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Research Article

The Effect of Computer-Supported Education on Student Attitudes: A Meta-Analytical Comparison for the Period 2005-2015

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Abstract

Using meta-analysis, this study examines the effect of computer-supported education on students' attitudes and determines the degree to which the effect size obtained by combining the effect sizes of various studies differs, in terms of educational level, course subjects and application duration. Based on the inclusion criteria, a total of 32 pieces of research from 621 studies that appeared in the national and international literature during 2005-2015 were analysed. Data analysis was carried out with the treatment effectiveness method, using the MetaWin 2.0 and the Comprehensive Meta-Analysis statistics programs. The findings of the research revealed that, according to the random effects model, computer-supported education had a moderate, positive and significant ($ES = 0.449$) effect on attitude scores. The positive correlation between the related method and student attitudes suggests that the correlation may be enhanced by the use of more interesting and better quality content designed for computer-supported education.

Keywords

Attitudes • Computer-supported education • Meta-analysis • Student • Comparison

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Rapid changes and advances in technology have led to an expansion of the use of technology in learning environments. It can be seen that computer applications play an important role in the designing phase of teaching processes, and make it possible for technology to be used effectively (Doğan, 2009; Mitra & Steffensmeier, 2000; Seo & Bryant, 2009). Computer technologies are the most popular, widespread and effective technologies used today, and represent a huge potential in terms of providing solutions for problems related to education. Differing from other educational methods, computer-supported teaching methods provide unique opportunities for teaching and learning, and make it possible for the computer to be integrated into the classroom environment as a tool for teaching, managing, presenting and communicating (Yalın, 2001).

Computer-supported education (CSE) is a method of instruction that has emerged as a result of the great amount of information available and emphasizing the increasing importance of individual differences. CSE is known to contribute to the teaching process, enhancing student motivation, and combining learning principles with computer technologies (Uşun, 2000). The objective of CSE applications is to use computer-based educational content and activities to help students learn, using the available tools as complementary and empowering instruments in accessing knowledge (Hannafin & Peck, 1989 as cited in Güven & Sülün, 2012). Studies that examine the effect of computer-supported teaching applications review the various sub-factors of “academic achievement,” “retention of knowledge,” “attitude” and “self-efficacy.” It can be seen in a review of the studies directed at “academic achievement” and the “retention of knowledge” of students and prospective teachers that CSE applications play an effective role in eliminating learning difficulties encountered in the process of science and mathematics education. In addition, the related applications contribute to increasing academic achievement when compared with traditional forms of teaching, and support individuals in formulating their own concepts (Güven & Sülün, 2012; Korucu & Gündüz, 2011; Lynch, Steele, Palensky, Lacy, & Duffy, 2001; Seo & Bryant, 2009).

One of the factors that is considered to be important in the case of students who participate in CSE processes is the students’ ability to achieve meaningful learning through an enhancement of their “attitudes,” which incorporate their permanent or temporary assumptions, expectations, emotions and beliefs (Kutluca & Ekici, 2010; Shashaani, 1993). There are numerous studies in the national and international literature that have reviewed the effect of CSE on student attitudes (Khorrami-Arani, 2001; Liao, 2007; Pilli & Aksu, 2013; Schuyten, Dekeyser, & Goemine, 1999; Tuncer & Tanaş, 2011). It has been seen in studies of computer-supported teaching processes that student and pre-service teachers develop a positive attitude and display a high level of self-efficacy when using the computer in the learning environment (Arslan, 2008; Sam, Othman, & Nordin, 2005; Yıldırım & Kaban, 2010). In this context, it may be said

that CSE applications stand out as an assistive and regulatory method that teachers can use in structuring the learning environment. Applications that help to present the teaching content in different ways contribute to the development of students' higher scientific processing skills and, by enriching the learning environment, make it possible for students to better structure the material in their minds.

Research Focus

Meta-analysis is explained as the statistical analysis of a number of studies' results, with the aim of combining the findings (Glass, 1976). There are meta-analysis studies in the literature that endeavor to examine the effectiveness of CSE applications in terms of the dimensions of "academic achievement," "self-efficacy," and "knowledge retention" (Camnalbur, 2008; Camnalbur & Erdoğan, 2008; Cheung & Slavin, 2011; Lai, 2014; Shachar, 2002; Şahin, 2005). There are however, few meta-analysis studies that explore the effectiveness of CSE applications in terms of "attitudes" (Bernard & Whitley, 1997). This study therefore seeks to reveal how effective computer-supported applications are in terms of enhancing the dimension of "attitudes" in the learning environment. Accordingly, various types of research (articles, theses) on CSE applications were reviewed on the basis of certain criteria in an effort to present a high quality study of the subject. Since numerous (621) studies on CSE applications in the national and international literature were examined in the meta-analysis, we believe that our research results will yield comprehensive and generalized conclusions regarding computer-supported teaching processes. It is expected that the study will therefore contribute to the literature by offering researchers the opportunity to approach any future studies they may undertake from a new and different perspective.

