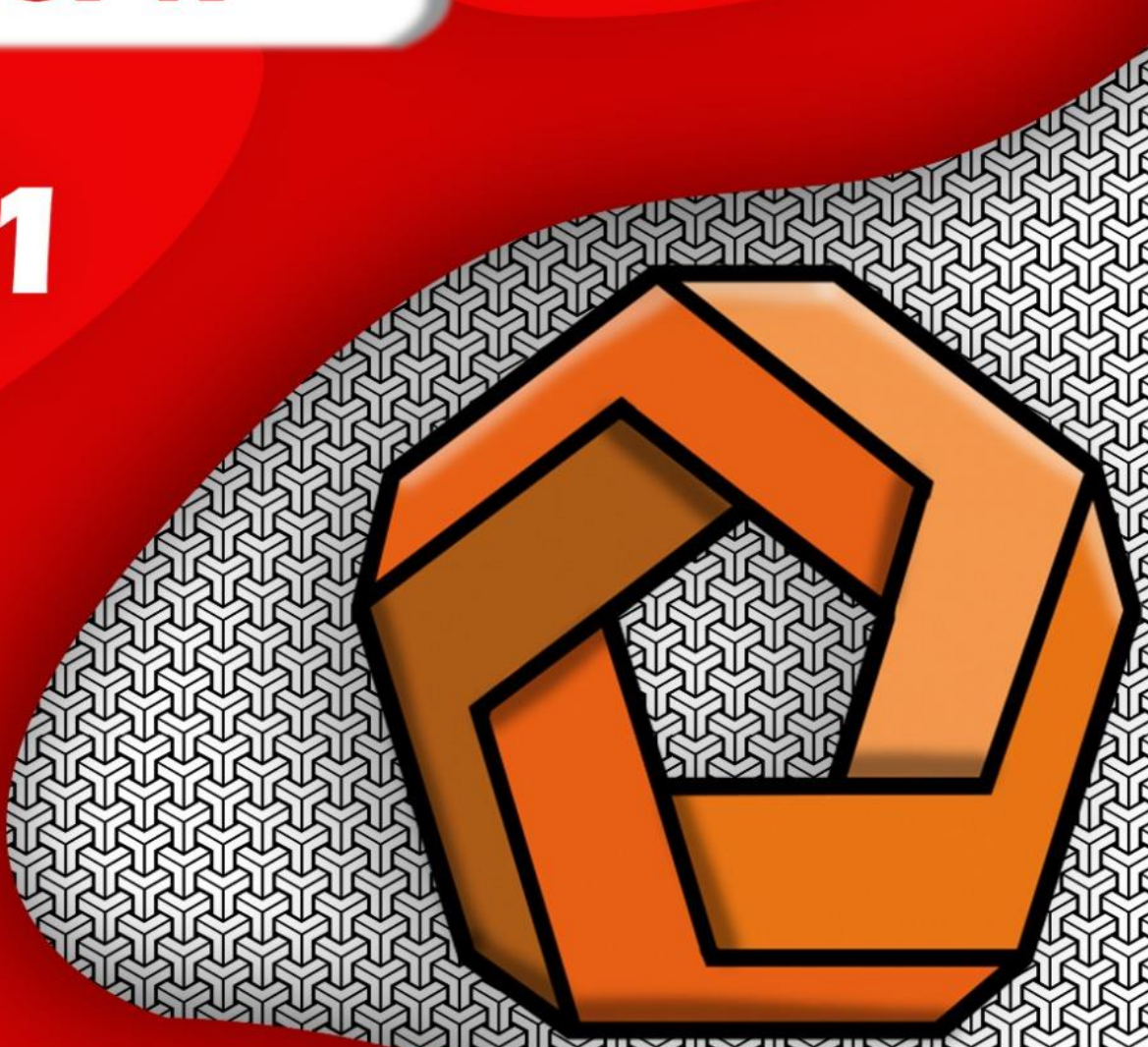
Journal of Educational Studies and Multidisciplinary Approaches

2757-8747

2021

VOLUME 1
NUMBER 1



JESMA

Editors

Editor-in-Chief

Dr. Mevlüt AYDOĞMUŞ
Necmettin Erbakan University

Konya, Turkey

maydogmus@erbakan.edu.tr

Editors:

Prof. Dr. Michael F. Shaughnessy
Eastern New Mexico University

United States

michael.Shaughnessy@enmu.edu

Assistant Professor Dr. Toni Denese Sturdivant
Texas A&M University-Commerce

United States

toni.sturdivant@tamuc.edu

Associated Professor Dr. Daniel D. Liou
Arizona State University

United States

dliou@asu.edu

Assistant Prof. Dr. Daniel Gutiérrez-Ujaque
University of Lleida

Spain

daniel.gutierrez@udl.cat

Editorial Board

Reviewers for this Issue

Dr. Mark Patrick Ryan, California State University
United States

Lacie Webb, Samford University, United States

Dr. Julie J. Padilla, United States

John Nightingale, UK

Dr Noorunnisa Khan, Iqra University, Karachi, Pakistan

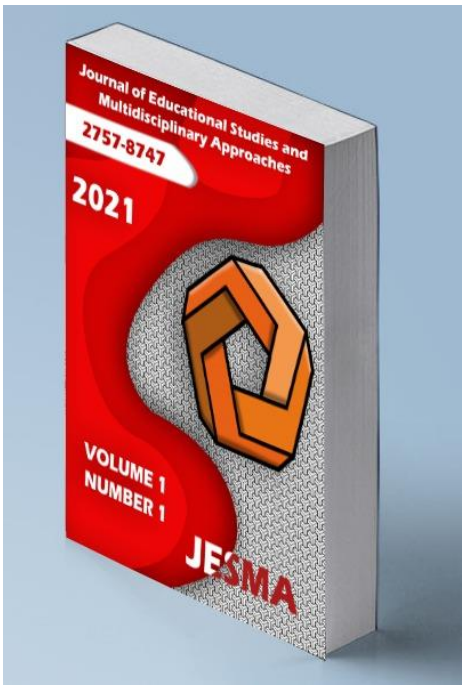
Assoc. Prof. Dr. Gary Padgett, University of North Alabama, United States

Dr Areej MA ElSayary, Zayed University, United Arab Emirates

Assoc. Prof. Dr. Bob Spires, Graduate Education University of Richmond, United States

Prof. Dr. Michael F. Shaughnessy, Eastern New Mexico University, United States

Table of Contents



Journal of Educational Studies and Multidisciplinary Approaches (JESMA)
ISSN:2757

www.jesma.net

Texas Grade 3 Underrepresented Boys and Economic Status Differences in Reading: A Statewide, Multiyear Study

Heather Hamilton[1] Frederick C. Lunenburg[2]
John R. Slate[3] Wally Barnes[4]
[1] Sam Houston State University – USA stdhal12@shsu.edu
[2] Sam Houston State University – USA edu_fcl@shsu.edu
[3] Sam Houston State University – USA profslate@aol.com
[4] Sam Houston State University – USA wbb001@shsu.edu

***** Corresponding Author: John R. Slate, profslate@aol.com

To cite this article:

Hamilton, H., Lunenburg, F.C, Slate, J. R., & Barnes, W. (2021). Texas Grade 3 Underrepresented Boys and Economic Status Differences in Reading: A Statewide, Multiyear Study Put the title of the paper here. *Journal of Educational Studies and Multidisciplinary Approaches (JESMA),1* (1), 8-39. https://doi.org/10.51383/jesma.2021.1

Journal of Educational Studies and Multidisciplinary Approaches (JESMA)
Volume 1, Issue 1 Year 2021 ISSN:2757

Texas Grade 3 Underrepresented Boys and Economic Status Differences in Reading: A Statewide, Multiyear Study

Heather Hamilton https://orcid.org/0000-0001-9915-7849

Frederick C. Lunenburg https://orcid.org/0000-0002-4226-3963

John R. Slate https://orcid.org/0000-0001-9915-7849

Wally Barnes https://orcid.org/0000-0001-9915-7849

ARTICLE INFORMATION

Original Research Paper
https://doi.org/10.51383/jesma.2021.1

Received 02 February 2021
Accepted 27 February 2021

ABSTRACT

In this statewide, multiyear analysis, the extent to which differences were present in reading by the economic status of Grade 3 Asian, Black, and Hispanic boys was determined. Specifically examined was the relationship of poverty to the three State of Texas Assessment of Academic Readiness (STAAR) Reading Reporting Categories for Grade 3 Asian, Black, and Hispanic boys in the 2015-2016 through the 2018-2019 school years. Also examined was the relationship of poverty to the STAAR Grade Level Phase-in Standards for Grade 3 Asian, Black, and Hispanic boys. Inferential statistical analyses revealed the presence of statistically significant differences in reading as a function of the economic status of Asian boys, Black boys, and Hispanic boys. In every instance, Asian boys, Black boys, and Hispanic boys who were Poor were outperformed by their counterparts who were Not Poor. Considering the majority of students in Texas come from poverty backgrounds, these findings are of great concern. Implications of these findings and recommendations for future research are discussed.

Keywords: Texas, Grade 3, STAAR, Reading, Economic Status, Asian, Black, Hispanic Boys

Introduction

Literacy, a skill that encompasses word recognition, vocabulary, comprehension, and much more, is a necessary part of everyday life (Stinnett, 2014). Literacy skills can be divided into general categories, word-reading literacy skills, and knowledge-based competencies (Reardon, Valentino, & Shores, 2012). Word-reading skills, the necessary first steps in acquiring the ability to read, include letter-word recognition, beginning and ending sounds, fluency, and recognizing sight words (Reardon et al., 2012; Stinnett, 2014). Knowledge-based competencies, the application of the ability to read, encompass analysis, synthesis, and evaluation (Golden, 2012). Grade 3 is a vital point in the literacy development of students because students are required to make the transition from "learning to read" to "reading to learn" (Hernandez, 2011, p. 4). Unfortunately, some students have not developed the academic ability make this transition, as approximately 10% of 17-year old students have the literacy skills of 9-year old students (Reardon et al., 2012; Stinnett, 2014).

A lack of literacy skills beyond the early years of schooling is clearly detrimental because of the influence on social mobility and the reliance on literacy skills in the workforce (Reardon et al., 2012). Gaps in literacy skills could potentially perpetuate the "Matthew Effect" where students who do not come from poverty are more equipped to learn at a more rapid pace than their peers who have lived in poverty (Stanovich, 2017). Additionally, compared to students who are not poor, students in poverty do not have the same home advantages and background knowledge (Stanovich, 2017). For example, students who are economically disadvantaged have fewer chances to participate in literacy-related activities, fewer shared reading activities, and fewer library visits (Stinnett, 2014). Students who come from poverty have less exposure to varied vocabulary and syntax (Stinnett, 2014) than their more privileged peers. Moreover, children who live in poverty are more likely to have weaker language and narrative skills and lower emergent literacy scores (Gardner-Neblett & Iruka, 2015). Furthermore, educational opportunities for these children are minimized due to frequent absences attributed to increased health or family problems (Hernandez, 2011).

In the State of Texas, the population of students living in poverty has remained over 50% since the 2001-2002 school year (Texas Education Agency, 2003). In 2015-2016, almost 60% of the public school population was living in poverty. This figure remained steady in 2016-2017 and 2017-2018 before increasing to almost 61% of the population in 2018-2019 (Texas Education Agency, 2019a). Students are eligible for either the reduced lunch program or free lunch program depending on family income. Students qualify for the reduced lunch program with a family income of 131% to 185% of the federal poverty line (Burney & Beilke, 2008). The percentages of students who qualified for the reduced lunch program during the four school years from 2015-2016 to 2018-2019 ranged from just under 4.5% to 6% (Texas Education Agency, 2019c). More concerning is the percentage of students who qualified for the free lunch program for the same four years. These figures were comprised of just under 42% of students and just under 44% of students on the high end (Texas Education Agency, 2019a). Students who were eligible for the free lunch program have a family income of 130% or less of the federal poverty line (Burney & Beilke, 2008). For the purposes of this study, due to the small percentages of students qualifying for the reduced lunch program, all students qualifying for either free or reduced lunch programs will be considered Poor.

According to the Texas Education Agency (2019a), the percentages of Black students living in poverty increased from 71% to 74% from 2015-2016 to 2018-2019. The percentages of Asian and Hispanic students living in poverty also increased during this time. The increase of Asian students living in poverty was one percentage point, but the increase consisted of over 10,000 students. Hispanic students living in poverty experienced an increase of less than one percent, however, this statistic reflected a growth of over 78,000 students.

In addition to the influence of poverty on academic achievement, gender is a contributing factor, as well. Boys and girls differ in their reading skills. Nationally, boys are falling behind each year from kindergarten to Grade 3 (National Assessment of Educational Progress, 2019). The reading achievement of boys decreased from 2017 to 2019, and, in Texas, this achievement by boys is below the national average (National Assessment of Educational Progress, 2019). To determine reading

achievement, the Texas Education Agency has adopted the Texas Essential Knowledge and Skills as the guiding standards for what students must learn (Texas Education Agency, 2019c). The STAAR test is the instrument used to determine if students have achieved mastery of the standards (Texas Assessment, 2019). Grade 3 standards specifically require students to read a variety of texts, recognize characteristics of digital media, and engage in their reading by using metacognitive skills to deepen comprehension (Texas Administrative Code, 2019).

Several studies have been conducted by researchers (Harris, 2018; McGown, 2016; Schleeter, 2017) who have analyzed the reading achievement of boys as assessed by the Texas state-mandated assessment. McGown (2016) investigated Grade 3 STAAR Reading performance for three school years (i.e., 2012-2013, 2013-2014, 2014-2015). In all three school years, less than 40% of boys achieved the Level II Satisfactory Performance Standard, now referred to as Approaches Grade Level (Texas Education Agency, 2017). With regard to the STAAR Reading Reporting Category One, in all three school years, boys responded incorrectly to approximately two out of six questions, in Reporting Category Two, boys missed approximately seven out of 18 questions, and in Reporting Category Three, boys answered approximately five questions incorrectly out of 16 (McGown, 2016). Across the three years of Texas data examined by McGown (2016), results were consistent regarding the performance of boys.

