JOURNAL OF BALTIC SCIENCE EDUCATION

ISSN 1648-3898 /Print/
ISSN 2538-7138 /Online/

A META-ANALYTIC EXAMINATION OF THE EFFECT OF INDIVIDUAL AND SCHOOL-AVERAGE ACHIEVEMENT ON STUDENTS' SELF-CONCEPT IN SCIENCE

Nurcan Kahraman

Abstract. *The purpose of the present study was to examine the effect of individual and school average achievement on students' self-concept in science. The data of the last four Trends in International Mathematics and Science Study (TIMSS) cycles were used, and a two-stage individual data meta-analysis was conducted to examine the relationship between achievement and self-concept in science. In the first stage, multilevel structural equation modeling was performed for each dataset. Furthermore, the effect sizes were synthesized via meta-analysis with a three-level random-effect model. In addition, moderation analysis was conducted for the year, grade, and degree of stratification in countries. The results suggested a positive and significant effect of individual science achievement on the self-concept of students in science. On the other hand, the relation of the average school achievement was negative. The results were discussed by considering the big-fish-little-pond effect.*

Keywords: *big fish little pond effect, TIMSS, self-concept, science education*

Nurcan Kahraman
Bursa Uludag University, Türkiye

Introduction

Students' self-concept is one of the significant educational constructs that influence their learning outcomes (Bong & Skaalvik, 2003). Self-concept is about individuals' self-beliefs about their ability in an academic domain (Ferla et al., 2009). Students can evaluate their abilities by using different references such as comparing their performances to past experiences or their peers' performances (Bong & Skaalvik, 2003; Wigfield & Eccles, 2000). The big-fish-little-pond effect (BFLPE) theory argues that social comparison is an important reference point for students to evaluate their ability in an academic domain. In other words, according to the theory, students tend to compare themselves with their peers like their classmates or schoolmates and adopt self-beliefs based on the results of this comparison (Marsh, 2004). The theory underlines that those external references may influence self-concept, and achievement is an important external reference for students. Hence, the achievement of the group that students are involved in becomes an important predictor of students' self-beliefs. As the average group's achievement increases, individuals' self-concept decreases (e.g., Marsh et al., 2008; Seaton et al., 2010). For instance, Chen (2022) examined the BFLPE in mathematics for Hong Kong students with Trends in International Mathematics and Science Study (TIMSS) 2019 data and supported that group achievement negatively affects self-concept not only for eighth graders but also for fourth graders. Besides, even though the BFLPE was significant for both grades, it was stronger for eighth graders. Marsh et al. (2014) also showed that the BFLPE is lower for younger students in their study in which they examined the BFLPE across diverse cultures. In another study, Wang (2020) examined the BFLPE in mathematics with a cross-national analysis, using TIMSS 2015 data for eighth and fourth graders. Multilevel structural equation modeling showed that the BFLPE was significant for most participant countries for both grades. Fang et al. (2018) conducted a meta-analysis to synthesize the BFLPE. They involved 56 effect sizes from 33 studies and found a significant and small mean effect size ($\beta = -0.28$).

Nowadays, researchers tend to be interested in synthesizing the BFLPE from complex surveys like TIMSS with a meta-analytic perspective. For instance, Parker et al. (2021) used TIMSS cycles from 2003 to 2015 and analyzed 130 BFLPE sizes for grades four and eight with a Bayesian random meta-regression. According to the findings, the BFLPE was negative and significant except in two cases. Furthermore, there was a large, positive relation between the BFLPE and ability stratification. In a recent study, Compos et al.

https://doi.org/10.33225/jbse/24.23.37

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

(2022) examined the BFLPE in mathematics by using international large assessments (e.g., TIMSS, PISA). They used a two-stage parameter-based meta-analysis to estimate the effect size and confirmed the significant negative effect of group average achievement on students' mathematics self-concepts. Moreover, the findings suggested no significant differences between years in terms of the BFLPE in mathematics. In addition, Guo et al. (2018) discussed that most studies that explored the BFLPE focus on mathematics. More recently, the BFLPE has been examined in different domains like reading. According to the author's knowledge, limited research examines the BFLPE in science with a meta-analytic perspective. Hence, this study aimed to contribute to the literature by adding results for science. To sum up, the present study aimed to examine the effect of individual and school average achievement on students' self-concept in science by synthesizing the results from the last four cycles of TIMSS.