Methodology of the Research

General Background of the Research

This study used the meta-analytical method to calculate the effect size of CSE applications on attitudes. This method statistically combines the results of independently conducted studies to arrive at a general conclusion (Briggs, 2005; Cooper, 1998; Lipsey & Wilson, 2001). Evaluating research findings to arrive at generalized conclusions promotes strong treatment effectiveness from a methodological perspective (DerSimonian & Laird, 1986). Additionally, combining studies, and thus increasing the power of parametric projections through more comprehensive samples, determining the reasons for errors/inconsistencies found in the examined studies, identifying variances that may have been ignored in the studies, and making a contribution to future research through such a review, constitute the strengths of meta-analysis (Hedges, 1992).

Stages of the Meta-analysis

The stages that need to be followed in meta-analysis studies may be listed as (i) identifying the question to be explored as the research problem, (ii) creating inclusion criteria for the studies to be analyzed, (iii) reviewing and finding studies appropriate to the criteria, (iv) making a methodical review of the studies to be included in the analysis and considering the results in detail, (v) finding a common denominator for study findings, (vi) combining the results and conducting a statistical analysis to obtain a common result, (vii) considering the variables in each study, (viii) evaluating all of the results obtained and creating a report (DeCoster, 2004).

Data Collection Process

In this context, the articles published on CSE in the national and international literature in the period 2005-2015, as well as the theses that were accessible in Google Scholar, the Council of Higher Education National Thesis Center, Ebscohost-Eric, ScienceDirect, and the Ebscohost-Professional Development Collection databases, were reviewed. A total of 621 studies (186 articles, 412 Master's Theses and 23 Doctoral Theses) on the subject were accessed. Keywords in the studies related to "computer-supported education and attitudes," which were searched in the databases in both English and Turkish. Papers drawn up for congresses, symposiums and other scientific events were not included in the search. The scan of the literature was conducted based on the following criteria: studies conducted in the period 2005-2015; a sample size (n) conducive to finding an effect size, containing statistical values such as arithmetic means (X) and standard deviations (ss), and the use of a pretest-posttest and control group model. In this context, 32 studies (7 articles, 19 Master's theses and 6 Doctoral theses) met the criteria and were included in the analysis.

Data Encoding

In the meta-analysis, a coding system was used whereby the studies would be identified under two headings, "Study Identity", and statistical information, set forth as "Study Data." To achieve this aim, the literature under consideration was collected in the form of PDF documents and then transferred to a file in which the studies were encoded and recorded, along with the names of the authors. The data falling under the category of "Study Identity" were compiled under the author's name, the year of publication, the type of publication, the course field, the teaching level, the duration of the application, and other pertinent information. Then, the sample size needed for the meta-analysis, together with statistical values such as arithmetic means and standard deviations, were categorized under "Study Data." Variances in the independent variables of the present meta-analysis were used as study characteristics. In other words, study characteristics were used to evaluate the relationships between the independent variables and their

effect sizes. At this point, the effectiveness of the CSE applications according to the attitude scores in the studies under analysis was expressed in terms of the variables of educational level, course subject and application duration. The effect sizes that were calculated based on the effect of CSE on student attitudes were defined as the study's dependent variable. Different studies have defined the impact of CSE on a range of variables such as academic achievement, motivation, anxiety and retention as dependent variables. The present study however has only analyzed measurements with respect to the impact of CSE on attitudes.

