Growth Mindset Intervention in Teaching and Learning: Meta-Analysis
การส่งเสริมการเรียนรู้ด้วยกรอบความคิดแบบเติบโตในการเรียนการสอน: การวิเคราะห์อภิมาน

Salilthip Laothong Sutthisomboon[1*] and Pimurai Limpapath[2]
สลิลทิพย์ หลาวทอง สุทธิสมบูรณ์[1*] และ พิมพ์อุไร ลิมปพัทธ์[2]
(Received: April 11, 2021 ; Revised: June 2, 2021 ; Accepted: June 9, 2021)

Abstract

In this study, meta-analysis was employed as to examine the effect sizes of growth mindset interventions on students' learning achievement and outcomes. Based on the inclusion criteria (Prisma, Moher et al., 2009), master's theses and doctoral dissertations in English publication, across the globe, from the years 2010 to 2019 were accumulated to find the effect sizes of growth mindset interventions on students' learning achievement and outcomes. After passing all of the inclusion criteria, ten of the master's theses and doctoral dissertations in full-text were obtained with the pretests and posttests scores that appeared in the quasi-experiments using growth mindset interventions on achievement and outcomes, in teaching and learning, with the samples of students at pre- to high school levels. Accordingly, the Comprehensive Meta-Analysis Software (CMA, version 3.0) was applied to calculate the effect sizes (Hedges, 1985) of the growth mindset interventions on learning achievement and outcomes, by choosing random-effects model for the mean effect sizes, with a confidence interval of 95%.

A new finding was found related to the growth mindset interventions in teaching and learning in that motivation was reported to have the largest effect with g = 1.53 and the significant level of p = 0.00. According to the result, it appeared that growth mindset interventions, effectively, helped intrinsically motivate students to challenge themselves in achieving their ultimate goals for better learning outcomes. Thus, it was recommended that

[1] Doctoral degree student, Educational Studies, Suryadhep Teachers College, Rangsit University

[2] Assistant Professor, Doctoral Program in Educational Studies, Suryadhep Teachers College, Rangsit University

[1] นิสิตปริญญาเอก สาขาวิชาการศึกษา วิทยาลัยครูสุริยเทพ มหาวิทยาลัยรังสิต

[2] ผู้ช่วยศาสตราจารย์ หลักสูตรศึกษาศาสตรดุษฎีบัณฑิต สาขาวิชาการศึกษา วิทยาลัยครูสุริยเทพ มหาวิทยาลัยรังสิต

*Corresponding author E-mail: s.salilthip@gmail.com

growth mindset interventions should be integrated into higher education in order for higher levels of students to intrinsically challenge themselves to achieve their ultimate goals for better outcomes in a realm of both living their lives and learning effectively.

Keywords: growth mindset, growth mindset intervention, teaching and learning, meta-analysis

บทคัดย่อ

การวิจัยครั้งนี้ใช้การวิเคราะห์อภิมานเพื่อศึกษาค่าอิทธิพลของการสอนโดยวิธีส่งเสริมกรอบความคิดแบบเติบโตที่มีผลต่อความสำเร็จและผลสัมฤทธิ์ทางการเรียนของนักเรียน โดยคัดเลือกงานวิจัยตามเกณฑ์คัดเข้า (Prisma, Moher et al., 2009) โดยรวบรวมวิทยานิพนธ์และดุษฎีนิพนธ์ที่ตีพิมพ์เป็นภาษาอังกฤษจากทั่วโลกตั้งแต่ปีค.ศ. 2019 ถึง 2010 เพื่อหาค่าขนาดอิทธิพลของการสอนโดยใช้วิธีการส่งเสริมกรอบความคิดแบบเติบโตมีผลต่อความสำเร็จและผลสัมฤทธิ์ทางการเรียนของนักเรียน หลังจากผ่านเกณฑ์คัดเข้าจึงได้วิทยานิพนธ์และดุษฎีนิพนธ์ฉบับเต็ม จำนวน 10 เล่ม ที่ใช้ผลคะแนนก่อนทดสอบและหลังทดสอบในงานวิจัยเชิงทดลองด้วยการสอนโดยวิธีการส่งเสริมกรอบความคิดแบบเติบโตที่มีผลต่อความสำเร็จและผลสัมฤทธิ์ของนักเรียนชั้นอนุบาลจนถึงมัธยมศึกษาตอนปลาย จากนั้นได้นำโปรแกรม Comprehensive Meta-Analysis Software (CMA) เวอร์ชัน 3.0 มาใช้ในการคำนวณหาค่าขนาดอิทธิพล (Hedges, 1985) ของการสอนโดยวิธีการส่งเสริมกรอบความคิดแบบเติบโตที่มีผลต่อความสำเร็จและผลสัมฤทธิ์ โดยเลือกใช้โมเดลแบบสุ่มในการคำนวณหาค่าเฉลี่ยของค่าขนาดอิทธิพลและระบุช่วงความเชื่อมั่นที่ระดับ 95%