School Stratification

Educational systems can shape students' school environments, which in turn influences their self-beliefs. To illustrate, Guo et al. (2018) examined the BFLPE in mathematics, science, and reading among 15 Organization for Economic Co-operation and Development (OECD) countries by considering school stratification influence. They used TIMSS and PIRLS 2011 databases, and intraclass correlation (ICC) as a measurement of the degree of school stratification. Their results suggested a negative and significant correlation between the BFLPE and ICC, which means that highly stratified systems feed the negative effect of school average achievement on the self-concept of students. In addition, comparing the magnitude of the correlation coefficients suggests that the effect in science is perceived as weaker than in mathematics. In a recent study, Parker et al. (2021) also examined how school stratification predicts the BFLPE of students. They used TIMSS datasets for 2003, 2007, 2011, and 2015 from OECD countries. They meta-analyzed 130 BFLPE and ICC estimates in mathematics and suggested a large relationship between ability stratification and the BFLPE. In other words, when students with similar abilities are encouraged to enter the same schools, the negative effect of group achievement average on students' mathematics self-concept becomes higher than usual. On the other hand, students in selective schools may tend to feel the school accomplished their success. This is assimilation and is termed the 'reflected glory effect'. Namely, students may think that if they are good enough to be in this school, they can be successful at the given task (Marsh et al., 2000). For instance, Parker et al. (2010) examined the effects of ability grouping on students' mathematics self-concepts and supported the idea that school average can have both a negative contrast effect (BFLPE) and a positive assimilation effect. Cultural characteristics are one of the factors affecting which of these school average achievement effects will dominate. For example, collectivistic countries tend to have a smaller contrast effect than individualistic countries (e.g., McFarland & Buehler, 1995). Another factor that determines whether the BFLPE would have a contrast effect or assimilation effect is socio-economic status (Parker et al., 2018). They discussed that when the BFLPE is large, students from a low socio-economic background tend to have a higher self-concept than expected. To sum up, school stratification is a critical issue that should be considered while investigating the BFLPE. However, there is little research about it (Parker et al., 2021). Consequently, in the current study, countries' school stratification degree was treated as a moderator variable of the relation of self-concept to both school average and individual achievement.

Research Focus

This study aimed to examine the effect of individual and school average achievement on students' self-concept in science and the effect of grade, year, and ability stratification on these relations by synthesizing the results from the last four cycles of TIMSS: 2007, 2011, 2015 and 2019 data. To reach the aim of the study, the following research questions were addressed:

(1) To what extent is the level of achievement related to the self-concept of students in science?
(2) Does school average science achievement relate to the science self-concept of students (BFLPE)?
(3) Do year and grade moderate the relation of science self-concept to school average and individual achievement of students?
(4) Does the degree of school stratification moderate the relation of science self-concept to school average and individual achievement of students?

https://doi.org/10.33225/jbse/24.23.37

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

Research Methodology

Data

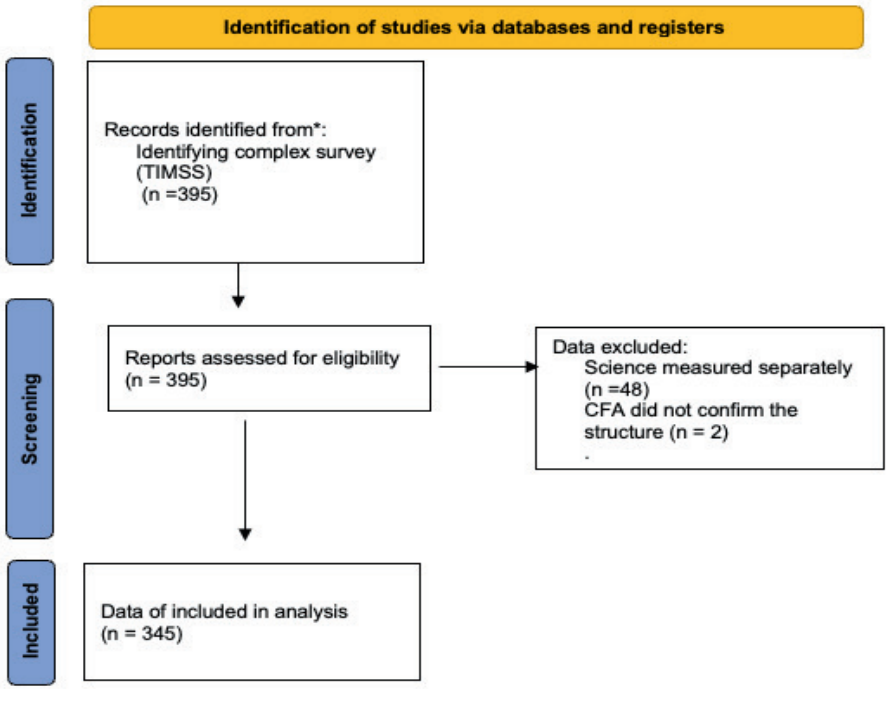
TIMSS is an international exam which is carried out by the International Association for the Evaluation of Educational Achievement (IEA). It is administered every four years according to a schedule and focuses on fourth and eighth graders' mathematics and science achievement. Additionally, it also provides data on non-achievement variables such as socioeconomic status, demographic characteristics, and home and class environment (International Association for the Evaluation of Educational Achievement, n.d.).

