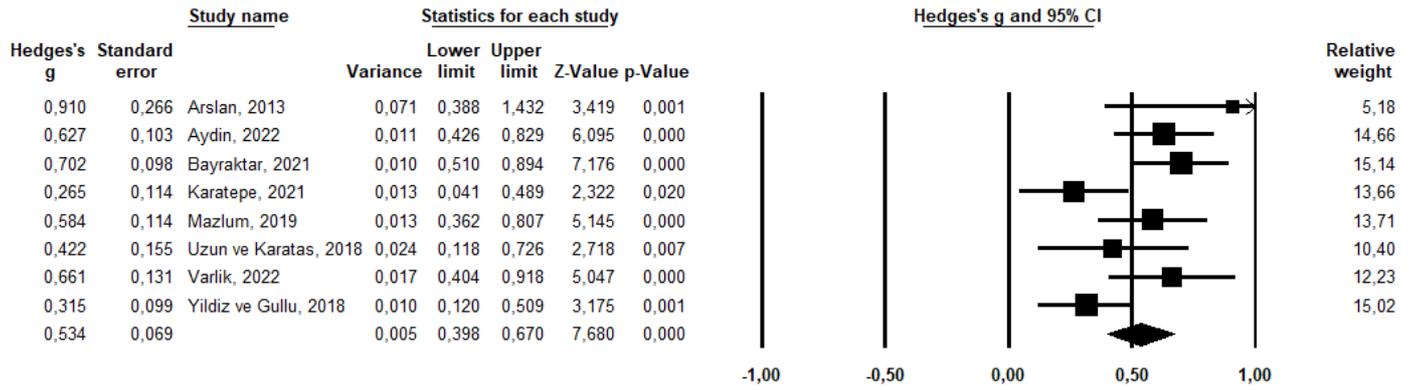


Figure 4. Funnel plot diagram of the effect sizes and weights of the studies included in the meta-analysis

When the analysis results regarding the average effect size in general were examined in Table 5, and the funnel plot diagram regarding the effect sizes and weights of the studies included in the meta-analysis in Figure 3; the effect sizes and weights of the studies were given in the 95% confidence interval in the funnel plot diagram regarding the effect sizes and weights of the studies included in the meta-analysis. Accordingly, it was seen that the study that contributed the most to the research contributed 15.14%, while the study that contributed the least contributed 5.18%. In this research, the funnel plot diagram was presented at  $\pm 1$  range reference. When the line lengths are taken into account, none of the studies included zero values, and the narrow range of the lines means that the decisions are more reliable (Cheung, 2015; Hunter & Schmidt, 2004). When the working weights were examined in the last column, it was found that the distribution was homogeneously close to each other. The smallest effect size value in the studies was calculated as .265 and the largest effect size value was calculated as .910. All effect size values were included in the confidence interval and the significance values were found below 0.05. The diamond shape at the bottom of the funnel plot diagram showed the overall effect sizes of all studies (Riley, Tierney & Stewart, 2021). The mean effect size value at the bottom in the diamond form was calculated as .534 and this value did not include zero. This value showed that the studies had positive and moderate average effect sizes. When these findings were taken together, the effect size level for uncertainty intolerance and uncertainty management research was positive. This finding stated that " $H_1=$ The effect size of intolerance of uncertainty and uncertainty management studies is positive." showed that the hypothesis was supported. In addition, the high level of heterogeneity indicated the presence of moderator variables that might be present in the meta-analysis study. In the current meta-analysis, title and publication type variables were predicted as moderators and calculations were made accordingly.

**Findings on Heterogeneity and Effect Size**

Table 6 shows the moderator analysis results on whether title and publication type variables played a moderator role in the effect size of uncertainty intolerance and uncertainty management research.

Table 6. Moderator Analysis Results

Değişken	Q <sub>b</sub>	df	p	X <sup>2</sup>	N	ES	LLCI	ULCI
Publication Type	4.761	1	.029*	3.84				
Article					2	.346	.182	.509
Thesis					6	.592	.443	.741
Title	.778	1	.378	3.84				
Teacher					6	.507	.328	.685
Education Manager					2	.617	.449	.785

\* p < .05; \*\* p < .01; \*\*\* p < .001 LLCI= Lower Confidence Interval; ULCI= Upper Confidence Interval

The homogeneity value between the groups created according to the publication type variable of the studies included in the meta-analysis was found to be Q<sub>b</sub>=4.761. From the X<sup>2</sup> table, the critical value for 1 degree of freedom at 95% significance level corresponds to 3.84. Since the critical value was smaller than the homogeneity value, the difference between the groups formed according to the publication type variable was statistically significant (p=.029). Therefore, the variable of publication type played a moderator role in the effect size of uncertainty intolerance and uncertainty management research (Chen & Peace, 2021). This finding stated that " $H_2=$ Publication type variable plays a moderator role in the effect size of uncertainty intolerance and uncertainty management studies." hypothesis was supported. The mean effect size of the articles included in the meta-analysis was .346 between .182 and 0.509 confidence intervals; The average effect size of the theses included in the meta-analysis was calculated as .592 between .443 and .741 confidence intervals. The effect size of the articles included in the meta-analysis for this research was "small", while the effect size of the theses was "medium". This finding showed that there was a significant increase in the mean effect size in favor of the theses.