In another Texas analysis conducted for the same three school years, Schleeter (2017) analyzed the passing rates of Grade 3 English Language Learner boys on the STAAR Reading Level III Advanced Performance Standard, now referred to as Masters Grade Level (Texas Education Agency, 2017). At no point in the 3-year period was the passing percentage on the Masters Grade Level standard for English Language Learner boys above 11%. At the Meets Grade Level standard, the passing percentage of English Language Learner boys was consistently below 50%. At the Approaches Grade Level, the passing percentage was always lower than 65% passing. Results for English Language Learner boys were remarkably consistent across the three years of Texas data (Schleeter, 2017).

In another related study, Harris (2018) conducted an analysis of the same three school years of statewide data for the STAAR Reading Level II Final Satisfactory Performance Standard, now referred to as Meets Grade Level (Texas Education Agency, 2017), by gender. In all three school years, statistically significant results for boys were present. The passing rate of Texas Grade 4 boys was not above 37% for any of the three school years.

In a comparison (Hamilton & Slate, 2019) of the reading performance of Grade 3 Black students by their economic status (i.e., Not Economically Disadvantaged or Economically Disadvantaged), Black students in poverty had statistically significantly lower passing rates than Black students who were not economically disadvantaged at the Approaches Grade Level, Meets Grade Level, and Masters Grade Level Phase-in standards on the Grade 3 STAAR Reading test. At the Approaches Grade Level standard, 53.6% of Black students who were Poor met the standard, compared to 81.7% of Black students who were Not Poor. At the Meets Grade Level standard, 21.8% of Black students who were Poor met the standard, compared to 50.7% of Black students who were Not Poor. At the Masters Grade Level standard, only 9.4% of Black students who were Poor met the standard, compared to 29.4% of Black students who were Not Poor.

Similar results were evident by the economic status of Hispanic students (Hamilton & Slate, 2019). At the Approaches Grade Level standard, 63.5% of Hispanic students who were Poor met the standard, compared to 87.8% of Hispanic students who were Not Poor. At the Meets Grade Level standard, 29.2% of Hispanic students who were Poor met the standard, compared to 59.1% of Hispanic students who were Not Poor. At the Masters Grade Level standard, 13.9% of Hispanic students who were Poor met the standard, compared to 35.6% of Hispanic students who were Not Poor. In the Hamilton and Slate (2019) Texas statewide investigation, poverty clearly had a strong influence on the reading achievement of Black and Hispanic Grade 3 students.

Within ethnic/racial groups, Hispanic boys, Black boys, and Asian boys all achieve at a lower rate than their girl counterparts (Husain & Millimet, 2009). As such, in this investigation only the reading achievement of boys was addressed. Though literature regarding a difference between boys and girls in reading achievement is plentiful, published empirical research of literacy academic

performance by only boys within an ethnic/racial group are limited. Analyses of the performance of boys with consideration to the variable of economic status is even more limited in the literature. As such, reading data on only Asian, Black, and Hispanic boys was examined in this multiyear, statewide investigation.

Statement of the Problem

Trends in reading achievement have, on average, revealed boys were outperformed by girls on the National Assessment of Educational Progress scores from 2003 to 2013 (David & Marchant, 2015). In Texas, gender is not one of the monitored subgroups in student academic achievement data. As such, opportunities to increase boys' knowledge could potentially be missed due to this lack of required monitoring. Continued analyses of gender-based data are necessary to understand the reading performance of boys.

Grade 3 is a pivotal year for literacy development. Grade 3 is the first year Texas students are assessed on the STAAR test, and although students are assessed yearly in reading until graduation, 26% of students who have lived in poverty and do not read on grade level in Grade 3 will not graduate from high school (Hernandez, 2011). Black and Hispanic students are much more likely to be economically disadvantaged, at a rate almost twice of the next-closest ethnic/racial group (National Center for Children in Poverty, 2017). Although only 10% of Asian children in Texas are living in poverty (National Center for Children in Poverty, 2017), the effects of living in poverty remain. The State of Texas has a 5% higher poverty rate than does the United States as a whole (National Center for Children in Poverty, 2017), and more than 60% of Texas public schoolchildren are classified as economically disadvantaged (Texas Education Agency, 2019a). Providing reading acquisition opportunities to these student groups is a necessity.

Purpose of the Study

The purpose of this study was to examine the degree to which the economic status (i.e., Poor, Not Poor) of Grade 3 Asian, Black, and Hispanic boys in Texas schools is related to their reading achievement. Specifically examined was the relationship of poverty to three STAAR Reading Reporting Categories and the STAAR Reading Phase-in standards. These relationships were determined separately for Asian, Black, and Hispanic boys in each of the three school years (i.e., 2015-2016, 2016-2017, 2017-2018, 2018-2019). Finally, the degree to which trends might be present for each of the three ethnic/racial groups of boys across the four school years was determined.

Significance of the Study

Little research regarding the intersection of economic status and reading achievement within ethnic/racial groups exists. To date, no researchers have conducted a within-group comparison in which the relationship between economic status and the reading achievement of Black, Hispanic, and Asian boys, as measured by the Texas state-mandated STAAR assessment, has been addressed. In analyzing the reading performance of Asian boys, Black boys, and Hispanic boys by their economic status, additional information can be provided to stakeholders. Stakeholders who could benefit from this study include literacy teachers and specialists, campus principals and associated decision-makers, curriculum directors, and district-level administrators.

Research Questions

The following overarching research question was addressed in this investigation: What is the difference in reading performance by the economic status (i.e., Poor, Not Poor) of Texas Grade 3 underrepresented boys (i.e., Asian, Black, and Hispanic)? Specific subquestions under this overarching research question were: (a) What is the difference in Reading Reporting Category One performance by

the economic status of Texas Grade 3 underrepresented boys?; (b) What is the difference in Reading Reporting Category Two by the economic status of Texas Grade 3 underrepresented boys?; (c) What is the difference in Reading Reporting Category Three performance by the economic status of Texas Grade 3 underrepresented boys?; (d) What is the difference in the Approaches Grade Level performance by the economic status of Texas Grade 3 underrepresented boys?; (e) What is the difference in the Meets Grade Level performance by the economic status of Texas Grade 3 underrepresented boys?; (f) What is the difference in the Masters Grade Level performance by the economic status of Texas Grade 3 underrepresented boys?; (g) To what extent is a trend present in the three Reading Reporting Categories performance by the economic status of Texas Grade 3 underrepresented boys for the 2015-2016 through the 2018-2019 school years?; and (h) To what extent is a trend present in the Approaches Grade Level, Meets Grade Level, and Masters Grade Level performance by the economic status of Texas Grade 3 underrepresented boys for the 2015-2016 through the 2018-2019 school years? The first six research questions were repeated separately for Asian, Black, and Hispanic boys for the 2015-2016, 2016-2017, 2017-2018, and 2018-2019 school years whereas the two trend questions will involve all four school years. Thus, 34 research questions were present in this investigation.

Research Design

For this empirical investigation, a non-experimental, causal-comparative research design was used (Creswell & Creswell, 2018; Johnson & Christensen, 2017). Causal-comparative research is used by researchers to find relationships between independent and dependent after the individual variables have already occurred (Johnson & Christensen, 2017). Extraneous variables are not controlled in this study design (Johnson & Christensen, 2017). The independent variable in this study was level of poverty (i.e., Poor, Not Poor) and the dependent variables were the three reporting categories (i.e., Reporting Category I, Reporting Category II, Reporting Category III) and the three Phase-in Standards (i.e., Approaches Grade Level, Meets Grade Level, Masters Grade Level) from the 2015-2016, 2016-2017, 2017-2018, and 2018-2019 STAAR assessments. Regarding the three reporting categories, because each reporting category contains a different number of questions, data were converted from raw scores to percentages to compare differences between scores

Participants and Instrumentation

Archival data were obtained from the Texas Education Agency Public Education Information Management System for the 2015-2016 through the 2018-2019 school years for Black, Hispanic, and Asian Grade 3 boys who took the STAAR Reading assessment, as well as their student demographic characteristics. To obtain the data, a Public Information Request was submitted to the Texas Education Agency.

Three reporting categories are assessed by the STAAR Reading test at three Phase-in standard levels. Assessed in Reporting Category I is reading and vocabulary development across genres of a variety of texts (Texas Education Agency, 2011). The Grade 3 STAAR Reporting Category II assesses students' abilities to understand and analyze literary texts, including fiction, literary nonfiction, poetry, and media literacy (Texas Education Agency, 2011). Measured in the Grade 3 STAAR Reading Reporting Category Three is students' abilities to understand and analyze informational texts, including expository, procedural, and media literacy (Texas Education Agency, 2011).

The Phase-In standards attempt to predict the level of success attainable, and the amount of academic intervention potentially required, in the following school year (Texas Education Agency, 2017). Did Not Meet Grade level on the STAAR demonstrates future success is unlikely without substantial and consistent academic intervention. Students at this level do not exhibit an understanding of the knowledge and skills assessed (Texas Education Agency, 2017). Approaches Grade Level on the STAAR indicates targeted academic intervention will be required in the following school year for a student to be successful. Students achieving at this level do not typically exhibit an understanding of the knowledge and skills assessed (Texas Education Agency, 2017). Meets Grade level on the STAAR indicates the students will most likely be successful in the following school year but may need short-

term academic intervention. In this category, students demonstrate the ability to apply the knowledge and skills assessed in familiar contexts. Additionally, a general ability to think critically is evident (Texas Education Agency, 2017). Finally, Masters Grade Level on the STAAR indicates the students will be successful in the following school year with little or no intervention. At the Masters Grade Level, students show the ability to think critically, apply knowledge and skills in familiar contexts, and utilize knowledge and skill in unfamiliar contexts (Texas Education Agency, 2017).

For the purpose of this article, economic status included the categories of Poor and Not Poor. Boys not eligible for free or reduced lunch were referred to as Not Poor. Boys who were eligible for the reduced lunch program, indicating a family income of 131% to 185% of the federal poverty line (Burney & Beilke, 2008), and boys who were eligible for the free lunch program, which indicates a family income of 130% or less of the federal poverty line (Burney & Beilke, 2008), were referred to as Poor. Due to the small percentages of boys qualifying for the reduced lunch program, all boys qualifying for either free or reduced lunch programs were considered Poor. For the purposes of this study, underrepresented boys referred to Asian, Black, and Hispanic boys.

Findings

Prior to conducting multivariate analysis of variance (MANOVA) procedures, its underlying assumptions were checked. Though the majority of these assumptions were not met, the robustness of a MANOVA procedure made it appropriate to use in this study (Field, 2009). Results of statistical analyses will be described by racial/ethnic group by Reading Reporting Category followed by Phase-in Standard. The results in this study will be discussed in chronological order by year and then for Asian boys, then for Black boys, and then for Hispanic boys.

Reading Reporting Category Results for Asian Boys

Regarding 2015-2016, the MANOVA revealed a statistically significant difference, Wilks' $\Lambda = .77$, $p < .001$, partial $\eta 2 = .23$, in overall reading performance as a function of the economic status of Asian boys. The effect size for this statistically significant difference was large (Cohen, 1988). Concerning 2016-2017, the MANOVA revealed a statistically significant difference, Wilks' $\Lambda = .82$, $p < .001$, partial $\eta 2 = .18$, large effect size (Cohen, 1988). With respect to 2017-2018, a statistically significant difference was revealed, Wilks' $\Lambda = .86$, $p < .001$, partial $\eta 2 = .14$, large effect size (Cohen, 1988). Regarding 2018-2019, a statistically significant difference was yielded, Wilks' $\Lambda = .83$, $p < .001$, partial $\eta 2 = .17$, large effect size (Cohen, 1988). In all four school years, effect sizes were large for Asian boys.

Following the overall results of the MANOVA, univariate follow-up Analysis of Variance (ANOVA) procedures were conducted for all four school years. A statistically significant difference was yielded between Asian boys who were Poor and Asian boys who were Not Poor in their Reading Reporting Category I performance in 2015-2016, $F(1, 3073) = 792.33$, $p < .001$, partial $\eta 2 = .20$, large effect size; in 2016-2017, $F(1, 3290) = 562.50$, $p < .001$, partial $\eta 2 = .15$, large effect size; in 2017-2018, $F(1, 3077) = 358.00$, $p < .001$, partial $\eta 2 = .10$, moderate effect size; and in 2018-2019 , $F(1, 3369) = 484.57$, $p < .001$, partial $\eta 2 = .13$, moderate effect size. In regard to the Grade 3 STAAR Reading Reporting Category I scores, Asian boys who were Poor had an average score approximately 34% lower than the average score for Asian boys who were Not Poor in 2015-2016; 26% lower than the average score for Asian boys who were Not Poor in 2016-2017; 24% lower in 2017-2018; and 31% lower in 2018-2019.

A statistically significant difference was yielded between Asian boys who were Poor and Asian boys who were Not Poor in their Reading Reporting Category II performance in 2015-2016, $F(1, 3073) = 723.35$, $p < .001$, partial $\eta 2 = .19$, large effect size; in the 2016-2017 school year, $F(1, 3290) = 582.13$, $p < .001$, partial $\eta 2 = .15$, large effect size; in 2017-2018, $F(1, 3077) = 385.84$, $p < .001$, partial $\eta 2 = .11$, moderate effect size; and in 2018-2019, $F(1, 3369) = 529.80$, $p < .001$, partial $\eta 2 = .14$, large effect

size. In regard to the Grade 3 STAAR Reading Reporting Category II scores, Asian boys who were Poor had an average score approximately 30% lower than the average score for Asian boys who were Not Poor in 2015-2016; 28% lower than the average score for Asian boys who were Not Poor in 2016-2017; and 27% lower than the average score for Asian boys who were Not Poor in 2017-2018 and 2018-2019.