การศึกษาในครั้งนี้ก่อให้เกิดข้อค้นพบใหม่ที่เกี่ยวเนื่องกับการสอนโดยวิธีส่งเสริมกรอบความคิดแบบเติบโตที่ส่งผลสูงสุดต่อแรงจูงใจของผู้เรียน โดยมีค่าขนาดอิทธิพลขนาดใหญ่ที่ระดับ g = 1.53 และมีนัยสำคัญทางสถิติที่ p = 0.00 จากผลของการวิจัยจึงสรุปได้ว่าการสอนโดยวิธีส่งเสริมกรอบความคิดแบบเติบโตนั้นสามารถสร้างแรงจูงใจอย่างมีประสิทธิภาพทำให้นักเรียนสามารถท้าทายตนเองสู่เป้าหมายสูงสุดเพื่อให้ได้มาซึ่งผลสัมฤทธิ์และผลของการเรียนที่ดีขึ้น ดังนั้นจึงควรมีการบูรณาการการสอนโดยวิธีส่งเสริมกรอบความคิดแบบเติบโตให้กับนักศึกษาในระดับอุดมศึกษาเพื่อให้เกิดแรงจูงใจภายในใจสามารถท้าทายตนเองสู่เป้าหมายของชีวิตควบคู่ไปกับการเรียนรู้อย่างมีประสิทธิภาพ

คำสำคัญ: กรอบความคิดแบบเติบโต การส่งเสริมการเรียนรู้ด้วยกรอบความคิดแบบเติบโต การเรียนการสอน การวิเคราะห์อภิมาน

Introduction

In recent years, the concept of growth mindset, has been popularly applied into the field of educational psychology all over the globe with the belief that growth mindset interventions, in particular, could help promote positive learning achievement and outcomes (Boylan et al., 2018; Burgoyne et al., 2018; Castiglione, 2019; Outes-León et al., 2020; Rintaro,

2019; Rissanen et al., 2019; Zeng et al., 2016). Several studies posited that the more positive growth mindset interventions were given, in teaching and learning, the more motivation students would gain (Haimovitz et al., 2011; Ng, 2018; Rhew et al., 2018).

When it comes to mindset, it has been defined under the notion of motivational and intelligence model involving individual differences in achieving their goals with either fixed or growth mindset (Dweck, 1986; Dweck & Leggett, 1988). While a fixed mindset reflects a maladaptive or helplessness pattern with the belief that intelligence was a static trait and unable to be developed or changed overtime, a growth mindset exhibits adaptive or mastery-oriented ways of thinking and behaving in that it could help bring about an intelligence of how to achieve ultimate goals in life (Cook & Artino Jr., 2016; Dweck, 2017). In other words, the more of the positive growth mindset, the more of the positive self (Dweck, 2017; Cook & Artino Jr., 2016; Lauria, 2018), a person will hold (Peterman & Ewings, 2019; Samuel & Warner, 2019).

While growth mindset is considered as a psychological intervention that could be applied into a field of education, especially, in teaching and learning as expected to help develop students' ultimate goals in achieving better learning outcomes (Dweck, 2017; Haimovitz & Dweck, 2017). It was shown in several research that growth mindset has been heavily studied in various levels of education, especially, from preschool to high school (Allen, 2018; Boylan et al., 2018; Ronkainen et al., 2019; Schmidt et al., 2015; Snipes & Tran, 2017; Zeng et al., 2016). Among those dependent variables experimented, academic achievement, motivation, goal-orientations, learning attitudes, perseverance, psychological well-being, self-development, and self-efficacy, were mostly popular (Andersen & Neilsen, 2016; Bettinger et al., 2017; Burnette et al., 2017; DeBacker et al., 2018; Mofield & Peters, 2018; Ng, 2018; O' Brien & Lomas, 2017). Hypotheses relating to students' growth mindset and motivation happened to be mostly correlated with the notion that the more growth mindset interventions were imposed on motivation, the more students' positive attitudes (Ng, 2018) and learning involvement would become (Bedford, 2017).

From those research findings, it was evident that growth mindset interventions have positive impact on students' achievement and outcomes. For instance, even for the students at the levels of preschool, with carefully prepared experiments, enthusiasm and the positive attitudes towards the engagement catered for effective self-development and self-regulation were demonstrated (Cancelliere, 2016; O'Brien & Lomas, 2017; Schrodt et al., 2019). For both of the junior- and senior high school students, growth mindset interventions illustrated

a positive impact on their academic achievements, learning attitudes, mindset, motivation, school persistence, and self-efficacy (Brougham & Kashubeck-West, 2018; DeBacker, et al, 2018; Dringenberg, 2020; Yeager et al., 2016).