Data Analysis

Data analysis with regard to this meta-analytical study was carried out using the treatment effectiveness method. The objective here was to use the formula $d = (X_e - X_c) / SD$ in the experimental studies to calculate the differences between the mean scores of study and control groups. Also, various authors in independent studies conducted at different times have converted their statistical data into a common unit of measurement (Hedges' d /Effect Size-ES) and have determined the confidence interval of their statistical analyses as 95%. The effect sizes that the different meta-analytical studies have identified can be interpreted according to different classifications. In this study, the effect size values based on arithmetic means were used to calculate effect coefficients according to the classification levels defined by [Thalheimer and Cook \(2002\)](#). Thus, the following effect classification was used: $-0.15 < \text{Cohen's } d < 0.15$ negligible; $0.15 < \text{Cohen's } d < 0.40$ small; $0.40 < \text{Cohen's } d < 0.75$ medium; $0.75 < \text{Cohen's } d < 1.10$ large; $1.10 < \text{Cohen's } d < 1.45$ very large; $1.45 < \text{Cohen's } d$ huge. According to this, "0" was interpreted to mean that there was no difference between the study and control groups, "-" was interpreted to mean that the method applied yielded a negative effect, and "+" was interpreted to mean that the method yielded a positive effect. Furthermore, the fixed effects model (FEM) and the random effects model (REM) were employed to determine effect sizes in the meta-analysis ([Borenstein, Hedges, Higgins, & Rothstein, 2009](#)). The MetaWin 2.0 and Comprehensive Meta Analysis (CMA) statistical programs were used to find effect sizes and variances in the study, and to compare the defined groups. In addition, an interpretation was made according to the value obtained from the calculation of the effect size z scores.

Results of Research

In this part of the meta-analysis, the descriptive statistics of the studies included in the research were combined with the hypotheses related to the sub-problems of the study using the meta-analysis method to find and interpret effect sizes. In this context, 32 studies (7 articles, 19 Master's theses and 6 doctoral theses) that revealed arithmetic means and standard deviations on the use of CSE were accessed for use in the meta-analysis. When the number of works subjected to analysis is considered, it

can be seen that data was obtained with regard to 993 individuals in the study group and 973 in the control group, adding up to a total of 1,966 individuals. Furthermore, it has been ascertained that the statistical significance level of the studies subjected to the meta-analysis was .05, and that therefore the research was significant at the 0.05 level.

In the review of the findings on the general effect sizes calculated in the studies on the effect of CSE on students' attitudes, as seen in Table 1, it was found that based on the fixed effects model, the standard error (SE) was 0.047; the upper limit of the 95% confidence interval was 0.527, the lower limit was 0.344, and the mean effect size was $ES = 0.436$. At the end of the homogeneity test, the Q-statistical value was calculated to be 152.097. The critical value, as found in the chi-square (χ^2) table, using 32 degrees of freedom at a 95% significance level, was 46.194. Since the calculated statistical value Q (152.097) was larger than the critical value, 46.194, it may be said that the distribution of effect sizes displayed homogeneity. Calculated according to the Z-test, the significance was calculated to be 9.335 ($p = 0.000$). In other words, the distribution of the effect sizes of the studies was heterogeneous in terms of the fixed effects model. With the Q-statistic homogeneity test value being found to be significant, it was seen that the variance in effect sizes was larger than the variance that could be expected from a sampling error (Lipsey & Wilson, 2001).

Table 1
Table of Homogeneous Distribution Values, Mean Effect Sizes and Confidence Intervals of the Studies Included in the Meta-Analysis, by Effect Models

Type of Model	n	Z	p	Q	ES	SE	95% Confidence Interval	
							Lower Limit	Upper Limit
Fixed Effects Model	32	9.335	0.000	152.097	0.436	0.047	0.344	0.527
Random Effects Model	32	4.280	0.000	43.873	0.449	0.105	0.243	0.655

df : 31

Because the results of the homogeneity test performed on the studies included in the meta-analysis were higher than expected, the variance of the random effect component was calculated, and the model was converted to the random effects model. When the data of the 32 studies included in the meta-analysis were examined in terms of the random effects model at the end of the calculations, it was found that standard error (SE) was 0.105; the upper limit of the 95% confidence interval was 0.655, the lower limit was 0.243, and the mean effect size was $ES = 0.449$. It may be said that the effect size, according to the classification by Thalheimer and Cook (2002), was medium, and that CSE had a positive effect on students' attitude scores. Calculated according to the Z-test, significance was calculated to be 4.280 ($p = .000$).

The Effect of CSE by Educational Level

The studies related to the effect of CSE on student attitudes that matched the inclusion criteria of the meta-analysis were categorized in terms of 4 different

learning levels (elementary school, middle school, high school and university) to determine the effect of the educational level on the total effect size (Table 2). In the examination of the effect of educational level on students' attitude scores in the applications, it was seen that the largest effect size was 0.625 in the middle school group, the smallest was -0.018 in the university group, and the total effect size of all groups was 0.358. It was also seen that the application in middle school and high school, middle school, elementary school and university levels displayed a negligible effect size and that the total effect size was small.