A statistically significant difference was yielded between Asian boys who were Poor and Asian boys who were Not Poor in their Reading Reporting Category III performance in 2015-2016, $F(1, 3073) = 666.58$, $p < .001$, partial $\eta 2 = .18$, large effect size; in 2016-2017, $F(1, 3290) = 512.47$, $p < .001$, partial $\eta 2 = .14$, large effect size; in 2017-2018, $F(1, 3077) = 340.43$, $p < .001$, partial $\eta 2 = .10$, moderate effect size; and in 2018-2019, $F(1, 3369) = 412.00$, $p < .001$, partial $\eta 2 = .11$, moderate effect size. In regard to the Grade 3 STAAR Reading Reporting Category III scores, Asian boys who were Poor had an average score approximately 29% lower than the average score for Asian boys who were Not Poor in 2015-2016; 26% lower than the average score for Asian boys who were Not Poor in 2016-2017 and 2017-2018; and 29% lower than the average score for Asian boys who were Not Poor in 2018-2019. Delineated in Table 1 are the descriptive statistics for these analyses. Depicted in Figures 1, 2, and 3 are these results for Asian boys by their economic status.

Table 1. Descriptive Statistics for the STAAR Grade 3 Reading Reporting Category Scores by the Economic Status of Asian Boys for the 2015-2016, 2016-2017, 2017-2018, and 2018-2019 School Years

Reporting Category and Year	*n*	*M%*	*SD%*
Reporting Category I: 2015-2016			
Not Poor	2,777	87.00	18.59
Poor	298	52.68	30.16
Reporting Category I: 2016-2017			
Not Poor	3,031	92.48	15.37
Poor	261	66.13	31.66
Reporting Category I: 2017-2018			
Not Poor	2,927	93.14	13.93
Poor	152	68.95	32.45
Reporting Category I: 2018-2019			
Not Poor	3,215	90.00	16.26
Poor	156	58.72	32.34
Reporting Category II: 2015-2016			
Not Poor	2,777	83.03	16.39
Poor	298	53.80	27.87
Reporting Category II: 2016-2017			
Not Poor	3,031	82.40	16.70
Poor	261	54.66	27.70
Reporting Category II: 2017-2018			
Not Poor	2,927	82.91	15.31
Poor	152	56.40	28.39
Reporting Category II: 2018-2019			
Not Poor	3,215	88.88	13.27
Poor	156	62.18	26.40
Reporting Category III: 2015-2016			
Not Poor	2,777	81.31	17.61
Poor	298	51.89	26.81
Reporting Category III: 2016-2017			
Not Poor	3,031	85.12	16.44
Poor	261	59.25	28.67
Reporting Category III: 2017-2018			
Not Poor	2,927	82.75	15.73
Poor	152	57.19	29.24
Reporting Category III: 2018-2019			
Not Poor	3,215	81.46	16.82
Poor	156	52.56	26.19

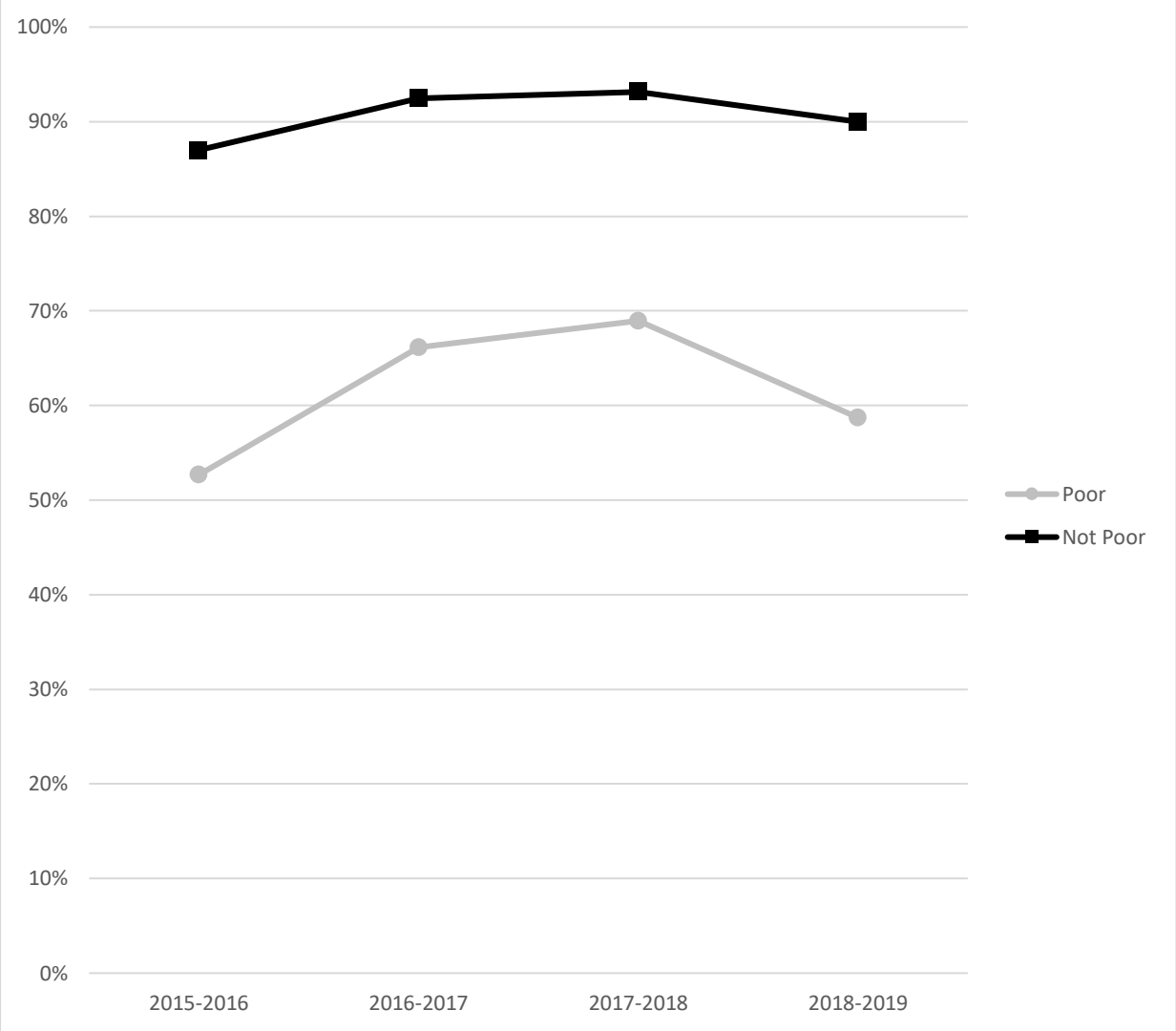


Figure 1. Grade 3 Reading Reporting Category I scores by the economic status of Asian boys for the 2015-2016 through the 2018-2019 school years.

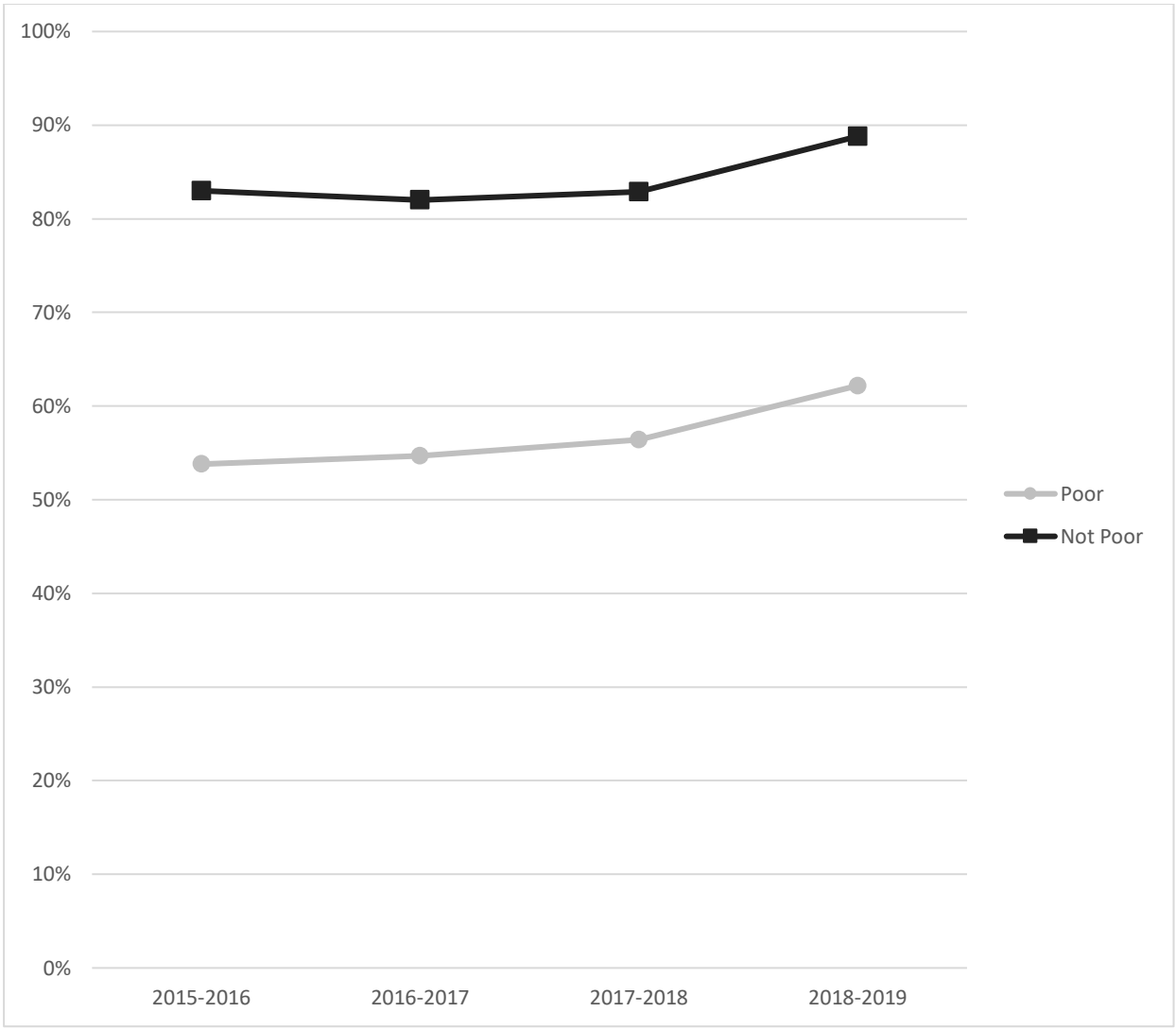


Figure 2. Grade 3 Reading Reporting Category II scores by the economic status of Asian boys for the 2015-2016 through the 2018-2019 school years.

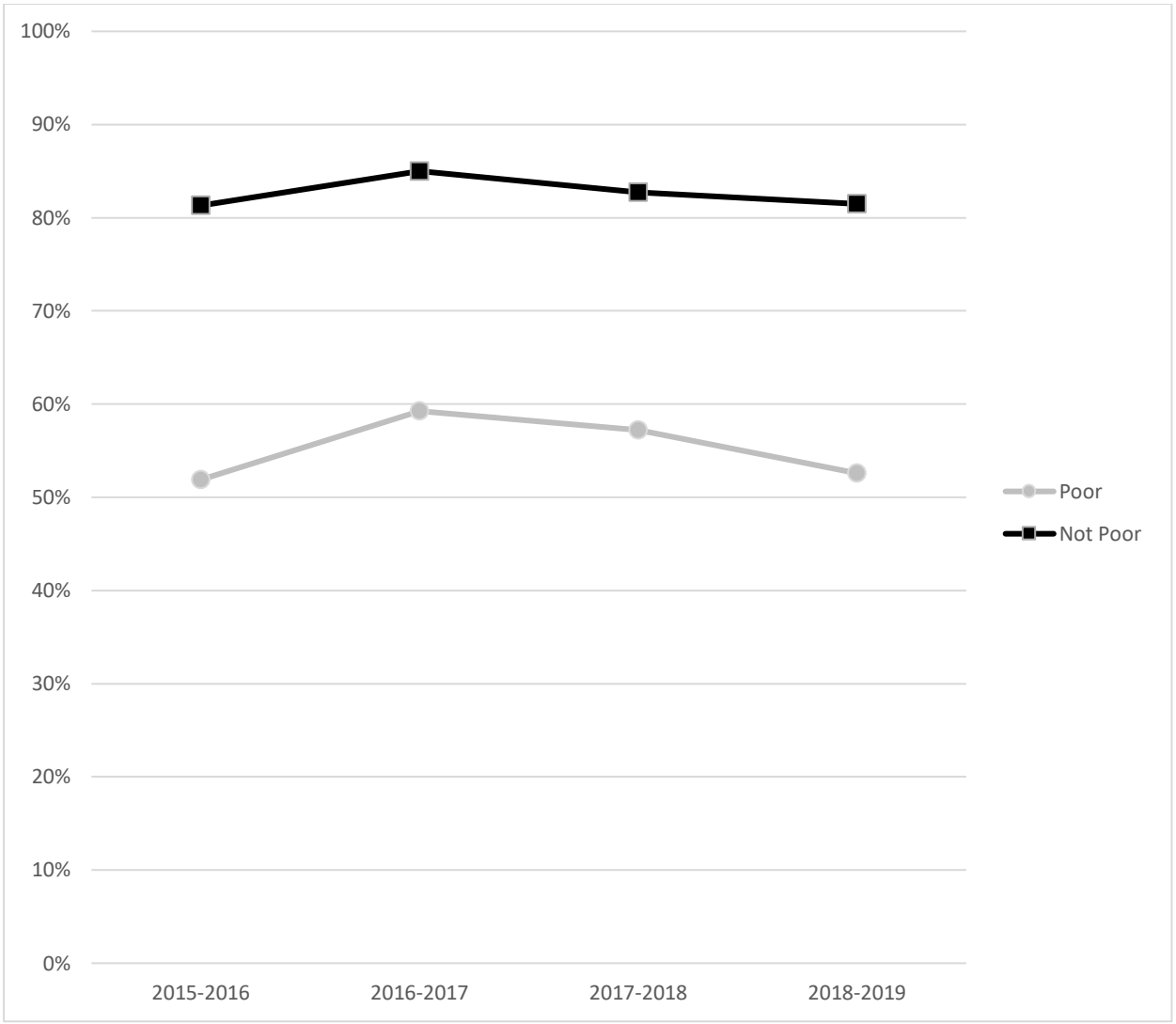


Figure 3. Grade 3 Reading Reporting Category III scores by the economic status of Asian boys for the 2015-2016 through the 2018-2019 school years.