While it has been widely argued, in the last decade, that growth mindset interventions have been prominence in teaching and learning, however, up to present, very few works have been done to examine the effect sizes of growth mindset interventions, especially, in the areas of students' learning achievement and outcomes. Apparently, only two articles had shown to explore the effect sizes of neuroplasticity on motivation, achievement, and brain activity (Sarrasin et al., 2018) and the effect of growth mindset and academic achievement (Sisk et al., 2018). Not enough work, especially, in meta-analysis had been done to confirm the effects of growth mindset interventions on students' achievement and outcomes. Thus, in order to fill the gap and added up the research in this area, meta-analysis was employed to examine the effect sizes of the growth mindset interventions, in teaching and learning, on students' learning achievement and outcomes to pre- to high school students, in the period of the last ten years.

Clearly, because of its notable results from the previous research, it appeared to be worthwhile to explore the effect sizes of growth mindset interventions, on learning achievement and outcomes. Hence, in this study, a meta-analysis was designed based on the inclusion criteria of the pretests and posttests scores occurred in the quasi-experiments using growth mindset interventions on learning achievement and outcomes, with the samples of pre- to high school students, found from master's theses and doctoral dissertations in full-text English publication, across the globe, from the years 2010 to 2019.

Objective

The objective of this meta-analysis, thus, was to examine the effect sizes of growth mindset interventions on students' learning achievement and outcomes with the samples of pre- to high school students occurred in the master's theses and doctoral dissertations in English publication, across the globe, from the years 2010 to 2019.

Method

1. Population and sample

1.1 The population of the study was the master's theses and doctoral dissertations, in English publication, across the globe, of which focused on using growth mindset interventions in teaching and learning, with the samples of pre- to high school students from the years 2010-2019.

1.2 The sample of this study was ten out of master's theses and doctoral dissertations, in English publication, across the globe, of which focused on using growth mindset interventions in teaching and learning, with the samples of pre- to high school students from the years 2010-2019.

2. Research instrument

The selected master's theses and doctoral dissertations were coded by using the Research Characteristics and Effect Size Coding Form which comprised of:

Part 1: Research characteristics: the information of study number, title, author, publication year, dependent variables, population and sample, and research methodology.

Part 2: Effect size information: the number of samples and statistical information regarding experimental and control groups.

3. Data collection

Systematic searching for master's theses and doctoral dissertations focusing on growth mindset interventions in teaching and learning from the years of 2010 and 2019 were conducted, using seven of the most relevant databases for theses and dissertations (i.e., EBSCO Open Dissertations, Proquest Dissertations and Theses Database (PQDT Open), Open Access Theses and Dissertations: OATD, Networked Digital Library of Theses and Dissertations (NDLTD), British Library Ethos, Google Scholar, and CU reference databases). All the keywords relating to mindset concepts and theories were accumulated -- growth mindset, implicit theories of intelligence, or growth mindset, implicit theories of intelligence, and growth mindset intervention, or teaching of growth mindset, and growth mindset intervention.

Inclusion Criteria and the coding process

Along the searching process of inclusion criteria, (i.e., identifying, screening, eligibility, and included), 910 studies of which titles and abstracts with the results yielded were compiled in an excel spread sheet in order to be examined to identify whether those master's theses and Doctoral dissertations matched the following criteria:

1. Using growth mindset interventions in teaching and learning from 2010 and 2019;

2. Were written in English and could be accessed via open access databases;

3. Were published in full-text; and

4. Contained with the pretest and posttest scores of means and standard deviations derived from control and experimental design studies using growth mindset interventions in teaching and learning with the samples of the students at any levels of pre - to high school

(i.e., preschool/early years, primary/secondary school, middle school, and high school) so that the effect sizes of growth mindset interventions could be obtained.

Based on the format of PRISMA 2009 Flow Diagram of the included studies (Moher et al., 2009), 10 doctoral dissertations and master's theses were obtained. The search and exclusion process were illustrated in Figure 1.