Table 2
Effect Sizes by Educational Level

Educational Levels	N	ES	95% Confidence Interval for Effect Size		ESL
			Lower Limit	Upper Limit	
Elementary School	2	0.148	-0.339	0.636	Negligible
Middle School	17	0.625	0.413	0.836	Medium
High School	9	0.410	-0.151	0.971	Medium
University	4	-0.018	-0.286	0.249	Negligible
Total	32	0.358	0.206	0.509	Small

$Q_B = 14.471$, $Z = 4.635$, $df = 3$, $p = .002$, ESL: Effect Size Level.

An examination of the inter-group homogeneity test in Table 2 reveals the value $Q_B = 14.471$. As found in the chi-square (χ^2) table, 3 degrees of freedom at a 95 % significance level was found to be 7.815. ($\chi^2_{(0.95)} = 7.815$). Since the Q_B statistical value ($Q_B = 14.471$) at 3 degrees of freedom and χ^2 distribution was larger than the critical value ($\chi^2_{(0.95)} = 7.815$), it may be said that distribution was heterogeneous. Accordingly, a look at the effect sizes between groups ($Q_B = 14.471$; $p = .002$) by educational level in the studies included in the meta-analysis shows that there are significant differences between groups.

Effect of CSE by Course Subjects

To determine the effect of course subjects on the total effect size in the studies analyzed, the course subjects were categorized in four different groups, as *Science*, *Mathematics*, *Social Studies* and *Other*. The results of the analysis are shown in Table 3. An examination of the effect of CSE on students' attitude scores according to course subjects indicates that the smallest effect size was in the category *Other* (ES:-0.018); the largest may be said to have been *Social Studies* (ES: 0.529), while the total effect size for the groups was 0.298. Furthermore, it was observed that the categories of *Science*, *Mathematics* and *Social Studies* displayed a medium, the *Other* group a negligible, and the total effect size for the group indicated a small effect size.

Table 3
Effect Sizes by Course Subjects

Course Subjects	N	ES	95% Confidence Interval for Effect Size		ESL
			Lower Limit	Upper Limit	
Science	17	0.529	0.219	0.839	Medium
Mathematics	7	0.509	0.146	0.871	Medium
Social Studies	4	0.487	-0.176	1.151	Medium
Other*	4	-0.018	-0.286	0.249	Negligible
Total	32	0.298	0.128	0.469	Small

*Undergraduate courses $Q_B = 9.127$, $Z = 3.423$, $df = 3$, $p = 0.028$.

In Table 3, which presents the analysis results with respect to the courses examined in the studies included in the meta-analysis, the homogeneity test value was found to be $Q_B = 9.127$. As found in the chi-square (χ^2) table, 3 degrees of freedom at a 95% significance level was found to be 7.815 ($\chi^2_{(0.95)} = 7.815$). Since the homogeneity value ($Q_B = 9.127$) at 3 degrees of freedom and χ^2 distribution was larger than the critical value ($\chi^2_{(0.95)} = 7.815$), it may be said that distribution was heterogeneous. Accordingly, when effect sizes between groups ($Q_B = 9.127$; $p = .028$) were examined by course subjects in the studies included in the analysis, it was found that there were significant differences between groups.

Effect of CSE by Duration of Application

To determine whether or not the effect size of CSE differed according to the duration of the application, the studies were categorized into 4 different groups: 2-4 weeks, 5-8 weeks, 9-18 weeks and Indeterminate Duration (Table 4). When the results of the analysis in the table are examined in terms of duration, it is seen that the smallest effect size, at 0.290, belongs to the *Indeterminate* group, the largest effect size, at 0.676, belongs to the *9-18 weeks* group, and the effect size for all groups is 0.434.

Table 4
Effect sizes by Duration of Application

Duration (Weeks)	N	ES	95% Confidence Interval for Effect Size		ESL
			Lower Limit	Upper Limit	
2-4	10	0.663	0.222	1.104	Medium
5-8	6	0.345	-0.059	0.749	Small
9-18	3	0.676	0.108	1.243	Medium
Indeterminate	13	0.290	-0.032	0.612	Small
Total	32	0.434	0.230	0.638	Medium

$Q_B = 2.688$, $Z = 4.168$, $df = 3$, $p = .442$.