The homogeneity value between the groups created according to the title variable of the studies included in the meta-analysis was found to be  $Q_b=.778$ . From the  $X^2$  table, the critical value for 1 degree of freedom at 95% significance level corresponds to 3.84. Since the critical value was greater than the homogeneity value, the difference between the groups formed according to the title variable was not statistically significant ( $p=.378$ ). Therefore, the title variable did not play a moderator role in the effect size of uncertainty intolerance and uncertainty management research. This finding stated that "*H<sub>3</sub>=Title variable plays a moderator role in the effect size of uncertainty intolerance and uncertainty management studies.*" hypothesis was not supported. In the title variable included in the meta-analysis, the average effect size of the teachers was .507 in the confidence interval between .328 and .685; In the title variable included in the meta-analysis, the average effect size of the education administrators was calculated as .617 in the confidence interval of .449 and .785. In the title variable included in the meta-analysis for this study, the effect size was "medium", while the effect size of the education administrators was "moderate". This finding showed that there was a significant increase in the mean effect size in favor of both teachers and education administrators.

## DISCUSSION, CONCLUSION AND RECOMMENDATIONS

In this research, which aimed to investigate the effect size of uncertainty intolerance and uncertainty management researches with meta-analysis method, results related to publication bias, heterogeneity and effect size, and moderator analysis were given in detail. In the meta-analysis study of uncertainty intolerance and uncertainty management research, a funnel plot diagram was drawn to test the reliability and validity of publication bias, and Rosenthal and Orwin's protected N, Duval and Tweedie's trim and fill and Egger's regression intercept calculations were used to reach a statistical general conclusion. When the funnel plot diagram for this study was examined, it was determined that the distributions of the studies included in the meta-analysis showed a symmetrical distribution and this distribution did not create publication bias (Dias et al., 2018; Egger, Higgins & Smith, 2022; Schmid, Stijnen & White, 2021). On the other hand, in Rosenthal's fail-safe N method, the p values for each study were converted to the z value and the z value was found. The fact that the z value found was greater than one showed that the results of the meta-analysis were also resistant for future studies and that there was no publication bias in the study (Harrer et al., 2022). The current meta-analysis study conducted with eight primary studies with Orwin's fail-safe N method analysis was found to be highly reliable and without publication bias (Rothstein, Sutton & White, 2021). When the results of Duval and Tweedie's trim and fill method analysis were examined, it was found that both observed effect sizes and adjusted effect sizes were close to each other. When the analyzes of Egger's regression intercept were examined, the significance value was found to be higher than the  $p<.05$  value, therefore, since this calculated value met the  $p>.05$  condition, it was determined that the studies included in the meta-analysis did not show publication bias (Borenstein et al., 2019). In general, it was concluded that the studies included in the meta-analysis for this study were valid, reliable and did not have publication bias.

The statistical values of  $Q$ ,  $I^2$  and  $X^2$  related to the heterogeneity and effect size calculations in the effectiveness of uncertainty intolerance and uncertainty management studies were calculated at the ninety-five percent confidence interval and at the five percent significance level. Accordingly, it was determined that  $I^2$  and  $Q$  values formed a high level of heterogeneity and exceeded the critical value in the chi-square ( $X^2$ ) table according to a certain degree of freedom and significance level (Rothstein, Sutton & White, 2021). Therefore, this meta-analysis study was conducted with a random effects model. In the drawn funnel plot diagram, it was determined that all studies were significant at the ninety-five percent confidence level and the distribution ratios of the studies were close to each other according to the random effects model (Schmid, Stijnen & White, 2021). Accordingly, it was seen that the study that contributed the most to the research contributed fifteen percent, and the study that contributed the least contributed five percent. In this research, the funnel plot diagram is presented at  $\pm 1$  range reference. Considering the line lengths, it was determined that none of the studies included zero value and the lines were in narrow range, thus meaning that the decisions were more reliable (Cooper, Hedges & Valentine, 2019). On the other hand, the effect size of the studies on uncertainty intolerance and uncertainty management in educational institutions was positive and moderate. In other words, these studies had a medium level of effectiveness for stakeholders in educational institutions. When these findings were taken together, the effect size level of uncertainty intolerance and uncertainty management research was positive. It was concluded that the hypothesis was supported.