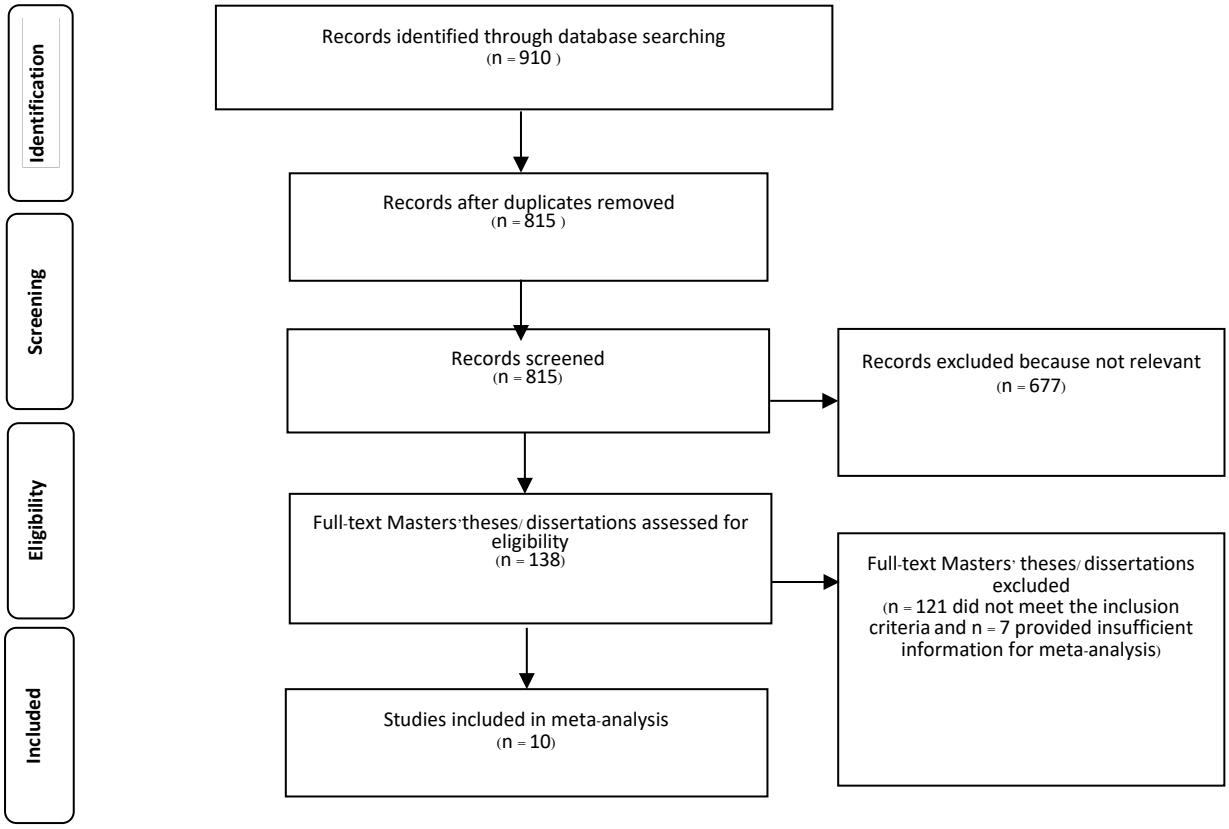

Figure 1. Adapted from PRISMA 2009 flow diagram of the included studies

Next, the coding pilot was performed as to check for its reliability by the researcher and two co- coders who are the experts in the field of education, using the Research Characteristics and Effect Size Coding Form.

Publication bias

In order to prevent publication bias and any problems of methodology used, it must be done by considering the information contained in the distribution of the effect sizes from the selected theses and dissertations. Funnel plot, then, was suggested as a tool for investigating publication bias in that no bias would appear in symmetric with respect to the distribution of effect sizes (Cooper, 2009).

Figure 2 presented a funnel plot with the approximate expected 95 percent confidence intervals around the pooled estimate for the expected shape of the funnel under a random effect assumption plotting standard error on the y-axis. The guidelines were straight lines and thus the theoretical underlying shape of the funnel was also straight sided. Because the majority of the points, illustrating seven out of ten studies, lie within the guidelines of being un-bias according to the propose by Simmonds (2015) in that with ten studies in a meta-analysis, an imbalance of at least five all together in the same side of funnel is needed to conclude for the publication bias. If not so, all of the ten studies could be included into the analysis.

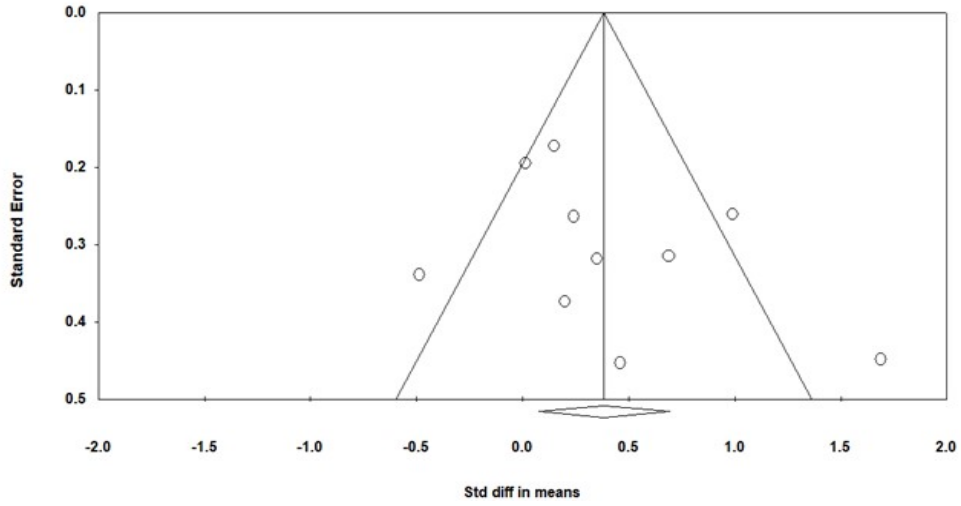

Figure 2. Funnel plot for the included master's theses and doctoral dissertations focusing on growth mindsets interventions in teaching and learning.