The data of TIMSS's last four cycles for both eighth-grade and fourth-grade students were used in the current study. For eighth-grade measures, some countries teach science in separate areas like biology, chemistry, or physics. Hence, they were not included in the study. Only the general science data of the survey is included in the analysis. Since there were no exclusion criteria except for measuring the self-concept of science in general form, all the available data, 345 data sets from 2007 to 2019, were used. There were 1,053,438 fourth-grade students and 795,936 eighth-grade students. In Figure 1, The PRISMA diagram (Moher et al., 2009) presents the included and excluded data sets of the current study. Table 1 summarizes the number of countries for each year.

Table 1.
Number of Countries For Each Year

Year	Number of countries	
	Fourth grade	Eighth grade
2007	40	34
2011	57	34
2015	50	32
2019	63	30

Figure 1
The PRISMA diagram



https://doi.org/10.33225/jbse/24.23.37

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

Instrument and Procedures

Science self-concept

Three items; (i) "I usually do well in science", (ii) Science is not one of my strengths, (iii) I learn things quickly in science were handled as students' science self-concept (Wang, 2015). The confirmatory factor analysis was conducted for each country to examine the validity of the measurement. All the data confirmed the structure of the self-concept (CFI >.90, RMSEA <.08, SMR <.08) except for two datasets. Hence, the data from the exception countries were removed from the analyses.

Science achievement

TIMSS assesses students' science achievement in four domains: biology, chemistry, physics, and earth science, and three cognitive areas: knowing, applying, and reasoning. Besides, achievement scores are treated as five plausible variables in databases.

School stratification degree

To assess countries' degree of school stratification, the ICC of science achievement was calculated for each country. ICC shows us how the total variance in science achievement is explained by school differences. If ICC approaches one, it means a high school stratification system; students may be rank-ordered according to their achievement scores and are entered into the school. In contrast, ICC close to zero means that students are randomly assigned to the schools (Parker et al., 2021).

Data Analysis

Two-stage individual data meta-analysis was conducted to examine the relationship between achievement and self-concept in science. Campos et al. (2023) suggested that meta-analysis of the data with complex sampling designs can be complex, and statistical problems can occur, such as handling survey weights or clustered data structure while conducting one stage of individual participant meta-analysis. Moreover, they suggested a two-stage individual participant data analysis for complex survey designs. According to their proposal, the first stage comprises individual data analysis from the studies and the second stage makes a meta-analytic synthesis of effect sizes.

In the current study, multilevel structural equation modeling analysis was performed for each of the data sets for the first stage of meta-analysis. Since achievement was assessed via five plausible variables, each analysis was run five times and combined for the data estimates. The quadratic component of science achievement was also included in the model at Level 1. At Level 2, the school average of science achievement was obtained by rounding the grand mean. Equation 1 and 2 represents a summary of the model.

$$scwij = \beta withinachwij + \beta 2(achij)^2 + \varepsilon ij \quad (1)$$

$$scbj = \beta betweenachbj + \delta j \quad (2)$$

swij: within level self-concept, sbj: between level self-concept, achij: student science achievement in group j, achbj: the average science achievement for the group.