Reading Reporting Category Results for Black Boys

Concerning 2015-2016, the MANOVA revealed a statistically significant difference, Wilks' $\Lambda = .93$, $p < .001$, partial $\eta 2 = .07$, in overall reading performance as a function of the economic status of Black boys. Using Cohen's (1988) criteria, the effect size was moderate. With respect to 2016-2017, the MANOVA yielded a statistically significant difference, Wilks' $\Lambda = .94$, $p < .001$, partial $\eta 2 = .06$, moderate effect size (Cohen, 1988). Regarding 2017-2018, the a statistically significant difference was yielded, Wilks' $\Lambda = .94$, $p < .001$, partial $\eta 2 = .06$, moderate effect size (Cohen, 1988). In 2018-2019, a statistically significant difference was revealed, Wilks' $\Lambda = .94$, $p < .001$, partial $\eta 2 = .06$, moderate effect size. Effect sizes were moderate for Black boys in all four school years.

Following the overall results of the MANOVA, univariate follow-up ANOVA procedures were conducted for all four school years. With regard to Reading Reporting Category I performance, a statistically significant difference was yielded between Black boys who were Poor and Black boys who were Not Poor in 2015-2016, $F(1, 9483) = 452.37$, $p < .001$, partial $\eta 2 = .05$, small effect size; in 2016-2017, $F(1, 10653) = 461.14$, $p < .001$, partial $\eta 2 = .04$, small effect size; in 2017-2018, $F(1, 8002) = 340.19$, $p < .001$, partial $\eta 2 = .04$, small effect size; and in 2018-2019, $F(1, 7342) = 256.85$, $p < .001$, partial $\eta 2 = .03$, small effect size. Concerning the Grade 3 STAAR Reading Reporting Category I scores, Black boys who were Poor had an average score approximately 16% lower than the average

score for Black boys who were Not Poor in 2015-2016 and 2016-2017; 15% lower than the average score for Black boys who were Not Poor in 2017-2018; and 14% lower than the average score for Black boys who were Not Poor in 2017-2018.

With regard to the performance in Reading Reporting Category II, a statistically significant difference was yielded between Black boys who were Poor and Black boys who were Not Poor in 2015-2016, $F(1, 9483) = 577.59$, $p < .001$, partial $\eta 2 = .06$, small effect size; in 2016-2017, $F(1, 10653) = 455.67$, $p < .001$, partial $\eta 2 = .04$, small effect size; in 2017-2018, $F(1, 8002) = 456.60$, $p < .001$, partial $\eta 2 = .05$, small effect size; and in 2018-2019, $F(1, 7342) = 409.18$, $p < .001$, partial $\eta 2 = .05$, small effect size. Concerning the Grade 3 STAAR Reading Reporting Category II scores, Black boys who were Poor had an average score approximately 15% lower than the average score for Black boys who were Not Poor in 2015-2016; 14% lower than the average score for Black boys who were Not Poor in 2016-2017; 13% lower than the average score for Black boys who were Not Poor in 2017-2018; and 15% lower than the average score for Black boys who were Not Poor in 2018-2019.

With regard to the Reading Reporting Category III performance, a statistically significant difference was yielded between Black boys who were Poor and Black boys who were Not Poor in 2015-2016, $F(1, 9483) = 655.62$, $p < .001$, partial $\eta 2 = .07$, small effect size; in 2016-2017, $F(1, 10653) = 566.26$, $p < .001$, partial $\eta 2 = .05$, small effect size; in 2017-2018, $F(1, 8002) = 438.47$, $p < .001$, partial $\eta 2 = .05$, small effect size; and in 2018-2019, $F(1, 7342) = 387.04$, $p < .001$, partial $\eta 2 = .05$, small effect size. Concerning the Grade 3 STAAR Reading Reporting Category III, Black boys who were Poor had an average score approximately 16% lower than the average score for Black boys who were Not Poor in 2015-2016; 15% lower than the average score for Black boys who were Not Poor in 2016-2017 and 2017-2018; and 14% lower than the average score for Black boys who were Not Poor in 2018-2019. Revealed in Table 2 are the descriptive statistics for these analyses. Portrayed in Figures 4 through 6 are the results of Reading Reporting Category I, 2, and 3 scores for Black boys who were Poor and Black boys who were Not Poor.

Table 2. Descriptive Statistics for the STAAR Grade 3 Reading Reporting Category Scores by the Economic Status of Black Boys for the 2015-2016, 2016-2017, 2017-2018, and 2018-2019 School Years

Reporting Category and Year	*n*	*M%*	*SD%*
Reporting Category I: 2015-2016			
Not Poor	1,689	71.59	26.44
Poor	7,796	55.75	28.03
Reporting Category I: 2016-2017			
Not Poor	1,966	74.79	26.95
Poor	8,689	59.07	29.81
Reporting Category I: 2017-2018			
Not Poor	1,314	82.42	22.94
Poor	6,690	67.52	27.45
Reporting Category I: 2018-2019			
Not Poor	1,209	75.90	25.99
Poor	6,135	61.49	29.05
Reporting Category II: 2015-2016			
Not Poor	1,689	68.24	22.02
Poor	7,796	53.70	22.65
Reporting Category II: 2016-2017			
Not Poor	1,966	63.78	25.00
Poor	8,689	50.49	24.92
Reporting Category II: 2017-2018			
Not Poor	1,314	68.42	21.28
Poor	6,690	54.03	22.51
Reporting Category II: 2018-2019			
Not Poor	1,209	75.80	21.77
Poor	6,135	60.64	24.20
Reporting Category III: 2015-2016			
Not Poor	1,689	63.70	23.48
Poor	7,796	47.67	23.28
Reporting Category III: 2016-2017			
Not Poor	1,966	63.34	25.46
Poor	8,689	48.81	24.22
Reporting Category III: 2017-2018			
Not Poor	1,314	66.59	22.26
Poor	6,690	51.96	23.31
Reporting Category III: 2018-2019			
Not Poor	1,209	61.41	23.23
Poor	6,135	47.54	22.25

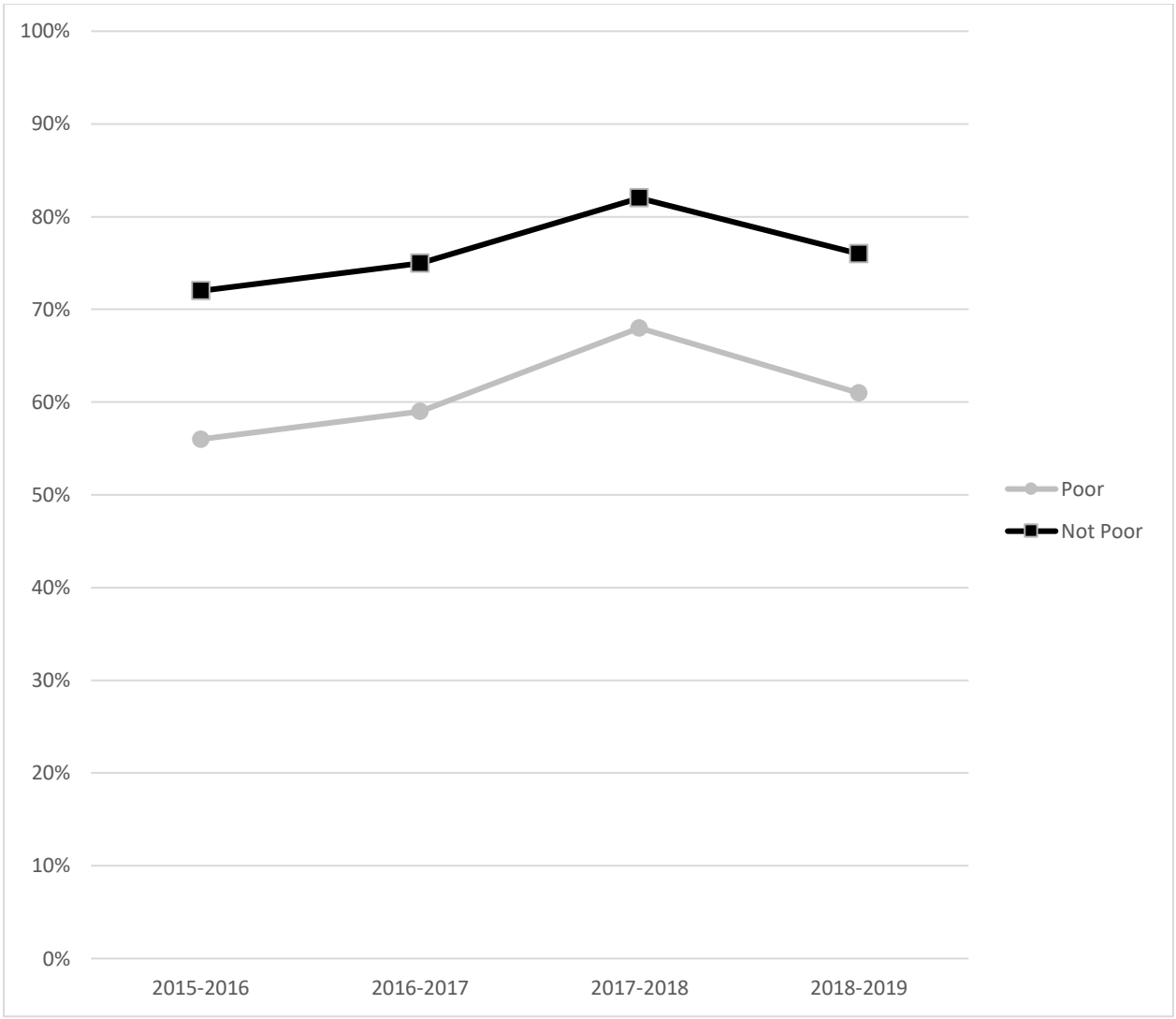


Figure 4. Grade 3 Reading Reporting Category I scores by the economic status of Black boys for the 2015-2016 through the 2018-2019 school years.

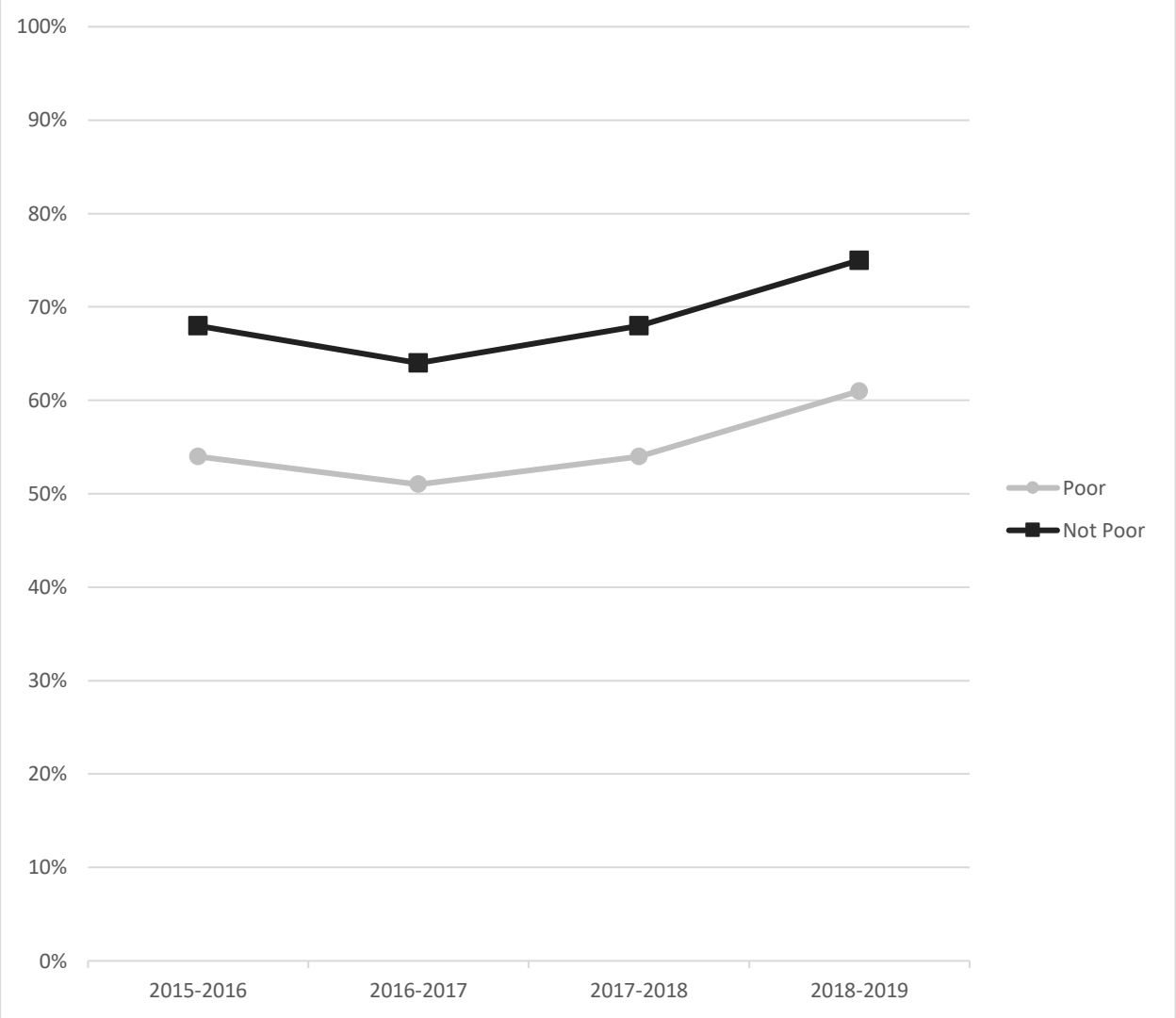


Figure 5. Grade 3 Reading Reporting Category II scores by the economic status of Black boys for the 2015-2016 through the 2018-2019 school years.