4. Data analysis

After the coding was performed, it showed that the majority of the studies employed in this meta-analysis carried small sample sizes, with the pretests and posttests scores of the students' learning achievement and outcomes derived from the variables found in those studies which were identified and categorized into academic achievement, mindset, motivation, character strengths, learning attitudes, math anxiety, and self-efficacy. The Comprehensive Meta-Analysis software (CMA) version 3.0. was used for all the associated calculations.

With the small sample sizes of the majority of the studies, Hedges'g was applied, with a 95% confidence interval, to calculate the effect sizes of the interventions, in that the standardized mean difference of the study was computed by subtracting the mean of the control group from the mean of the experimental group, divided by the pooled standard

deviation. In so doing, all the effect sizes were adjusted, accordingly, the bias, particularly, in overestimating the effect sizes in small samples was assured (Borenstein et al, 2009; Hedges & Olkin, 1985).

Q heterogeneity test was, also, conducted. While Q test confirmed whether the effect sizes are heterogeneous, the I^2 index, ranged from 0% to 100%, represented the percentage of total variation in a set of effect sizes. The I^2 index of 25% equals low, 50% equals medium, and 75% equals high heterogeneity (Higgins et al., 2003). While I^2 index is used to facilitate the choice of either a fixed- or random effects model, a fixed- effects model is for homogeneity, and a random-effects model was for the heterogeneity (Borenstein et al, 2009). Given the nature of heterogeneity of the distribution of the I^2, 25 to 75 percent among the studies indicates the random-effects model rather than fixed-effects model.

Results

1. Descriptive analysis

In table 1. Descriptive statistics of master' s theses and doctoral dissertations of using growth mindset interventions in teaching and learning with sample of students from pre- to high school were shown. A total of 10 included studies were displayed with equal numbers of the master's theses (50%), and the doctoral dissertations (50%). In terms of the years of publication, the most frequent years of publication were 2016 (20%), 2017 (20%), and 2018 (20%) with 10 % for the rest of the years 2011, 2013, 2015, and 2019. However, no master's theses and doctoral dissertations found in the year of 2010, 2012, and 2014.

Table 1. Years and types of publication

Types of publication	No. of studies	Years of publication										Total	%
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019		
Master	5							1	2	1	1	5	50
Doctoral	5		1		1		1	1		1		5	50
Total (Percentage)	10 (100)		1 (10)		1 (10)		1 (10)	2 (20)	2 (20)	2 (20)	1 (10)	10	100

2. Meta-analysis

In table 2, among 10 studies of the master's theses and doctoral dissertations, that were subjected to meta-analysis for the effect of growth mindset interventions on learning achievement and outcomes, seven outcome variables were found: academic achievement, mindset, motivation, character strengths, learning attitudes, math anxiety, and self-efficacy.

However, since the effect size is for reporting and interpreting effectiveness of a particular intervention (Coe, 2002), when analyzing the mean effect sizes for each dependent variable, in this study, motivation turned out to have the largest effect size of 1.53 with the statistically significant at the level of 0.00. In terms of Q value, it was shown to be statistically significant (Q = 5.80, p = 0.05), with moderate heterogeneity (I^2 = 65.54). Accordingly, with moderate heterogeneity, random- effects model for the meta-analysis was preferably than the fixed model which yielded similar pooled estimates. Since the random-effects model incorporated the differences between studies in the calculations to maximize the width of the confidence interval around the pooled estimate, so lending a more conservative estimate of effect (Borenstein et al., 2009). While, the remaining variables, in meta-analysis were revealed to have small effect sizes, with no significant differences: the academic achievement (g = 0.34, p = 0.12); and mindset (g = 0.12, p = 0.48). However, the rest were inconclusive: the character strengths; math anxiety; reading attitudes; and self-efficacy.

Table 2. Effect sizes related to all dependent variables

Variable	*k*	*g*	95% CI	Z-value	*p*-value	Test of heterogeneity of effect size		
						Q-value	*p*-value	I^2
Academic achievement	6	0.34	[-0.08, 0.66]	1.52	0.12	11.12	0.04	55.03
Character strengths	1	0.08	[-0.29, 0.46]	0.43	0.66	0.00	1.00	0.00
Math anxiety	1	0.60	[-0.05, 1.28]	1.80	0.07	0.00	1.00	0.00
Mindset	7	0.12	[-0.21, 0.44]	0.69	0.48	12.31	0.05	51.29
Motivation	3	1.53	[0.77, 2.35]	3.88	0.00***	5.80	0.05	65.54
Reading attitudes	1	-0.20	[-0.93, 0.52]	-0.55	0.58	0.00	1.00	0.00
Self-efficacy	1	0.01	[-0.47, 0.49]	0.04	0.96	0.00	1.00	0.00

Notes. k = number of studies; *g* = Effect size; CI = confidence interval; Q = test of heterogeneity; significant level at *p* = p<0.05*; I^2= 95% uncertainty interval.