The R programming language and Mplus software were used for data analysis. The packages of EdSurvey, MplusAutomation, tidyverse, and rlang were installed in R. The codes were adopted from Wang (2020). The standardized effect sizes were calculated by using equations 3 and 4 (Wang & Bergin, 2017).

$$ES=2 \times \beta \times SD(science)/SD(scij) \quad (3)$$

$$BFLPE\ ES=2x\ (\beta between - \beta within) \times SD(science)/SD(scij) \quad (4)$$

β: unstandardized regression coefficient, *SD*: standard deviation

https://doi.org/10.33225/jbse/24.23.37

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

In Step 2, a meta-analysis was performed for (1) science achievement within the level, and (2) the BFLPE separately. Three-level random-effects models with the sampling variance for each effect size (Level 1), variation effect sizes within countries (Level 2), and between countries (Level 3). The analysis was conducted using the metafor package in R. The codes were adopted from Campos et al. (2023).

Research Results

Effect Size

Before calculating the pooled effect size, Cochran's Q was used to examine the heterogeneity. It is the classic method for assessing heterogeneity in meta-analyses. Using a chi-squared distribution, it calculates the probability that, if significant, indicates greater diversity between studies than within subjects within a single study (Higgins & Green, 2008). The results of Cochran's Q statistics suggested heterogeneity among studies for the BFLPE (Q [343] = 2195.58, p <.001) and the effect of within-level achievement (Q[343] = 9202.89, p <.001). According to the I^2 values of the variables, the magnitude of the heterogeneity was 93.51% for the effect of science achievement and 85.56% for the BFLPE. Hence the heterogeneity is high for both variables (Borenstein et al., 2009). The three-level random-effect model suggested a significant negative BFLPE ($\hat{\mu}$ = -.27) and a significant positive achievement effect ($\hat{\mu}$ = .60). The findings are presented in Table 2.

Table 2
Average Effect Sizes and Heterogeneity

	$\hat{\mu}$ (se)	95 % CI	σ^2_{ES}	σ^2_c	I^2_{ES}	I^2_c	I^2_{total}	QE (df)
BFLPE	-.27 (.01)	-.29, -.25	.19	.04	82.57	2.99	85.56	2195.58 (353)
Within-level linear effect	.60 (.01)	.58, .63	.21	.03	93.51	2.34	95.56	9202.89 (353)

$\hat{\mu}$ = Weighted average effect siz, σ^2_{ES} = Variation between effect sizes within the countries, σ^2_c=Between-country variation, I^2_{ES}, I^2_c, and are the corresponding heterogeneity indices, QE= test fot heterogenity

Analysis of Moderator Variables

After calculating the general effect size, the grade was added to the model as a moderator of the variables. Q statistics showed that the moderator is significant for both the BFLPE (Q [1] = 38.86, p < .01) and within-level achievement (Q [1] = 73.36, p < .01). In other words, there was a significant difference between fourth and eighth graders in terms of the effect of not only individual achievement but also school average achievement on science self-concept. According to the results, the relationship between achievement and self-concept of eighth-grade students is larger than the relationship between achievement and self-concept of fourth-grade students. In another model, the year was considered as a moderator of the outcome variables. According to the findings, the year was not a significant predictor of the BFLPE. It was significant for science achievement. The highest score was for 2007 whereas the lowest score was for 2019. Finally, the ICC of science achievement was added to the model as a moderator to examine the stratification effect. According to the results, ICC was only significant for within-level achievement. The findings of each moderator analysis are presented in Table 3.

Table 3
The Findings of Moderator Analyses

Moderator	ICC		Year		Grade	
	BFLPE	Within level linear effect	BFLPE	Within level linear effect	BFLPE	Within-level linear effect
$\hat{\mu}$ (se)	-.24 (.03)*	.54 (.02)*	-.29 (.02)*	.70 (.02)*	-.22 (.01)*	.53 (.01)*
95 % CI	-.29, -.19	.48, .59	-.34, -.24	.65, .75	-.25, -.18	.50, .56