An examination of the inter-group homogeneity test in Table 4 reveals the value $Q_B = 2.688$. As found in the chi-square (χ^2) table, the value of 3 degrees of freedom at a 95% significance level was found to be 7.815. Since the statistical value Q_B at 3 degrees of freedom and χ^2 distribution was smaller than the critical value ($\chi^2_{(0.95)} = 7.815$), the homogeneity hypothesis for the distribution of effect sizes was accepted in the fixed effects

model. In other words, it was found that the effect of the applications on students' attitude scores did not display significant differences in terms of the duration of the application ($Z = 4.168, p = .442$). This finding indicates that the attitude scores of students taking lessons conducted with computer-supported applications do not change according to the length of time the application is implemented. For this reason, it can be seen that instruction based on such applications displayed a similar large effect in all the groups. On the other hand, it can be said that because there were few studies with a 9-18-week application period that matched the criteria, this information only provided an insight into the current situation, and was not sufficient to make a definitive judgment.

Publication Bias

In meta-analytic studies, publication bias is a threat (Rothstein, Sutton, & Borenstein, 2005; Vevea & Woods, 2005). It is a particular concern for the meta-analysis process because meta-analytic results are based on the assumption that available papers are a random sample of all those that exist on the topic. And if they are not representative, the validity of the conclusions can be threatened. As there is a potential threat in terms of publication bias, certain strategies have been suggested for eliminating or preventing such publication bias, one of which is to determine the fail-safe number (f-sn) developed by Rosenthal (1979) with the aim of estimating the number of unidentified studies. In this study, by using the MetaWin program in the analysis process, the value of f-sn considering the effect of CSE on attitude was found as being 978.2. When some more studies exceeding the related f-sn number were included in the analysis, the effect size of CSE on attitude would drop to be .001. If the number of studies (17) is taken into account as studies have been included in the related analysis, it can be inferred that the number of 978 is greatly in excess, and the results can be viewed as reliable.

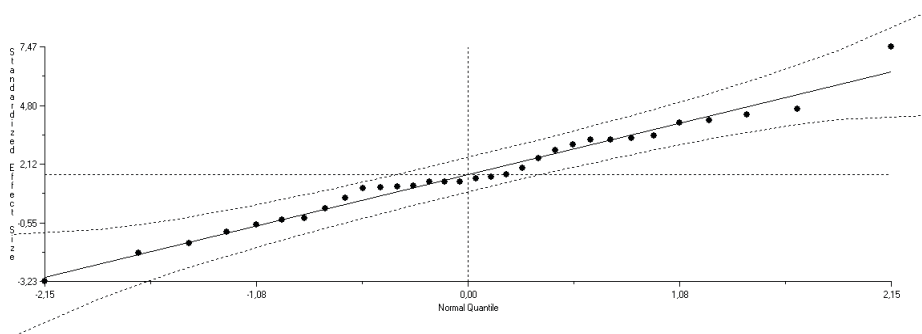


Figure 1. Normal quantile plot.

In Figure 1, the chart of the Normal Quantile Plot created through the MetaWin program is seen. With this chart, the aim was to make clear whether or not the assumption that the

effect sizes of the studies were appropriate to the normal distribution. Heterogeneity tests were therefore implemented quantitatively, and checked with the chart. When the general distribution of effect sizes is between the confidence interval identified along the line $X = Y$, the distribution is considered to be normal (Rosenberg, Adams, & Gurevitch, 2000). In Figure 1, it can be seen that the effect size distribution stretches along the line normally between the two dashed lines and without any large deviations which means that the distribution represents a normal function. It can be inferred from this situation that the studies included in the meta-analysis display a statistical relevance.

Discussion and Conclusions

The purpose of this study was to determine the effect of computer-supported applications used in the classroom environment on students' attitude scores. In the context of this goal, quantitative studies conducted over the period 2005-2015 comparing CSE and traditional instruction were reviewed. That is, 186 articles, 412 Master's theses and 23 doctoral theses were accessed on this subject. Only those studies that represented experimental research conducted with control groups and those that treated the effect of CSE on student attitudes were included the meta-analysis. A total of 621 studies in the national and international literature (Google Scholar, the Council of Higher Education National Thesis Center, Ebscohost-Eric, ScienceDirect, Ebscohost-Professional Development Collection) matching the inclusion criteria, and 32 studies matching the research criteria, were reviewed using CMA and the MetaWin package programs.