Discussion

In this meta-analysis, the new finding revealed that the effect of growth mindset interventions had illustrated a significant impact on motivation (g = 1.53, p = 0.00). As growth mindset interventions worked its way through motivation, students intrinsically or inherently aroused inside their minds and attitudes of being more capable of effective-self-determination (Rhew et al., 2018). As such, students became more aware of their ability not only to challenge themselves, accept mistakes, and/or obstacles but also to seek encouragement in order to pursue their ultimate goals in achieving better learning outcomes (Dweck, 2017). Hence, encouraging a growth mindset, particularly, on motivation, students tended to be more responsible in their learning (Anindito, 2015, Yeager & Dweck, 2012) and be able to develop a sense of success, as well as, to manage a process of their learning as to attain intrinsic value of achievement (Jordan, 2010; Ng, 2018).

By so doing, when students were intrinsically motivated with high levels of growth mindset, the levels of higher effort and persistence in school would directly go up and be encouraged to achieve their goals in better learning outcomes (Logan et al., 2011). Along with this finding, in the last decade, apparently, several studies constantly confirmed the relationships of the positive impact of growth mindset interventions with intrinsic motivation in association with the better learning outcomes in different educational levels (Albalawi, 2017; Cook & Artino Jr., 2016; Hodis et al., 2011; Park, 2016; Richardson et al., 2020; Verberg et al., 2018).

Recommendation

1. Implication for practice

Evidently, this study has contributed a new and significant finding to the area of growth mindset interventions on motivation of pre- to high school students. Since growth mindset interventions seemed to be effective in motivating students at school levels to be better in their learning, thus, it should also be integrated into higher education in order for students in higher levels to intrinsically challenge themselves to achieve their ultimate goals for better outcomes in a realm of both living their lives and learning effectively.

2. Recommendation for future research

Since the scope of this study was about the effect sizes of growth mindset interventions, the future research should further more with the moderator analyses on various types of variables such as students' educational level, intervention characteristics, and research design to identify and effectively determine possible variables or characteristics moderating the effect sizes.

References

Albalawi, F. (2017). *L2 demotivation among Saudi learners of English: The role of the language learning mindsets [*Doctoral dissertation*].* http://eprints.nottingham.ac.uk/52351/1/AlBalawiFthesis.pdf

Allen, A. C. (2018). *The role of mindsets on Southeast Asian youth: A study on academic attitudes and performance* [Doctoral dissertation]. https://escholarship.org/uc/item/9tx5d5bt

Andersen, S. C., & Nielsen, H. S. (2016). Reading intervention with a growth mindset approach improves children's skills. *PNAS, 113*(43), 12111-12113. http:doi.org/ 10.1073/pnas.1607946113

Anindito, A. (2015). Students' response to academic setback: growth mindset as a buffer against demotivation. *International Journal of Education Psychology, 4* (2), 198-222. https://eric.ed.gov/?id=EJ1111638

Bedford, S. (2017). Growth mindset and motivation: A study into secondary school science learning. *Research Paper in Education, 32* (4), 424-44. http://doi.org/10.1080/02671522017.1318809

Bettinger, E., Ludvigsenet, S., Rege, M., Solli, I. F., & Yeager, D. (2017). Increasing perseverance in math: Evidence from a field experiment in Norway. *Journal of Economic Behavior & Organization, 146*, 1–15. http://doi.org/10.1016/j.jebo.2017.11.032

Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2009). *Introduction to meta analysis.* West Sussex: John Wiley & Sons.

Boylan, F., Barblett, L., & Knaus, M. (2018). Early childhood teachers' perspectives of growth mindset: Developing agency in children. *Australasian Journal of Early Childhood, 43* (3), 16-24. http://doi.org/10.23965/AJEC.43.3.02

Brougham, L. & Kashubeck-West, S. (2018). Impact of a growth mindset intervention on academic performance of students at two urban high schools. *Professional School Counseling. 21*(1), 1-9. https://doi.org/10.1177/2156759X18764934

Burgoyne, A. P., Hambrick, D. Z., Moser, J. S., & Burt, S. A. (2018). Analysis of a mindset intervention. *Journal of Research in Personality, 77*, 21-30. http://doi.org/10.1016/j.jrp.2018.09.004

Burnette, J. L., Russell, M. V., Hoyt, C. L., Orvidas, K., & Widman, L. (2017). An online growth mindset intervention in a sample of rural adolescent girls. *British Journal of Educational Psychology, 88* (3), 428-445. http://doi.org/10.1111/bjep.12192

Cancelliere, G. M. (2016). *Getting an early start: Promoting the growth mindset in kindergarten children.* [Doctoral Dissertation]. Philadelphia College of Osteopathic Medicine. https://digitalcommons.pcom.edu/psychology_dissertations/369/

Castiglione, R. A. (2019). *Establishing growth mindset teaching practices as part of the third grade math curriculum to increase math self-efficacy, math mindset* (Doctoral dissertation). https://repository.asu.edu/attachments/217088/content/Castiglione_asu_0010E_18805.pdf

Coe, R. (2002, September 12-14). *It's the effect size, stupid: What effect size is and why it is important* [Conference session]. University of Exeter, England. http://www.leeds.ac.uk/educol/documents/00002182.htm

Cook, D. A., & Artino, A. R. (2016). Motivation to learn: An overview of contemporary theories. *Medical Education, 50*, 997-1014. http://doi.org/10.1111/medu.13074

Cooper, H. (2009). *Research synthesis and meta-analysis: A step-by-step approach* (4th ed.). Thousand Oaks, CA: Sage.