https://doi.org/10.33225/jbse/24.23.37

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

Moderator	ICC		Year		Grade	
	BFLPE	Within level linear effect	BFLPE	Within level linear effect	BFLPE	Within-level linear effect
ICC	-.03	.07*	-	-	-	-
2011 [95 % CI]	-	-	-.03 [-.01, .03]	-.10 [-.16, -.04]*	-	-
2015 [95 % CI]	-	-	.04 [-.03, .10]	-.13 [-.20, -.07]*	-	-
2019 [95 % CI]	-	-	.05 [-.01, .11]	-.16 [-.22, -.09]*	-	-
Grade 8 [95 % CI]			-	-	-.14 [-.18, -.09]*	.19 [.14, 23]*
σ^2_{ES}	.19	.21	.18	.20	.18	.19
σ^2_c	04	.04	.04	.04	.04	.03
I^2_{ES}	82.47	93.09	80.92	92.31	79.80	92.45
I^2_c	3.07	2.68	3.41	2.92	3.35	2.44
I^2_{total}	84.54	95.77	84.33	95.24	83.16	94.89
QE (df)	2180.92 (352)*	8864.79 (352)**	2053.54 (352)*	8478.97 (352)*	1970.32 (352)*	6655.12 (352)*
QM (df)	1.32 (1)	6.05 (1)*	3.49 (3)	27.67 (3)*	38. 86 (1)*	73.36 (1)*

$\hat{\mu}$ = Weighted average effect siz, σ_{ES}^2 = Variation between effect sizes within the countries, $\sigma_{\hat{u}}^2$ = Between-country variation, I_{ES}^2, I_C^2, and are the corresponding heterogeneity indices, QE= test fot heterogenity, QM = Test of Moderator, *$p < .01$

Discussion

The current study aimed to synthesize the effect of individual and group average achievement on the self-concept of students in science. To achieve this aim, the last four cycles of TIMSS data for grade four and grade eight were used. Concerning Research Question 1 (To what extent is the level of achievement related to the self-concept of middle school students in science?), results suggested a significant and positive linear effect on students' science self-concept within the level. The magnitude of the pooled effect size was 0.54 and the heterogeneity of the effect size was extremely high within countries (I^2 = 93.09%). Contrariwise, there was little heterogeneity between countries (I^2 = 2.68 %). Research Question 2 was related to the BFLPE. Results suggested that school average achievement has a significant and negative effect on students' science self-concept. In other words, the findings supported the BFLPE theory for science. According to three-level random-effects models, although most of the heterogeneity lies within countries (I^2 = 82.47%), heterogeneity also exists between countries (I^2 = 3.07%). In respect thereof, it will be useful to mention the findings of the first stage. According to the multilevel structural equation modeling analyses, the achievement was positively significant for science self-concept for nearly all countries for each grade within the level, and the school achievement average (BFLPE) was negatively related to the science self-concept of students for most of the countries. This finding is parallel to previous studies' results. For instance, Guo et al. (2022) examined the BFLPE in three different domains, mathematics, science and reading, across 15 countries and found that the between-country variance is too small. Moreover, they explored the relationship between the degree of ability stratification and the BFLPE at the country level and suggested that the relationship for mathematics is stronger than the relationship for science. Supporting this idea, in a recent study, Campos et al. (2023) synthesize the size of the BFLPE in mathematics with three-level random-effects models and suggest that most of the heterogeneity lies between countries (I^2 = 78%). Hence in a further study, the BFLPE can be examined with individual data meta-analysis for both science and mathematics over the same data sets.

In addition, moderator analyses were conducted to understand the role of year and grade on the heterogeneity of the effect of both individual and school average achievements on students' self-concept. Findings supported non-significant heterogeneity among cycles of TIMSS regarding the BFLPE. Namely, the year did not contribute significantly to the heterogeneity of the school average effect size. On the other hand, it was a significant moderator of the linear effect of science achievement. While the lowest effect size was for 2019, the highest one was for

https://doi.org/10.33225/jbse/24.23.37

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

2007. Furthermore, the grade was a significant predictor for the BFLPE and within-level achievement; eighth-grade students tend to feel the effects more strongly than fourth-grade students. This was an expected finding because previous studies also offer a smaller BFLPE for younger students (e.g., Chen, 2022; Marsh, 2014).