In the analysis of the data belonging to the 32 studies revealing students' attitude scores according to the criteria determined for meta-analysis and based on the random effects model, it was found that the standard error (SE) was 0.105; the upper limit of the 95% confidence interval was 0.655, the lower limit was 0.243 and the mean effect size was $ES = 0.449$, signifying a medium, positive and significant effect in terms of the classification by Thalheimer and Cook (2002). These results indicate that the effect of the classroom use of computer-supported applications is of an acceptable level in terms of student attitude scores, meaning that such applications have a positive effect. The research findings are consistent with the results indicated in Master's theses (Başaran, 2005; Demirer, 2006; Olgun, 2006; Tavukcu, 2008), articles (Akçay, Tüysüz, Feyzioğlu, & Oğuz, 2008; İşman, Çağlar, Dabaj, Altınay, & Altınay, 2004), and doctoral theses (Karakuş, 2004) in the national literature which were not included in the analysis, as well as in various studies published abroad (Koyunlu Ünlü & Dökme, 2011; Papastergiou, 2010; Soyibo & Hudson, 2010; Ünlü, Avcu, & Avcu, 2010). For this reason, it may be said that the meta-analysis results regarding the effects on attitude scores are in parallel with what has been revealed in the literature. In other words, according to the general results of the studies, it has been determined

that computer-supported lessons have a more positive effect on student attitudes compared to lessons taught by traditional instruction methods. In contrast to these results however, findings revealed in a doctoral thesis by Teyfur (2010) on computer-supported geography lessons which are designed based on the constructivist theory that there was no significant difference among gender variable in terms of attitude; similarly, Yakışan (2008) and Tosun (2006) also showed in their doctoral theses that there was no significant difference between the two methods of instruction. Another similar result was obtained in studies (Gönen, Kocakaya, & İnan, 2006; Güven & Sülün, 2012) that found that students' attitudes toward their studies showed no difference, no matter which of the two modes of instruction were used.

The meta-analysis carried out to discover the effect of educational level on effect size was performed on four levels (elementary school, middle school, high school and university). The largest effect size was observed at the middle school level (ES:0.625) while the smallest one was found with regard to the university group (ES:-0.018). Moreover, in the review of the different course subjects (Science, Mathematics, Social Studies and Other) to determine their effect on total effect size, it was seen that the smallest effect size was in the category Other (ES:-0.018), which included undergraduate courses. The largest effect size was observed in Social Studies (ES:0.529), while total effect size for the groups was 0.298. Furthermore 4 different durations (2-4, 5-8, 9-18 weeks and indeterminate) were examined to determine whether or not the effect sizes of computer-supported applications changed according to the application duration. In this, the smallest effect size was 0.290 in the indeterminate group, while the largest effect size was 0.676 in the 9-18-week group. The effect size for all the groups was 0.434, a medium effect size according to the classification by Thalheimer and Cook (2002). This result indicates that computer supported applications have similarly large effects across all application durations. Parallel to this outcome, in Armağan's (2011) study on the effect of conceptual change texts, no difference in effect size depending on application duration was found ($Q_B = 2.362$; $p = .306$). This finding is consistent with the group results of the present study. At the same time, outside of the 9-18 week application period, all other groups (N:3) resulted in positive effect sizes. Since the duration data were obtained from only 3 comparisons, the effect size results may not be generalizable in terms of duration periods, and it can only be said that they solely reflect the present status. At this point, it is worth noting that Rosenberg et al. (2000) have emphasized that the Hedges' g value used in calculating effect size should be used with regard to at least 5 comparisons for sound results. It can be said that the evaluation of the meta-analysis showed that the effect of computer-supported applications on students' attitude scores is at an acceptable level. For this reason, and because of their positive effect on student attitudes, the said applications may be recommended for widespread use across educational levels. It may also be recommended that content prepared within the scope of CSE be of a nature that will make courses more interesting for students and ensure

their enthusiastic attention. In this context, we contribute our study to the literature in the belief that this meta-analytical review of the effect of CSE on student attitudes will encourage other researchers to conduct more studies using meta-analysis.

The research results indicate that CSE has positive effects on attitude. It can be truly stated that computer technology is not an alternative method to be used in the instructional process, but a necessity in this information technology age. Since technology has an effect on every aspect of current life, many researchers work with different versions of the term CSE, and have revealed mostly positive effects of CSE on various factors such as academic performance, retention, attitude, skills, etc. The great effect of CSE on attitude is a significant advantage in educational environments, as it is known that a positive attitude enhances learning, while a negative one hinders it. Thus, teachers should use CSE more than they do. They could set online homework instead of traditional ones which would be expected to increase students' interest and desire for learning. As for the reserchers, it is recommended that they conduct studies regarding the impact of CSE on different variables and factors in terms of different courses.

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