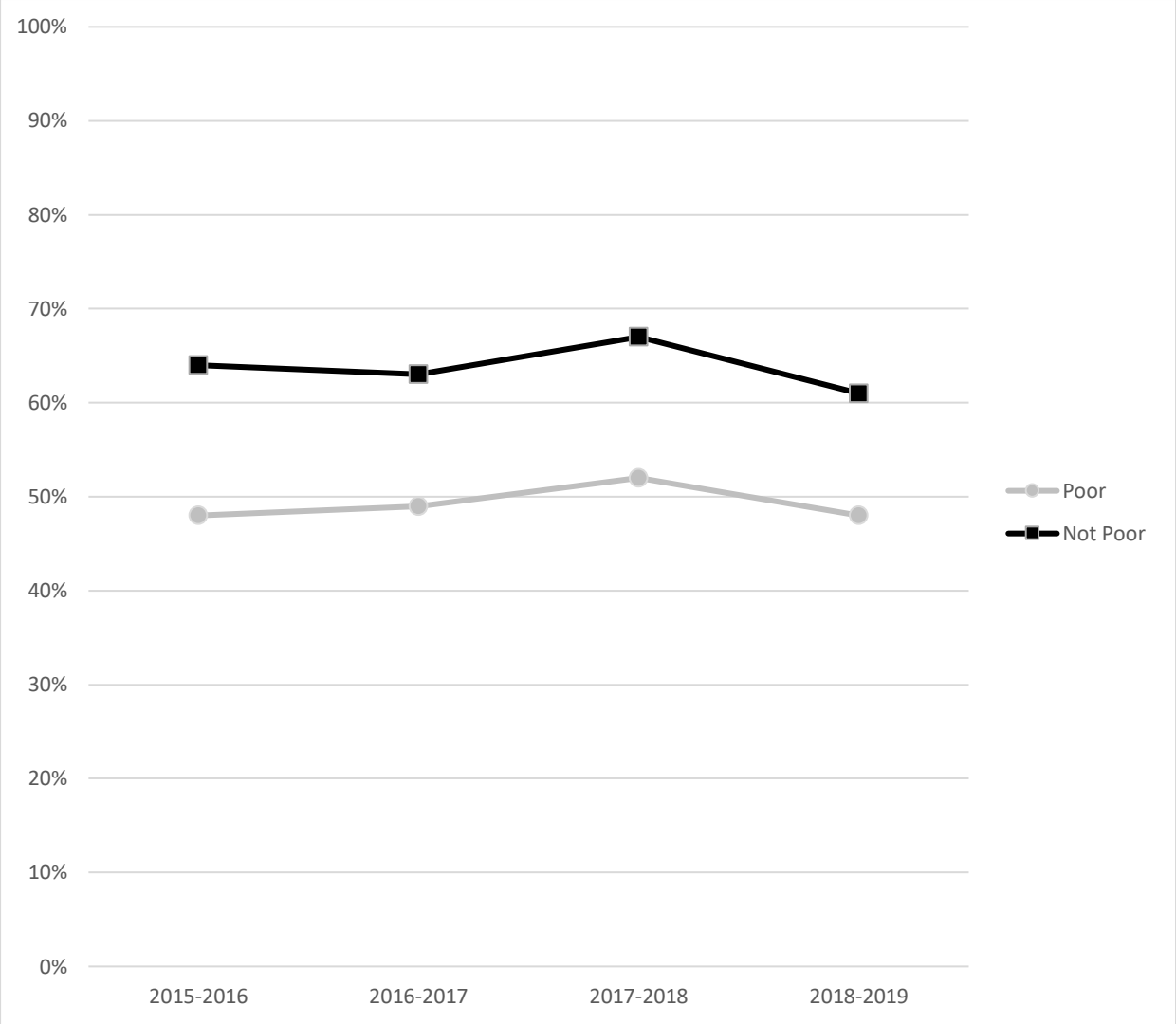


Figure 6. Grade 3 Reading Reporting Category III scores by the economic status of Black boys for the 2015-2016 through the 2018-2019 school years.

Reading Reporting Category Results for Hispanic Boys

Regarding 2015-2016, the MANOVA yielded a statistically significant difference, Wilks' $\Lambda = .93$, $p < .001$, partial $\eta^2 = .07$, moderate effect size (Cohen, 1988) in overall reading performance as a function of the economic status of Hispanic boys. Concerning 2016-2017, a statistically significant difference was revealed, Wilks' $\Lambda = .93$, $p < .001$, partial $\eta^2 = .07$, moderate effect size (Cohen, 1988). With respect to 2017-2018, a statistically significant difference was present, Wilks' $\Lambda = .93$, $p < .001$, partial $\eta^2 = .07$, moderate effect size (Cohen, 1988). Regarding 2018-2019, a statistically significant difference was revealed, Wilks' $\Lambda = .92$, $p < .001$, partial $\eta^2 = .07$, moderate effect size. Effect sizes for the statistically significant differences in overall reading performance were moderate for Hispanic boys in all four school years.

Following the overall results of the MANOVA, univariate ANOVA procedures were conducted for all four school years. A statistically significant difference was yielded between Hispanic boys who were Poor and Hispanic boys who were Not Poor in their Reading Reporting Category I performance in 2015-2016, $F(1, 51689) = 2471.24$, $p < .001$, partial $\eta^2 = .05$, small effect size; in 2016-2017, $F(1, 44518) = 1783.72$, $p < .001$, partial $\eta^2 = .04$, small effect size; in 2017-2018, $F(1, 34403) = 1503.68$, $p < .001$, partial $\eta^2 = .04$, small effect size; and in 2018-2019, $F(1, 31187) = 1658.59$, $p < .001$, partial $\eta^2 = .05$, small effect size. With regard to the Grade 3 STAAR Reading Reporting Category I scores, Hispanic boys who were Poor had an average score approximately 15% lower than the average score for Hispanic boys who were Not Poor in 2015-2016; 14% lower than the average score for Hispanic boys who were Not Poor in 2016-2017 and 2017-2018; and 16% lower than the average score for Hispanic boys who were Not Poor in 2018-2019.

A statistically significant difference was yielded between Hispanic boys who were Poor and Hispanic boys who were Not Poor in their Reading Reporting Category II performance in 2015-2016, $F(1, 51689) = 3671.78$, $p < .001$, partial $\eta^2 = .07$, moderate effect size; in 2016-2017, $F(1, 44518) = 3040.85$, $p < .001$, partial $\eta^2 = .06$, moderate effect size; in 2017-2018, $F(1, 34403) = 1875.47$, $p < .001$, partial $\eta^2 = .05$, small effect size; and in 2018-2019, $F(1, 31187) = 2150.33$, $p < .001$, partial $\eta^2 = .07$, moderate effect size. With regard to the Grade 3 STAAR Reading Reporting Category II scores, Hispanic boys who were Poor had an average score approximately 15% lower than the average score for Hispanic boys who were Not Poor in 2015-2016; 16% lower than the average score for Hispanic boys who were Not Poor; 13% lower than the average score for Hispanic boys who were Not Poor in 2017-2018; and 15% lower than the average score for Hispanic boys who were Not Poor in 2018-2019.

A statistically significant difference was yielded between Hispanic boys who were Poor and Hispanic boys who were Not Poor in their Reading Reporting Category III performance in 2015-2016, $F(1, 51689) = 3022.38$, $p < .001$, partial $\eta^2 = .06$, moderate effect size; in 2016-2017, $F(1, 44518) = 2645.21$, $p < .001$, partial $\eta^2 = .06$, moderate effect size; in 2017-2018, $F(1, 34403) = 2129.23$, $p < .001$, partial $\eta^2 = .06$, moderate effect size; and in 2018-2019, $F(1, 31187) = 2100.19$, $p < .001$, partial $\eta^2 = .06$, moderate effect size. With regard to the Grade 3 STAAR Reading Reporting Category III scores, Hispanic boys who were Poor had an average score approximately 14% lower than the average score for Hispanic boys who were Not Poor in 2015-2016 and approximately 15% lower than the average score for Hispanic boys who were Not Poor in 2016-2017, 2017-2018, and 2018-2019. Delineated in Table 3 are the descriptive statistics for these analyses. Illustrated in Figures 7, 8, and 9 are these results for Hispanic boys by their economic status.

Table 3. Descriptive Statistics for the STAAR Grade 3 Reading Reporting Category Scores by the Economic Status of Hispanic Boys for the 2015-2016, 2016-2017, 2017-2018, and 2018-2019 School Years

Reporting Category and Year	*n*	*M%*	*SD%*
Reporting Category I: 2015-2016			
Not Poor	9,111	75.77	24.04
Poor	42,580	60.60	26.92
Reporting Category I: 2016-2017			
Not Poor	8,059	81.68	23.51
Poor	36,461	67.46	28.12
Reporting Category I: 2017-2018			
Not Poor	6,041	86.02	20.65
Poor	28,364	72.40	25.59
Reporting Category I: 2018-2019			
Not Poor	5,990	80.47	23.08
Poor	25,199	64.88	27.40
Reporting Category II: 2015-2016			
Not Poor	9,111	73.61	19.50
Poor	42,580	58.32	22.32
Reporting Category II: 2016-2017			
Not Poor	8,059	71.28	22.02
Poor	36,461	55.02	24.36
Reporting Category II: 2017-2018			
Not Poor	6,041	72.37	20.24
Poor	28,364	59.12	21.86
Reporting Category II: 2018-2019			
Not Poor	5,990	79.75	18.75
Poor	25,199	65.09	22.71
Reporting Category III: 2015-2016			
Not Poor	9,111	69.91	21.31
Poor	42,580	55.52	22.96
Reporting Category III: 2016-2017			
Not Poor	8,059	71.90	22.46
Poor	36,461	56.58	24.57
Reporting Category III: 2017-2018			
Not Poor	6,041	72.25	20.83
Poor	28,364	57.67	22.59
Reporting Category III: 2018-2019			
Not Poor	5,990	69.17	21.56
Poor	25,199	54.26	22.88

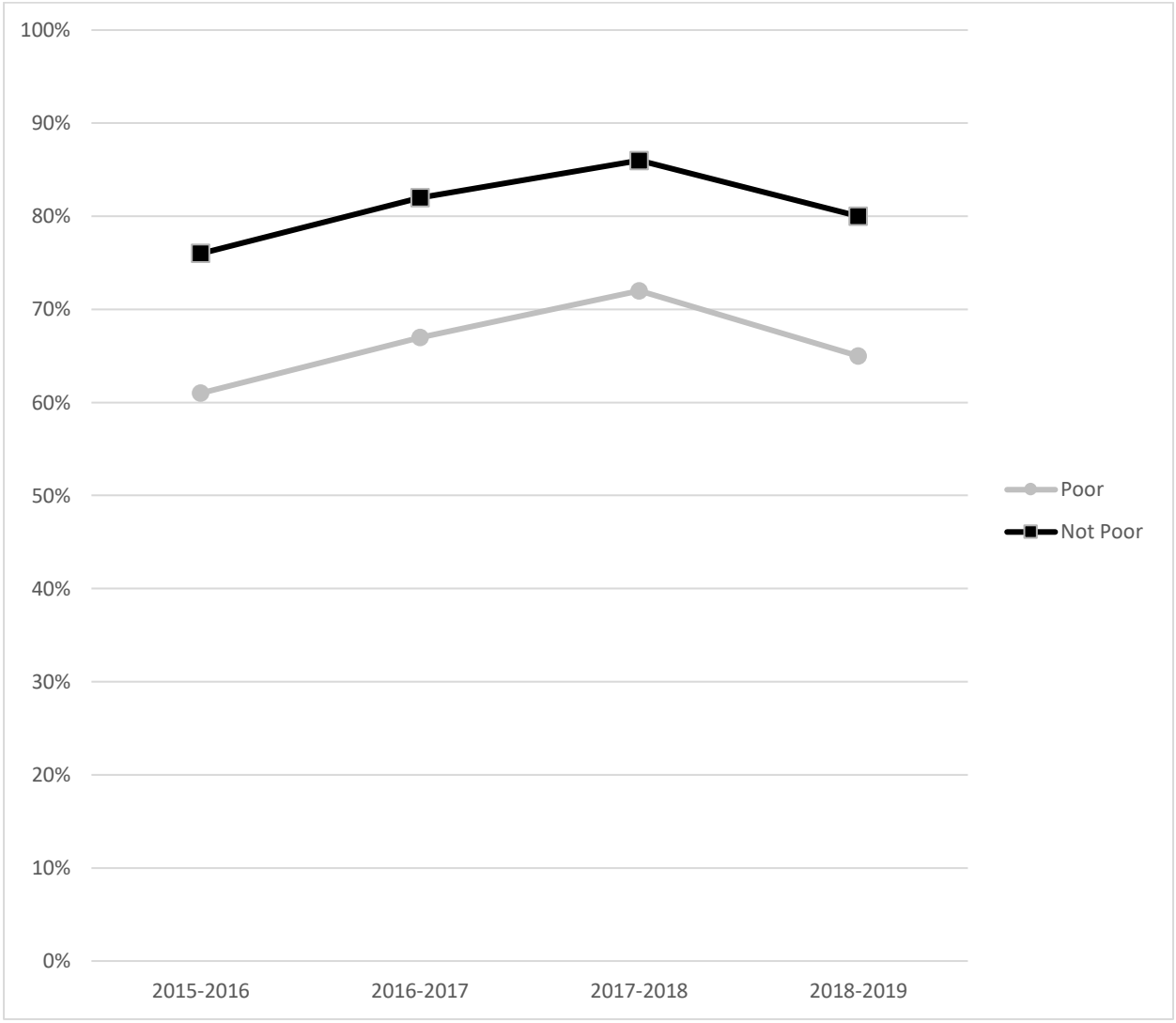


Figure 7. Grade 3 Reading Reporting Category I scores by the economic status of Hispanic boys for the 2015-2016 through the 2018-2019 school years.