Another aim of the current study was to examine whether the degree of school stratification controls the relationship between achievement and self-concept in science. Therefore, the ICC of science achievement for each country was considered as a moderator for the effect sizes both for school average achievement (BFLPE) and individual achievement. According to the results, there was no significant moderation impact on the BFLPE. This was a surprising finding since it is expected that selective educational systems tend to cause a negative BFLPE on students' self-concept. In addition, previous results suggested negative relations between the degree of stratification and the BFLPE. For instance, in their study, Parker et al. (2021) meta-analyzed 28 OECD countries' data in mathematics and suggested a large and negative significant relation between ICC and the BFLPE. In another study, Guo et al. (2018) examined this relation not only for mathematics but also for science and reading and confirmed the significant and negative impact of school stratification on the BFLPE of students. They also demonstrated that the negative effect is larger in mathematics compared to science. However, they examined this effect only in OECD countries. These countries mostly show individualistic characteristics, and individualistic countries tend to have a larger negative effect of school average achievement on the self-concept of students than collectivistic cultures (e.g., McFarland & Buehler, 1995). On the other hand, the data of the current study involves not only OECD countries, but all TIMSS participant countries involved in the analyses, so in some countries, a positive assimilation effect of the BFLPE can occur. For instance, in the reflected glory effect, the student can perceive the group success as a reference to evaluate their ability in an academic domain (Marsh et al., 2000). Therefore, these cultural or economical differences may cause a drop in the significance of school stratification. In a further study, the school stratification effect can be examined by considering the cultural differences among countries.

To sum up, the effects of both individual and school average achievement were meta-analyzed in this study. The last four cycles of TIMSS data were searched, and 355 data were involved in the analysis. This study makes several contributions. Firstly, considering the relationship between self-concept and other educational outcomes (e.g., Suárez-Álvarez et al., 2014), it is important to examine the factors that influence students' self-concepts, of which achievement is a prominent predictor. Hence, this study examined the effects of achievement in two forms: the linear individual effect within the level, and the school average form (BFLPE). Next, although the BFLPE is mainly explored for mathematics in the relevant literature (Guo et al., 2018), the magnitude of the effects can vary with the academic domain. To the author's knowledge, this is the first study that synthesizes the BFLPE with individual participant data meta-analysis in science.

Conclusions and Implications

The study presented an insightful examination into the influence of individual and school-average achievement on students' self-concept in science, using data from multiple cycles of TIMSS. The results illuminated the nuanced relationship between academic achievement and self-concept, particularly emphasizing the significant impact of both individual science achievement and school-average achievement on students' perceptions of themselves in the scientific domain. The results concerning the BFLPE in science which are consistent with previous research in mathematics and provide a comparative perspective across academic domains. The study's examination of the BFLPE in science education, an area with limited prior meta-analytic investigation, adds depth to the literature. Recognizing the impact of group achievement on individual self-beliefs could lead to tailored interventions or teaching methods to counteract negative effects.

In addition, the study examined the moderating roles of grade, year, and school stratification, providing insights into how these factors influence the associations between achievement and self-concept. The study highlights the influence of grade level on the relationship between achievement and self-concept. Understanding that older students may be more affected by group performance could lead to age-specific interventions aimed at increasing self-confidence, especially in subjects where the BFLPE is more apparent.

Acknowledgements

This work was supported by the Bursa Uludag University under Grant 1064.

https://doi.org/10.33225/jbse/24.23.37

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

References

Bong, M., & Skaalvik, E. M. (2003). Academic self-concept and self-efficacy: How different are they really? *Educational Psychology Review, 15*(1), 1–40. https://doi.org/10.1023/A:1021302408382

Campos, D. G., Cheung, M. W. -L., & Scherer, R. (2023). A primer on synthesizing individual participant data obtained from complex sampling surveys: A two-stage IPD meta-analysis approach. *Psychological Methods.* https://doi.org/10.1037/met0000539

Chen, X. (2022). The effects of individual- and class-level achievement on attitudes towards mathematics: An analysis of Hong Kong students using TIMSS 2019. *Studies in Educational Evaluation, 72*, 1–10. https://doi.org/10.1016/j.stueduc.2021.101113

Fang, J., Huang, X., Zhang, M., Huang, F., Li, Z., & Yuan, Q. (2018). The big-fish-little-pond effect on academic self-concept: A meta-analysis. *Frontiers in Psychology*, *9*(AUG), 1–11. https://doi.org/10.3389/fpsyg.2018.01569

Ferla, J., Valcke, M., & Cai, Y. (2009). Academic self-efficacy and academic self-concept: Reconsidering structural relationships. *Learning and Individual Differences, 19*, 499–405. https://doi.org/10.1016/j.lindif.2009.05.004

Guo, J., Marsh, H. W., Parker, P. D., & Dicke, T. (2018). Cross-cultural generalizability of social and dimensional comparison effects on reading, math, and science self-concepts for primary school students using the combined PIRLS and TIMSS data. *Learning and Instruction*, *58*(July), 210–219. https://doi.org/10.1016/j.learninstruc.2018.07.007

Higgins, J. P., & Green, S. (Eds.). (2008*). Cochrane handbook for systematic reviews of interventions.* Wiley-Blackwell.