As a result of the analyzes made on whether the publication types included in the meta-analysis and the title variable played a moderator role in the effectiveness of uncertainty intolerance and uncertainty management research; It was determined that the variable of publication type played a moderator role in the effect size of uncertainty intolerance and uncertainty management researches (Simske, 2019). Therefore, "*H<sub>2</sub>=Publication type variable plays a moderator role in the effect size of uncertainty intolerance and uncertainty management studies.*" hypothesis was supported. The articles included in the meta-analysis had the average effect size in the confidence interval; It was determined that the theses included in the meta-analysis had an average effect size in the confidence interval. The effect size of the articles included in the meta-analysis for this research was "small", while the effect size of the theses was "medium". In the studies on uncertainty intolerance and uncertainty management in educational institutions, it was concluded that the average effect size of theses is higher. On the other hand, in the moderator analysis, it was determined that the title variable did not play a moderator role in the effect size of uncertainty intolerance and uncertainty management research. For this reason, "*H<sub>3</sub>=Title variable plays a moderator role in the effect size of uncertainty intolerance and uncertainty management studies.*" hypothesis was rejected. However, in the studies on uncertainty intolerance

and uncertainty management in educational institutions, it was concluded that although the average effect size of teachers was at a medium level, it was lower than the average effect size of educational administrators.

According to Suls & Mullen (1981), uncontrollable factors under uncertainty affect employees and managers. This study showed that education administrators made the right plans based on the motivation tool when there was uncertainty in education when there was uncertainty in education, and they understood that they took on a different task and responsibility. In change processes, managers need to allocate time and resources to deal with uncertainty, because it is an undeniable fact that organizational change is a part of life (Bordia et al., 2004). Therefore, the consequences of not managing organizational change well will be severe (Allen, Jimmieson, Bordia & Irmer, 2007; DiFonzo & Bordia, 1998; Nelson, Cooper & Jackson, 1995). Education administrators try to reflect the changes that can be experienced in education to the school compared to teachers. In addition to learning change and innovations quickly, they also conduct research to learn about development and changes. However, when considered in terms of organization, the communication process is more complex. Individual characteristics, prejudices and abilities of people complicate communication processes. The issues of whether the organization can be successful are related to communication, so communication skills have a special importance for organizational managers. Managers use communication to increase organizational effectiveness, and thanks to communication, employees are taught what is expected of them and how they should do their jobs (Hunt, Tourish & Hargie, 2000). When employees in organizations cannot get information from managers, they turn to other sources of information and therefore uncertainties arise. Compared to teachers, education administrators tried to obtain multidimensional information about complex events and situations in manager-employee relationship and communication. In addition, this finding showed that education administrators cooperated with all stakeholders in the school to eliminate hesitations about any issue, and when there was uncertainty about a subject, they tried to comfort the stakeholders based on the existing experience and knowledge. Individuals' reaction to uncertainty and the degree of emotion also determined the level of tolerance. Each individual's degree of acceptance, acceptance and rejection of uncertainty differs from each other (Clampitt & Williams, 2000). Individuals who cannot tolerate uncertainty will also find they cannot accept that most aspects of life are uncertain, such individuals will experience extreme anxiety, fear, and anxiety under uncertainty and will not be able to manage uncertainty effectively (Buhr & Dugas, 2002).

As a result of the analysis results on the effectiveness of uncertainty intolerance and uncertainty management research in educational institutions, the following suggestions were developed for teachers, education administrators, stakeholders, decision makers, research and researchers.

#### Research Recommendations

1. Uncertainty is inherent in nature, so uncertainty must be tolerated and managed.
2. Tolerance to ambiguity is a robust construct that has been conceptualized and measured in various ways, so in-service training should be given to teachers through experts on ambiguity tolerance.
3. In the study, the intolerance of uncertainty and uncertainty management effect size value of education administrators was higher than that of teachers. People had different levels of tolerance for uncertainty management. From this point of view, education administrators need to bring teachers together through communication and respect differences.

#### Recommendations for Researchers

1. With this research, a meta-analysis study was conducted to determine whether the researches on uncertainty intolerance and uncertainty management effectiveness in educational institutions work in practice. A meta-synthesis study can be planned by interpreting the qualitative research on this subject.
2. In educational institutions, teacher behavior under uncertainty and decision-making in uncertainty situations can be carried out with quantitative or mixed method researches so that they can be the subject of meta-analysis in the future, and lay the groundwork for meta-analysis and meta-synthesis researchers in the future.

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#### Statements of publication ethics

I hereby declare that the study has no unethical issues and that research and publication ethics have been carried out carefully.

#### Ethics Committee Approval Information

Ethics committee permission is not required as this research is a meta-analysis study.

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