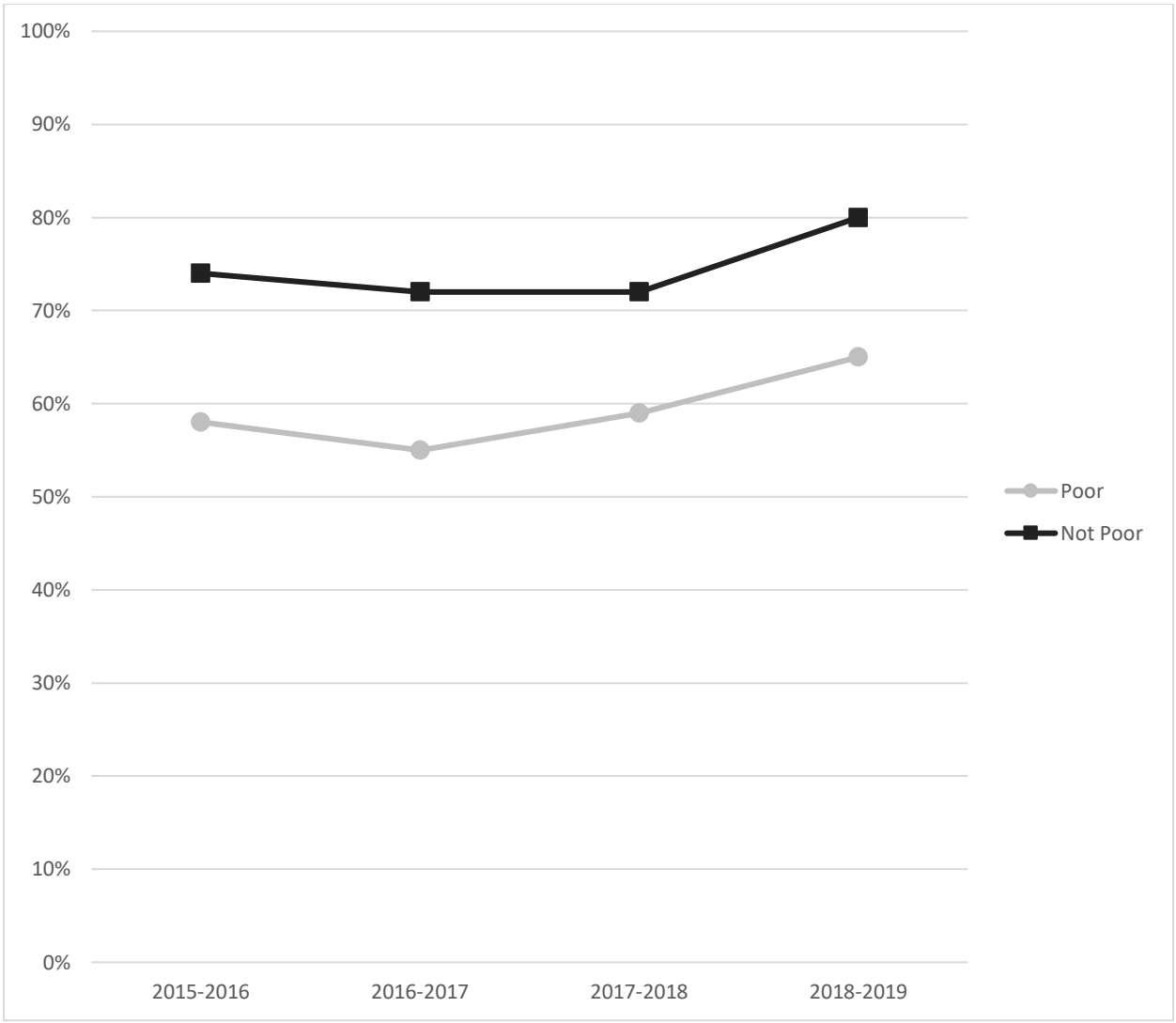


Figure 8. Grade 3 Reading Reporting Category II scores by the economic status of Hispanic boys for the 2015-2016 through the 2018-2019 school years.

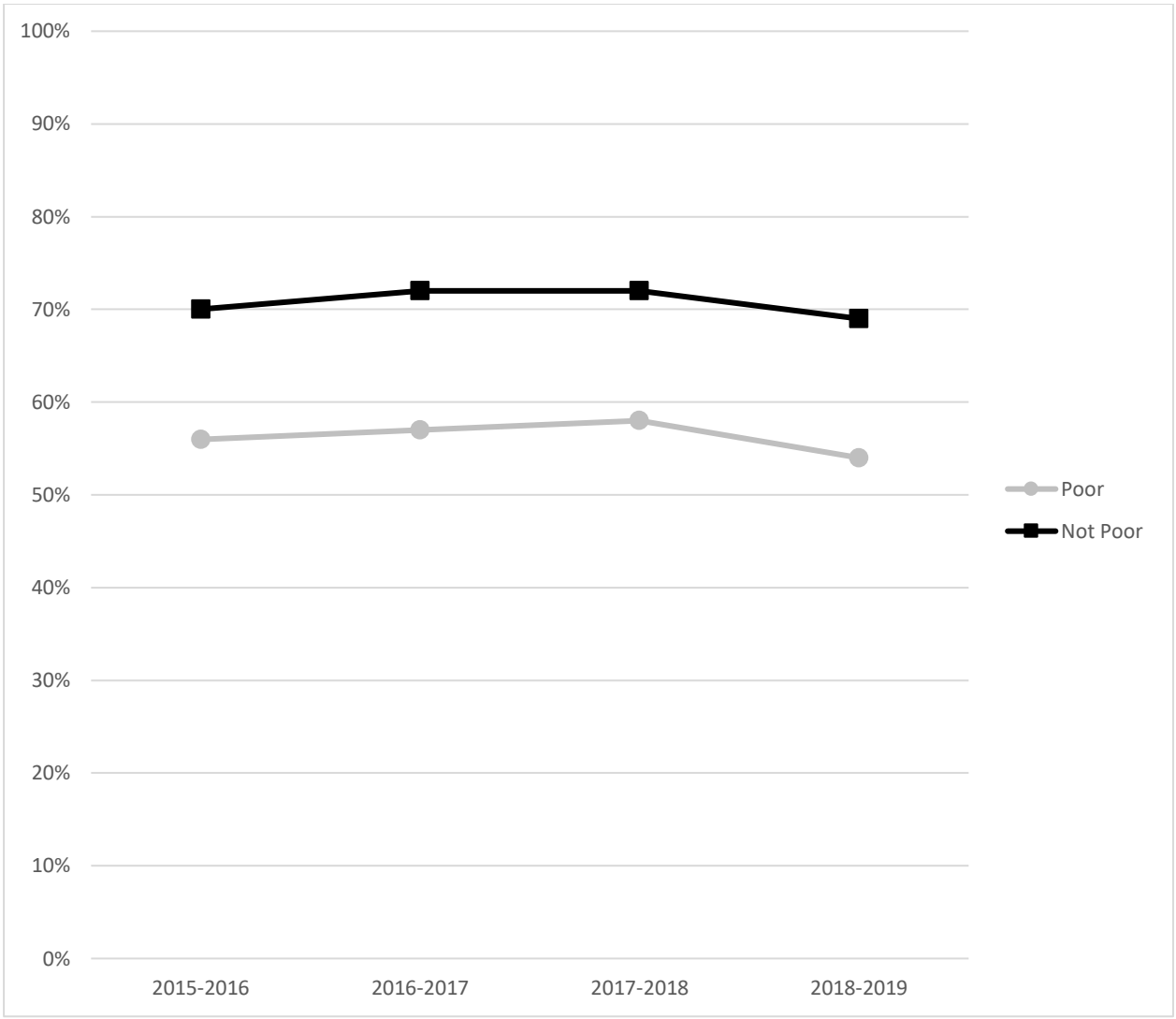


Figure 9. Grade 3 Reading Reporting Category III scores by the economic status of Hispanic boys for the 2015-2016 through the 2018-2019 school years.

To ascertain whether differences were present in the three Grade 3 STAAR Reading Phase-in standards (i.e., Approaches Grade Level, Meets Grade Level, or Masters Grade Level) by the economic status of underrepresented boys, Pearson chi-square analyses were conducted. Because frequency data were present for the independent and dependent variables, this statistical procedure was optimal. When both variables are categorical, chi-squares are the statistical procedure of choice (Slate & Rojas-LeBouef, 2011).

Grade Level Standard Results for Asian Boys

Regarding the economic status of Asian boys in 2015-2016 and their performance on the Approaches Grade Level standard, the result was statistically significant, $\chi^2(1) = 516.09$, $p < .001$, Cramer's V of .41, moderate effect size (Cohen, 1988). Slightly over 55% of Asian boys who were Poor met the Approaches Grade Level standard, compared to approximately 95% of Asian boys who were Not Poor who met this standard. In regard to the Meets Grade Level performance level, the result was statistically significant, $\chi^2(1) = 466.45$, $p < .001$, Cramer's V of .39, moderate effect size (Cohen, 1988). At the Meets Grade Level standard, less than 26% of Asian boys who were Poor met this standard in comparison to over 81% of Asian boys who were Not Poor. Finally, for the Masters Grade Level performance level, the result was statistically significant, $\chi^2(1) = 260.59$, $p < .001$, Cramer's V of .29, small effect size (Cohen, 1988). Less than 15% of Asian boys who were Poor met this standard, whereas slightly less than 62% of Asian boys who were Not Poor met this standard.

Concerning the economic status of Asian boys in 2016-2017 and their performance on the Approaches Grade Level standard, a statistically significant difference was yielded, $\chi^2(1) = 472.04$, $p < .001$, Cramer's V of .38, moderate effect size (Cohen, 1988). Less than 62% of Asian boys who were Poor met the Approaches Grade

Level standard, compared to approximately 96% of Asian boys who were Not Poor who met this standard. In regard to the Meets Grade Level performance level, the result was statistically significant, $\chi^2(1) = 344.72$, $p < .001$, Cramer's V of .32, moderate effect size (Cohen, 1988). At the Meets Grade Level standard, only about 35% of Asian boys who were Poor met this standard compared to over 83% of Asian boys who were Not Poor. Finally, for the Masters Grade Level performance level, a statistically significant difference was revealed, $\chi^2(1) = 231.66$, $p < .001$, Cramer's V of .26, small effect size (Cohen, 1988). Less than 21% of Asian boys who were Poor met this highest standard, whereas slightly less than 68% of Asian boys who were Not Poor met this standard. Table 4 contains the descriptive statistics for these analyses.

Table 4. Frequencies and Percentages of Grade 3 STAAR Reading Performance of Asian Boys by Their Economic Status for the 2015-2016 and the 2016-2017 School Years

School Year, Performance, and Group Membership	Did Not Meet Standard *n* and %age of Total	Met Standard *n* and %age of Total
2015-2016 Approaches Grade Level		
Not Poor	(*n* = 142) 5.1%	(*n* = 2,635) 94.9%
Poor	(*n* = 133) 44.6%	(*n* = 165) 55.4%
2015-2016 Meets Grade Level		
Not Poor	(*n* = 511) 18.4%	(*n* = 2,266) 81.6%
Poor	(*n* = 222) 74.5%	(*n* = 76) 25.5%
2015-2016 Masters Grade Level		
Not Poor	(*n* = 1,061) 38.2%	(*n* = 1,716) 61.8%
Poor	(*n* = 259) 86.9%	(*n* = 39) 13.1%
2016-2017 Approaches Grade Level		
Not Poor	(*n* = 114) 3.8%	(*n* = 2,917) 96.2%
Poor	(*n* = 100) 38.3%	(*n* = 161) 61.7%
2016-2017 Meets Grade Level		
Not Poor	(*n* = 501) 16.5%	(*n* = 2,530) 83.5%
Poor	(*n* = 169) 64.8%	(*n* = 92) 35.2%
2016-2017 Masters Grade Level		
Not Poor	(*n* = 976) 32.2%	(*n* = 2,055) 67.8%
Poor	(*n* = 207) 79.3%	(*n* = 54) 20.7%

With respect to the economic status of Asian boys in 2017-2018 and their performance on the Approaches Grade Level standard, the result was statistically significant, $\chi^2(1) = 431.39$, $p < .001$, Cramer's V of .37, moderate effect size (Cohen, 1988). Slightly less than 65% of Asian boys who were Poor met the Approaches Grade Level standard in comparison to approximately 98% of Asian boys who were Not Poor who met this standard. Concerning the Meets Grade Level performance level, a statistically significant difference was yielded, $\chi^2(1) = 221.52$, $p < .001$, Cramer's V of .27, small effect size (Cohen, 1988). At the Meets Grade Level standard, less

than 33% of Asian boys who were Poor met this standard compared to over 82% of Asian boys who were Not Poor. Finally, for the Masters Grade Level performance level, the result was statistically significant, $\chi^2(1) = 107.05$, $p < .001$, Cramer's V of .19, small effect size (Cohen, 1988). Only 20% of Asian boys who were Poor met this standard, whereas almost 63% of Asian boys who were Not Poor met this standard.