International Association for the Evaluation of Educational Achievement. (n.d.). *TIMSS. Trends in International Mathematics and Science Study*. https://www.iea.nl/studies/iea/timss

Marsh, H. W. (2004). Negative effects of school-average achievement on academic self-concept: A comparison of the big-fish-little-pond effect across Australian states and territories. *Australian Journal of Education, 48*(1), 5–26. https://doi.org/10.1177/000494410404800102

Marsh H. W., Abduljabbar, A. S., Parker, P. D., Morin, A. J. S., Abdelfattah, F., & Nagengast, F. (2014). The big-fish-little-pond effect in mathematics: A cross-cultural comparison of U.S. and Saudi Arabian TIMSS responses. *Journal of Cross-Cultural Psychology, 45*(5), 777–804. https://doi.org/10.1177/0022022113519858

Marsh, H. W., Kong, C. K., & Hau, K. T. (2000). Longitudinal multilevel models of the big-fish-little-pond effect on academic self-concept: counterbalancing contrast and reflected-glory effects in Hong Kong schools. *Journal of Personality and Social Psychology*, *78*(2), 337–349. https://doi.org/10.1037/0022-3514.78.2.337

Marsh, H. W., Trautwein, U., Lüdtke, O., & Koller, O. (2008). Social comparison and big-fish–little-pond-effect on self-concept and other self-belief constructs: Role of generalized and specific others. *Journal of Educational Psychology, 100*, 510–524. https://doi.org/10.1037/0022-0663.100.3.510

McFarland, C., & Buehler, R. (1995). Collective self-esteem as a moderator of the frog-pond effect in reactions to performance feedback. *Journal of Personality and Social Psychology*, *68*(6), Article 1055. https://doi.org/10.1037/0022-3514.68.6.1055

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Med, 6*(7), 332–336. https://doi.org/10.1136/bmj.b2535

Parker, P., Dicke, T., Guo, J., Basarkod, G., & Marsh, H. (2021). Ability Stratification Predicts the Size of the Big-Fish-Little-Pond Effect. *Educational Researcher*, *50*(6), 334–344. https://doi.org/10.3102/0013189X20986176

Parker, P. D., Marsh, H. W., Guo, J., Anders, J., Shure, N., & Dicke, T. (2018). An information distortion model of social class differences in math self-concept, intrinsic value, and utility value. *Journal of Educational Psychology*, *110*(3), 445–463. https://doi.org/10.1037/edu0000215

Seaton, M., Marsh, H. W., & Craven, R. G. (2010). Big-fish-little-pond effect: Generalizability and moderation-two sides of the same coin. *American Educational Research Journal*, *47*(2), 390–433. https://doi.org/10.3102/0002831209350493

Wang, Z. (2020). When large-scale assessments meet data science: The big-fish-little-pond effect in fourth- and eighth-grade mathematics across nations. *Frontiers in Psychology*, *11*(September), 1–17. https://doi.org/10.3389/fpsyg.2020.579545

Wigfield, A., & Eccles, J. S. (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology, 25*, 68–81. https://doi.org/10.1006/ceps.1999.1015

Received: *November 17, 2023* Revised: *December 07, 2023* Accepted: *January 18, 2024*

Cite as: Kahraman, N. (2024). A meta-analytic examination of the effect of individual and school-average achievement on students' self-concept in science. *Journal of Baltic Science Education*, *23*(1), 37–44. https://doi.org/10.33225/jbse/24.23.37

Nurcan Kahraman PhD, Science Education Department, Bursa Uludag University, Bursa, Türkiye.
E-mail: nurcankahraman@uludag.edu.tr
ORCID: https://orcid.org/0000-0003-1009-3047