DeBacker, T. K., Heddy, B. C., Kershen, J. L., Crowson, H. M., Looney, K., & Goldman, J. (2018). Effects of a one-shot growth mindset intervention on beliefs about intelligence and achievement goals. *Educational Psychology, 38* (6), 711-733. http://doi.org/10.1080/01443410.2018.1426833

Dringenberg, E., Baird, C., Spears, J., Heiman, S., & Betz, A. R. (2020). The influence of a growth mindset intervention on middle school girls' beliefs about the nature of intelligence. *Journal of Woman and Minorities in Science and Engineering. 26*(3) , 245- 262. http://doi.org/10.1615/JWomenMinorScienEng.2020026324

Dweck, C. S. (1986). Motivational Processes Affecting Learning. *American Psychologist, 41*, 1040-1048. http://doi.org/10.1037/0003-066X.41.10.1040

Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological Review, 95* (2), 256-273. http://doi.org/10.1037/0033-295X.95.2.256

Dweck, C. S. (2017). *Mindset: Changing the way you think to fulfill your potential.* Robinson.

Haimovitz, K., & Dweck, C. S. (2017). The origins of children's growth and fixed mindsets: New research and a new proposal. *Child Development, 88* (6), 1849-1859. http://doi.org/10.1111/cdev.12955

Haimovitz, K., Wormington, S. V., & Corpus, J. H. (2011). Dangerous mindsets: How beliefs about intelligence predict motivational change. *Learning and Individual Differences, 21*, 747-752. http://doi.org/0.1016/j.lindif.2011.09.002

Hedges, L. V., & Olkin, I. (1985). *Statistical methods for meta-analysis.* Academic Press.

Higgins, J. P. T., Thompson, S. G., Deeks, J. J., & Altman, D. G. (2003). Measuring inconsistency in meta-analyses. *BMJ (Clinical Research ed.), 327 (*7414*)*, 557-560. http://doi.org/10.1136/bmj.327.7414.557

Hodis, F. A., Meyer, L. H., McClure, J., Weir, K. F., & Walkey, F. H. (2011). A longitudinal investigation of motivation and secondary school achievement using growth mixture modeling. *Journal of Educational Psychology*, *103* (2), 312. http://doi.org/10.1037/a0022547

Jordan, H. M. (2010). Loving our differences motivation and special education. http://higherlogicdownload.s3.amazonaws.com/SPED/04bdc7a0-1ec9-4eaab61c677439532d1a/UploadedImages/Journal_2010/Loving_Our_Differences__Jordan.pdf

Lauria, J. (2018). Mindfulness methods and a growth mindset approach as social-emotional learning supports. *Harvard Conference on Preparing Students for an Uncertain Future, 16* (1). https://www.21caf.org/uploads/1/3/5/2/13527682/11._21cef-7129-_lauria_.pdf

Logan, S., Medford, E. & Hughes, N. (2011). The importance of intrinsic motivation for high and low ability reader's reading comprehension performance. *Learning and Individual Differences. 21 (*1*).* 124-128. https.doi.org/10.1016/j.lindif.2010.09.011

Mofield, E. L., & Peters, M. P. (2018). Mindset misconception? Comparing mindsets, perfectionism, and attitudes of achievement in gifted, advanced, and typical students. *Gifted Child Quarterly, 62* (4), 327-349. http://doi.org/10.1177/0016986218758440

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & The PRISMA Group. (2009).Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med 6(7): e1000097. https://doi.org/10.1371/journal.pmed.1000097

Ng, B. (2018). The neuroscience of growth mindset and intrinsic motivation. *Brain Sciences, 8* (2), 20. http://doi.org/10.3390/brainsci8020020

O'Brien, K., & Lomas, T. (2017). Developing a Growth Mindset through outdoor personal development: can an intervention underpinned by psychology increase the impact of an outdoor learning course for young people? *Journal of Adventure Education and Outdoor Learning, 17* (2), 133-147. http://doi.org/10.1080/14729679.2016.1232199

Outes-Leon, I., Sanchez, A., & Vakis, R. (2020). The power of believing you can get smarter: The impact of a growth-mindset intervention on academic achievement in Peru. *World Bank Policy Research Working Paper Series*. http://doi.org/10.1596/1813-9450-9141