Regarding the economic status of Asian boys in 2018-2019 and their performance on the Approaches Grade Level standard, a statistically significant difference was revealed, $\chi^2(1) = 534.89$, $p < .001$, Cramer's V of .40, moderate effect size (Cohen, 1988). Only 60% of Asian boys who were Poor met the Approaches Grade Level standard, compared to almost all, 98%, of Asian boys who were Not Poor who met this standard. With respect to the Meets Grade Level performance level, the result was statistically significant, $\chi^2(1) = 309.90$, $p < .001$, Cramer's V of .30, moderate effect size (Cohen, 1988). At the Meets Grade Level standard, only 30% of Asian boys who were Poor met this standard compared to approximately 85% of Asian boys who were Not Poor. Finally, for the Masters Grade Level performance level, a statistically significant difference was yielded, $\chi^2(1) = 177.04$, $p < .001$, Cramer's V of .23, small effect size (Cohen, 1988). Less than 20% of Asian boys who were Poor met this standard, whereas approximately 70% of Asian boys who were Not Poor met this standard. Revealed in Table 5 are the descriptive statistics for the analyses of the Grade 3 STAAR Reading Performance of Asian boys by economic status for the 2017-2018 and the 2018-2019 school years.

Table 5. Frequencies and Percentages of Grade 3 STAAR Reading Performance of Asian Boys by Their Economic Status for the 2017-2018 and the 2018-2019 School Years

School Year, Performance, and Group Membership	Did Not Meet Standard *n* and %age of Total	Met Standard *n* and %age of Total
2017-2018 Approaches Grade Level		
Not Poor	(*n* = 65) 2.2%	(*n* = 2,862) 97.8%
Poor	(*n* = 54) 35.5%	(*n* = 98) 64.5%
2017-2018 Meets Grade Level		
Not Poor	(*n* = 524) 17.9%	(*n* = 2,403) 82.1%
Poor	(*n* = 103) 67.8%	(*n* = 49) 32.2%
2017-2018 Masters Grade Level		
Not Poor	(*n* = 1,098) 37.5%	(*n* = 1,829) 62.5%
Poor	(*n* = 121) 79.6%	(*n* = 31) 20.4%
2018-2019 Approaches Grade Level		
Not Poor	(*n* = 78) 2.4%	(*n* = 3,137) 97.6%
Poor	(*n* = 63) 40.4%	(*n* = 93) 59.6%
2018-2019 Meets Grade Level		
Not Poor	(*n* = 491) 15.3%	(*n* = 2,724) 84.7%
Poor	(*n* = 110) 70.5%	(*n* = 46) 29.5%
2018-2019 Masters Grade Level		
Not Poor	(*n* = 973) 30.3%	(*n* = 2,242) 69.7%
Poor	(*n* = 127) 81.4%	(*n* = 29) 18.6%

Grade Level Standard Results for Black Boys

Regarding the economic status of Black boys in the 2015-2016 school year and their performance on the Approaches Grade Level standard, the result was statistically significant, $\chi^2(1) = 468.86$, $p < .001$, Cramer's V of .22, small effect size (Cohen, 1988). Less than half of Black boys who were Poor met the Approaches Grade Level standard, compared to approximately 78% of Black boys who were Not Poor who met this standard. In regard to the Meets Grade Level performance level, a statistically significant difference was revealed, $\chi^2(1) = 542.52$, $p < .001$, Cramer's V of .24, small effect size (Cohen, 1988). At the Meets Grade Level standard, less than 20% of Black boys who were Poor met this standard in comparison to over 45% of Black boys who were Not Poor. Finally, for the Masters Grade Level performance level, the result was statistically significant, $\chi^2(1) =$

406.61, $p < .001$, Cramer's V of .21, small effect size (Cohen, 1988). Less than 8% of Black boys who were Poor met this standard, whereas slightly less than 25% of Black boys who were Not Poor met this standard.

Concerning the economic status of Black boys in 2016-2017 and their performance on the Approaches Grade Level standard, a statistically significant difference was yielded, $\chi^2(1) = 398.50$, $p < .001$, Cramer's V of .19, small effect size (Cohen, 1988). Less than half of Black boys who were Poor met the Approaches Grade Level standard, compared to almost three-fourths of Black boys who were Not Poor who met this standard. In regard to the Meets Grade Level performance level, the result was statistically significant, $\chi^2(1) = 515.31$, $p < .001$, Cramer's V of .22, small effect size (Cohen, 1988). At the Meets Grade Level standard, less than 20% of Black boys who were Poor met this standard, compared to approximately 45% of Black boys who were Not Poor. Finally, for the Masters Grade Level performance level, a statistically significant difference was revealed, $\chi^2(1) = 414.04$, $p < .001$, Cramer's V of .20, small effect size (Cohen, 1988). Less than 10% of Black boys who were Poor met this highest standard, whereas slightly less than 27% of Black boys who were Not Poor met this standard. Table 6 contains the descriptive statistics for these analyses.

Table 6. Frequencies and Percentages of Grade 3 STAAR Reading Performance of Black Boys by Their Economic Status for the 2015-2016 and the 2016-2017 School Years

School Year, Performance, and Group Membership	Did Not Meet Standard *n* and %age of Total	Met Standard *n* and %age of Total
2015-2016 Approaches Grade Level		
Not Poor	(*n* = 375) 22.2%	(*n* = 1,314) 77.8%
Poor	(*n* = 3,989) 51.2%	(*n* = 3,807) 48.8%
2015-2016 Meets Grade Level		
Not Poor	(*n* = 926) 54.8%	(*n* = 763) 45.2%
Poor	(*n* = 6,338) 81.3%	(*n* = 1,458) 18.7%
2015-2016 Masters Grade Level		
Not Poor	(*n* = 1,271) 75.3%	(*n* = 418) 24.7%
Poor	(*n* = 7,181) 92.1%	(*n* = 615) 7.9%
2016-2017 Approaches Grade Level		
Not Poor	(*n* = 545) 27.7%	(*n* = 1,421) 72.3%
Poor	(*n* = 4,573) 52.6%	(*n* = 4,116) 47.4%
2016-2017 Meets Grade Level		
Not Poor	(*n* = 1,102) 56.1%	(*n* = 864) 43.9%
Poor	(*n* = 6,979) 80.3%	(*n* = 1,710) 19.7%
2016-2017 Masters Grade Level		
Not Poor	(*n* = 1,444) 73.4%	(*n* = 522) 26.6%
Poor	(*n* = 7,854) 90.43%	(*n* = 835) 9.6%

Regarding the economic status of Black boys in 2017-2018 and their performance on the Approaches Grade Level standard, the result was statistically significant, $\chi^2(1) = 331.47$, $p < .001$, Cramer's V of .20, small effect size (Cohen, 1988). More than half, 56%, of Black boys who were Poor met the Approaches Grade Level standard compared to over 83% of Black boys who were Not Poor who met this standard. With respect to the Meets Grade Level performance level, a statistically significant difference was yielded, $\chi^2(1) = 423.61$, $p < .001$, Cramer's V of .23, small effect size (Cohen, 1988). At the Meets Grade Level standard, 21% of Black boys who were Poor met this standard compared to approximately 47% of Black boys who were Not Poor. Finally, for the Masters Grade Level performance level, a statistically significant difference was revealed, $\chi^2(1) = 317.75$, $p < .001$, Cramer's V of .20, small effect size (Cohen, 1988). Less than 9%of Black boys who were Poor met this standard, whereas approximately 26% of Black boys who were Not Poor met this standard.

With respect to the economic status of Black boys in 2018-2019 and their performance on the Approaches Grade Level standard, a statistically significant difference was yielded, $\chi^2(1) = 302.76$, $p < .001$, Cramer's V of .20, moderate effect size (Cohen, 1988). Slightly less than 56% of Black boys who were Poor met the Approaches Grade Level standard in comparison to approximately 82% of Black boys who were Not Poor who met this standard. Concerning the Meets Grade Level performance level, the result was statistically significant, $\chi^2(1) = 370.86$, $p < .001$, Cramer's V of .20, small effect size (Cohen, 1988). At the Meets Grade Level standard, less than 23% of Black boys who were Poor met this standard compared to approximately 50% of Black boys who were Not Poor. Finally, for the Masters Grade Level performance level, a statistically significant difference was revealed, $\chi^2(1) = 307.71$, $p < .001$, Cramer's V of .20, small effect size (Cohen, 1988). Only 11% of Black boys who were Poor met this standard, whereas almost 30% of Black boys who were Not Poor met this standard. Revealed in Table 7 are the descriptive statistics for these analyses for the 2017-2018 and the 2018-2019 school years.

Table 7. Frequencies and Percentages of Grade 3 STAAR Reading Performance of Black Boys by Their Economic Status for the 2017-2018 and the 2018-2019 School Years

School Year, Performance, and Group Membership	Did Not Meet Standard *n* and %age of Total	Met Standard *n* and %age of Total
2018-2019 Approaches Grade Level		
Not Poor	(*n* = 220) 16.7%	(*n* = 1,094) 83.3%
Poor	(*n* = 2,914) 43.6%	(*n* = 3,776) 56.4%
2018-2019 Meets Grade Level		
Not Poor	(*n* = 691) 52.6%	(*n* = 623) 47.4%
Poor	(*n* = 5,316) 79.5%	(*n* = 1,374) 20.5%
2018-2019 Masters Grade Level		
Not Poor	(*n* = 970) 73.8%	(*n* = 344) 26.2%
Poor	(*n* = 6,096) 91.1%	(*n* = 594) 8.9%
2018-2019 Approaches Grade Level		
Not Poor	(*n* = 215) 17.8%	(*n* = 994) 82.2%
Poor	(*n* = 2,738) 44.6%	(*n* = 3,397) 55.4%
2018-2019 Meets Grade Level		
Not Poor	(*n* = 615) 50.9%	(*n* = 594) 49.1%
Poor	(*n* = 4,766) 77.7%	(*n* = 1,369) 22.3%
2018-2019 Masters Grade Level		
Not Poor	(*n* = 850) 70.3%	(*n* = 359) 29.7%
Poor	(*n* = 5,481) 89.3%	(*n* = 654) 10.7%

Grade Level Standard Results for Hispanic Boys

Concerning the economic status of Hispanic boys in 2015-2016 and their performance on the Approaches Grade Level standard, a statistically significant difference was revealed, $\chi^2(1) = 2159.60$, $p < .001$, Cramer's V of .20, small effect size (Cohen, 1988). Less than 61% of Hispanic boys who were Poor met the Approaches Grade Level standard, compared to approximately 86% of Hispanic boys who were Not Poor who met this standard. In regard to the Meets Grade Level performance level, the result was statistically significant, $\chi^2(1) = 3003.65$, $p < .001$, Cramer's V of .24, small effect size (Cohen, 1988). At the Meets Grade Level standard, only about 27% of Hispanic boys who were Poor met this standard in comparison to over 56% of Hispanic boys who were Not Poor. Finally, for the Masters Grade Level performance level, a statistically significant difference was yielded, $\chi^2(1) =$

2333.85, $p < .001$, Cramer's V of .21, small effect size (Cohen, 1988). Less than 13% of Hispanic boys who were Poor met this highest standard, whereas 33% of Hispanic boys who were Not Poor met this standard.

Regarding the economic status of Hispanic boys in 2016-2017 and their performance on the Approaches Grade Level standard, a statistically significant difference was yielded, $\chi^2(1) = 1930.53$, $p < .001$, Cramer's V of .21, small effect size (Cohen, 1988). Approximately 59% of Hispanic boys who were Poor met the Approaches Grade Level standard, compared to approximately 85% of Hispanic boys who were Not Poor who met this standard. In regard to the Meets Grade Level performance level, the result was statistically significant, $\chi^2(1) = 2513.11$, $p < .001$, Cramer's V of .24, small effect size (Cohen, 1988). At the Meets Grade Level standard, less than 29% of Hispanic boys who were Poor met this standard compared to over 57% of Hispanic boys who were Not Poor. Finally, for the Masters Grade Level performance level, a statistically significant difference was revealed, $\chi^2(1) = 2120.53$, $p < .001$, Cramer's V of .22, small effect size (Cohen, 1988). Less than 16% of Hispanic boys who were Poor met this standard, whereas less than 39% of Hispanic boys who were Not Poor met this standard. Table 8 contains the descriptive statistics for these analyses.

Table 8. Frequencies and Percentages of Grade 3 STAAR Reading Performance of Hispanic Boys by Their Economic Status for the 2015-2016 and the 2016-2017 School Years

School Year, Performance, and Group Membership	Did Not Meet Standard *n* and %age of Total	Met Standard *n* and %age of Total
2015-2016 Approaches Grade Level		
Not Poor	(*n* = 1,282) 14.1%	(*n* = 7,829) 85.9%
Poor	(*n* = 16,898) 39.7%	(*n* = 25,682) 60.3%
2015-2016 Meets Grade Level		
Not Poor	(*n* = 3,975) 43.6%	(*n* = 5,136) 56.4%
Poor	(*n* = 31,148) 73.2%	(*n* = 11,432) 26.8%
2015-2016 Masters Grade Level		
Not Poor	(*n* = 6,104) 67.0%	(*n* = 3,007) 33.0%
Poor	(*n* = 37,257) 87.5%	(*n* = 5,323) 12.5%
2016-2017 Approaches Grade Level		
Not Poor	(*n* = 1,231) 15.3%	(*n* = 6,828) 84.7%
Poor	(*n* = 15,069) 41.3%	(*n* = 21,392) 58.7%
2016-2017 Meets Grade Level		
Not Poor	(*n* = 3,417) 42.4%	(*n* = 4,642) 57.6%
Poor	(*n* = 26,095) 71.6%	(*n* = 10,366) 28.4%
2016-2017 Masters Grade Level		
Not Poor	(*n* = 4,985) 61.9%	(*n* = 3,074) 38.1%
Poor	(*n* = 30,771) 84.4%	(*n* = 5,690) 15.6%

With respect to the economic status of Hispanic boys in 2017-2018 and their performance on the Approaches Grade Level standard, a statistically significant difference was revealed, $\chi^2(1) = 1117.60$, $p < .001$, Cramer's V of .18, small effect size (Cohen, 1988). Slightly less than 69% of Hispanic boys who were Poor met the Approaches Grade Level standard in comparison to approximately 90% of Hispanic boys who were Not Poor who met this standard. Concerning the Meets Grade Level performance level, the result was statistically significant, $\chi^2(1) = 1786.78$, $p < .001$, Cramer's V of .23, small effect size (Cohen, 1988). At the Meets Grade Level standard, less than 30% of Hispanic boys who were Poor met this standard compared to over 58% of Hispanic boys who were Not Poor. Finally, for the Masters Grade Level performance level, a statistically significant difference was yielded, $\chi^2(1) = 1670.94$, $p < .001$, Cramer's V of .22, small effect size (Cohen, 1988). Only 14% of Hispanic boys who were Poor met this standard, whereas almost 36% of Hispanic boys who were Not Poor met this standard.