Park, S. (2016). *Implicit Theory of Intelligence and Gifted Students* [Doctoral dissertation]. https://libraetd.lib.virginia.edu/public_view/ns0646000

Peterman, C. J., & Ewing, J. (2019). Effects of movement, growth mindset and math talks on math anxiety. *Journal of Multicultural Affairs, 4* (1). https://core.ac.uk/download/pdf/228082511.pdf

Rhew, E., Piro, J. S., Goolkasian, P., & Cosentino, P. (2018). The effects of a growth mindset on self-efficacy and motivation. *Cogent Education, 5* (1). http://doi.org/10.1080/2331189X.2018.1492337

Richardson, D. S., Bledsoe, R. S., & Cortez, Z. (2020). Mindset, motivation, and teaching practice: Psychology applied to understanding teaching and learning in STEM disciplines. *CBE – Life Science Education, 19* (3). http://doi.org/10.1187/cbe.19-11-0238

Rintaro, S. (2019). Cultivating a growth mindset in Japanese EFL learners with a presentation practice-production-based approach. *Cultural and Social Science, 68* (1), 195-202. http://doi.org/10.1080/2331189X.10.20636/00013288

Rissanen, I., Kuusisto, E., Tuominen, M., & Tirri, K. (2019). In search of a growth mindset pedagogy: A case study of one teacher's classroom practices in a Finnish elementary school. *Teaching and Teacher Education, 77*, 204-213. http://doi.org 10.1016/j.tate.2018.10.002

Ronkainen, R., Kuusisto, E., & Tirri, K. (2019). Growth mindset in teaching: A case studyof Finnish elementary school teacher. *International Journal of Learning, Teaching and Educational Research, 18*(8), 141-154. https:doi.org/10.26803/ijlter.18.8.9

Samuel, T., & Warner, J. (2019). I can math: Reducing math anxiety and increasing math self-efficacy using a mindfulness and growth mindset-based intervention in first-year students. *Community College Journal of Research and Practice*. http://doi.org 10.1080/10668926.2019.1666063

Sarrasin, J. B., Nenciovici, L., Foisy, L. M. B., Allaire-Duquette, G., Riopel, M., & Masson, S. (2018). Effects of teaching the concept of neuroplasticity to induce a growth mindset on motivation, achievement, and brain activity: A meta-analysis. *Trends in Neuroscience and Education, 12*, 22-31. http://doi.org 10.1016/j.tine.2018.07.003

Schmidt, J., Shumow, L., & Kackar-Cam, H. (2015). Exploring teacher effects for mindset intervention outcomes in seventh-grade science classes. *Middle Grades Research Journal, 10*(2), 17-32.

Schrodt, K. E., Elleman, A. M., FitzPatrick, E. R., Hasty, M. M. Kim, J. K., Tharp, T. J., & Rector, H. (2019). An examination of mindset instruction, self-regulation, and writer's workshop on kindergarteners' writing performance and motivation: A mixed-methods study. *Overcoming Learning Difficulties. 35*(5), 427-444. https://doi.org/10.1080/10573569.2019.1577778

Simmonds, M. (2015). Quantifying the risk of error when interpreting funnel plots. *Systematic Reviews. 4*(24). https://doi.org/101186/s13643-015-0004-8

Sisk, V. F., Burgoyone, A. P., Sun, J. S., Butler, J. L., & Macnamara, B. N. (2018). To what extent and under which circumstances are growth mind-sets important to academic: Two meta-analyses. *Psychological Science, 29* (4). http://doi.org10.1177/0956797617739704

Snipes, J., & Tran, L. (2017). *Growth mindset, performance avoidance, and academic behaviors in Clark County School District (REL 2017–226).* Washington, DC: U. S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory West. http://ies.ed.gov/ncee/edlabs

Verberg, F. L. M., Helmond, P., & Overbeek, G. (2018). Study protocol: a randomized controlled trial testing the effectiveness of an online mindset intervention in adolescents with intellectual disabilities. *BMC Psychiatry, 18*, 377. http://doi.org/10.1186/s12888-018-1939-9

Yeager, D. S., & Dweck, C. S. (2012). Mindsets that promote resilience: When students believe that personal characteristics can be developed. *Educational Psychologist, 47*(4), 302-314. doi:10.1080/00461520.2012.722805

Yeager, D. S., Romero, C., Paunesku, D., Hulleman, C., Schneider, B., Hinojosa, C., Dweck, C. S. (2016). Using design thinking to improve psychological interventions: The case of the growth mindset during the transition to high school. *Journal of Educational Psychology, 108* (3), 374-391. http://doi.org/10.1037/edu0000098

Zeng, G., Hanchao, H., & Peng, K. (2016). Effect of Growth Mindset on School Engagement and Psychological Well-Being of Chinese Primary and Middle School Students: The Role of Resilience. *Front. Psychol. 7* (1873). http://doi.org/10.3389/fpsyg.2016.01873