Regarding the economic status of Hispanic boys in 2018-2019 and their performance on the Approaches Grade Level standard, a statistically significant difference was revealed, $\chi^2(1) = 1252.60$, $p < .001$, Cramer's V of .20, small effect size (Cohen, 1988). Only 67% of Hispanic boys who were Poor met the Approaches Grade Level standard compared to almost 90% of Hispanic boys who were Not Poor who met this standard. With respect to the Meets Grade Level performance level, the result was statistically significant, $\chi^2(1) = 1868.39$, $p < .001$, Cramer's V of .24, small effect size (Cohen, 1988). At the Meets Grade Level standard, only 31% of Hispanic boys who were Poor met this standard compared to approximately 61% of Hispanic boys who were Not Poor. Finally, for the Masters Grade Level performance level, a statistically significant difference was yielded, $\chi^2(1) = 1670.29$, $p < .001$, Cramer's V of .23, small effect size (Cohen, 1988). Less than 16% of Hispanic boys who were Poor met this standard, whereas approximately 40% of Hispanic boys who were Not Poor met this standard. Revealed in Table 9 are the descriptive statistics for the analyses of the Grade 3 STAAR Reading Performance of Hispanic boys by economic status for the 2018-2019 and the 2018-2019 school years.

Table 9. Frequencies and Percentages of Grade 3 STAAR Reading Performance of Hispanic Boys by Their Economic Status for the 2017-2018 and the 2018-2019 School Years

School Year, Performance, and Group Membership	Did Not Meet Standard *n* and %age of Total	Met Standard *n* and %age of Total
2017-2018 Approaches Grade Level		
Not Poor	(*n* = 630) 10.4%	(*n* = 5,411) 89.6%
Poor	(*n* = 8,988) 31.7%	(*n* = 19,376) 68.3%
2017-2018 Meets Grade Level		
Not Poor	(*n* = 2,531) 41.9%	(*n* = 3,510) 58.1%
Poor	(*n* = 19,966) 70.4%	(*n* = 8,398) 29.6%
2017-2018 Masters Grade Level		
Not Poor	(*n* = 3,882) 64.3%	(*n* = 2,159) 35.7%
Poor	(*n* = 24,479) 86.3%	(*n* = 3,885) 13.7%
2018-2019 Approaches Grade Level		
Not Poor	(*n* = 603) 10.1%	(*n* = 5,387) 89.9%
Poor	(*n* = 8,333) 33.1%	(*n* = 16,866) 66.9%
2018-2019 Meets Grade Level		
Not Poor	(*n* = 2,354) 39.3%	(*n* = 3,636) 60.7%
Poor	(*n* = 17,442) 69.2%	(*n* = 7,757) 30.8%
2018-2019 Masters Grade Level		
Not Poor	(*n* = 3,623) 60.5%	(*n* = 2,367) 39.5%
Poor	(*n* = 21,206) 84.2%	(*n* = 3,993) 15.8%

Results for the Reading Reporting Categories Analyses Over Time

With regard to trends in the differences in the Reading Reporting Category scores between Asian boys who were Poor and Asian boys who were Not Poor from the 2015-2016 through the 2018-2019 school years, Asian boys who were Poor scored below Asian boys who were Not Poor at every measure. Asian boys who were Poor had statistically significantly lower average scores in each Reading Reporting Category. Concerning the Reading Reporting Category I scores, Asian boys who were Poor scored an average of 29% lower than Asian boys who were Not Poor. With respect to the Reading Reporting Category II scores, Asian boys who were Poor scored an average of approximately 28% less than Asian boys who were Not Poor. Regarding the Reading Reporting Category III scores, Asian boys who were Poor earned an average of approximately 27% less than Asian boys who were Not Poor.

Concerning the trends in the differences in the Reading Reporting Category scores between Black boys who were Poor and Black boys who were Not Poor from the 2015-2016 through the 2018-2019 school years, Black boys who were Poor scored below Black boys who were Not Poor at every measure. Black boys who were Poor had statistically significantly lower average scores in each Reading Reporting Category. Concerning the Reading Reporting Category I scores, Black boys who were Poor scored an average of 15% lower than Black boys who were Not Poor. With respect to the Reading Reporting Category II scores, Black boys who were Poor scored an average of approximately 14% less than Black boys who were Not Poor. Regarding the Reading Reporting Category III scores, Black boys who were Poor earned an average of approximately 15% less than Black boys who were Not Poor.

With respect to trends in the differences in the Reading Reporting Category scores between Hispanic boys who were Poor and Hispanic boys who were Not Poor from the 2015-2016 through the 2018-2019 school years, Hispanic boys who were Poor scored below Hispanic boys who were Not Poor at every measure. Hispanic boys who were Poor had statistically significantly lower average scores in each Reading Reporting Category. Concerning the Reading Reporting Category I scores, Hispanic boys who were Poor scored an average of approximately 15% lower than Hispanic boys who were Not Poor. With respect to the Reading Reporting Category II scores, Hispanic boys who were Poor scored an average of approximately 15% less than Hispanic boys who were Not Poor. Regarding the Reading Reporting Category III scores, Hispanic boys who were Poor earned an average of approximately 15% less than Hispanic boys who were Not Poor.

Results for the Grade Level Phase-In Standards Over Time

Concerning trends in the differences in the Grade Level Phase-in Standards between Asian boys who were Poor and Asian boys who were Not Poor from the 2015-2016 through the 2018-2019 school years, Asian boys who were Poor scored below Asian boys who were Not Poor at every measure. Asian boys who were Poor had statistically significantly lower rates of achieving each grade level standard. Asian boys who were Poor met the Approaches Grade Level standard an average of 36% less than Asian boys who were Not Poor. Asian boys who were Poor met the Meets Grade Level standard an average of 52% less than Asian boys who were Not Poor. Asian boys who were Poor met the Masters Grade Level standard an average of 47% less than Asian boys who were Not Poor.

With respect to trends in the differences in the Grade Level Phase-in Standards between Black boys who were Poor and Black boys who were Not Poor from the 2015-2016 through the 2018-2019 school years, Black boys who were Poor scored below Black boys who were Not Poor at every measure. Black boys who were Poor had statistically significantly lower rates of achieving each grade level standard. Black boys who were Poor met the Approaches Grade Level standard an average of approximately 27% less than Black boys who were Not Poor. Black boys who were Poor met the Meets Grade Level standard an average of approximately 26% less than Black boys who were Not Poor. Black boys who were Poor met the Masters Grade Level standard an average of approximately 18% less than Black boys who were Not Poor.

Concerning trends in the differences in the Grade Level Phase-in Standards between Hispanic boys who were Poor and Hispanic boys who were Not Poor from the 2015-2016 through the 2018-2019 school years, Hispanic boys who were Poor scored below Hispanic boys who were Not Poor at every measure. Hispanic boys who were Poor had statistically significantly lower rates of achieving each grade level standard. Hispanic boys who were Poor met the Approaches Grade Level standard an average of approximately 24% less than Hispanic boys who were Not Poor. Hispanic boys who were Poor met the Meets Grade Level standard an average of

approximately 29% less than Hispanic boys who were Not Poor. Hispanic boys who were Poor met the Masters Grade Level standard an average of approximately 22% less than Hispanic boys who were Not Poor.

Discussion

Analyzed in this investigation was the extent to which differences were present in the reading performance of Texas Grade 3 underrepresented boys by their economic status. Four years of statewide data on the three Grade 3 STAAR Reading Reporting Categories were examined for Poor and Not Poor Asian boys, Poor and Not Poor Black boys, and Poor and Not Poor Hispanic boys. Statistically significant results were present in all four school years. Following these statistical analyses, the Grade Level Phase-in Standards by the economic status of underrepresented boys were examined and yielded statistically significant results in all four school years.

In each of the three STAAR Reading Reporting Category results in all four years analyzed, underrepresented boys who were Poor had statistically significantly lower scores than underrepresented boys who were Not Poor. The differences were consistent regarding the gap between Asian boys who were Poor and Asian boys who were Not Poor. In each Reporting Category, the gap between the two student groups was over 27%. The Reporting Category with the lowest average score for all student groups was Reporting Category III.

Similarly, in each of the three Grade Level Phase-in Standards in all four years investigated, underrepresented boys who were Poor had statistically significantly lower achievement than underrepresented boys who were Not Poor. Effect sizes for the reading performance of Asian boys ranged from moderate to small each year at each Grade Level Phase-in Standard. Effect sizes for Black boys and Hispanic boys were small each year at each Grade Level Phase-in Standard.

Connections to Existing Literature

Clearly established in this multiyear, statewide analysis are the effects of poverty on student reading achievement. In previous articles, researchers (Hamilton & Slate, 2019; Harris, 2018; McGown, 2016; Schleeter, 2017) have documented statistically significant differences between students from poverty backgrounds and students who were not from poverty backgrounds. Results were consistent across grade levels and ethnic/racial backgrounds.

Researchers (Gardner-Neblett & Iruka, 2015; Hernandez, 2011; Stinnett, 2014) have examined the link between poverty and low-level literacy skills. The lack of literacy opportunities for students from poverty backgrounds is well-documented and contributes to lower literacy skills (Gardner-Neblett & Iruka, 2015; Hernandez, 2011; Stinnett, 2014). Literacy opportunities include exposure to varied vocabulary and syntax (Stinnett, 2014) and minimized time to learn due to frequent absences attributed to increased health or family problems (Hernandez, 2011).

Implications for Policy and Practice

Based on the analysis of four years of Texas statewide data, several implications for policy and for practice can be recommended. With respect to policy implications, legislators passed House Bill 3 (Texas Education Agency, 2019b) in 2019, creating funding for high-quality, full-day Pre-K for all eligible 4-year old children. The funding must be maintained beyond the current legislative session. Maintaining funding will allow researchers to conduct future studies and to determine the success rate of the program. Also included in House Bill 3 was a requirement for all elementary teachers to be trained on the science of reading (Texas Education Agency, 2019b). Continuing this requirement into future legislative sessions is necessary to ensure teachers are prepared to provided literacy instruction across all content areas.

Regarding implications for practice, underrepresented boys from poverty backgrounds require additional instruction to meet the rigorous standards assessed on the STAAR Reading test. Empowering teachers with additional knowledge, including being trained in the science of reading, to combat gaps in literacy development is necessary to ensure gaps do not grow in future school years. Furthermore, teachers should utilize resources designed to address the Texas standards. Curriculum leaders must review all adopted materials and check for alignment.

Recommendations for Future Research

Given the results of this empirical multiyear investigation, several recommendations for future research can be made. First, this study was conducted on data on only Grade 3 underrepresented boys. The degree to which findings obtained herein would be generalizable to underrepresented boys in other grade levels is not known. Accordingly, researchers are encouraged to examine the reading achievement of underrepresented boys at middle schools and at high schools. Second, because only reading performance was addressed in this article, researchers should examine the degree to which economic status is related to other subjects such as mathematics, science, and social studies. Third, researchers should ascertain the extent to which results from this Texas statewide analysis would be generalizable to underrepresented boys in other states. The extent to which the results of this investigation can be generalized to other states is unknown. Fourth, researchers are encouraged to examine the reading achievement of underrepresented girls, because only data on underrepresented boys were examined in this study. Finally, researchers are encouraged to conduct longitudinal studies in which they follow the progress of students over the course of their public-school careers. The results would allow researchers to analyze how economic status affects underrepresented boys over time.

Conclusions

The purpose of this research investigation was to determine the degree to which differences were present in the reading performance of Texas Grade 3 underrepresented boys as a function of their economic status. Inferential statistical procedures revealed the presence of statistically significant differences in the reading achievement of Asian boys, Black boys, and Hispanic boys by their economic status. By every measure, Asian boys who were Poor achieved at a lower rate than Asian boys who were Not Poor, Black boys who were Poor were less successful than Black boys who were Not Poor, and Hispanic boys who were Poor achieved at a lower rate than Hispanic boys who were Not Poor. As such, poverty was clearly established as a detrimental influence on student reading performance.

References

Burney, V. H., & Beilke, J. R. (2008). The constraints of poverty on high achievement. *Journal for the Education of the Gifted, 31*(3), 171-197. https://doi.org/10.4219/jeg-2008-771

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). Thousand Oaks, CA: Sage.

David, K. A., & Marchant, G. J. (2015). Achievement gaps in the United States: Race, poverty, and interactions over ten years. *The International Journal of Assessment and Evaluation, 22*(4), 1-15. https://doi.org/10.18848/2327-7920/CGP/v22i04/48378

Field, A. (2009). *Discovering statistics using SPSS* (3rd ed.). Thousand Oaks, CA: Sage.

Gardner-Neblett, N., & Iruka, I. U. (2015). Oral narrative skills: Explaining the language-emergent literacy link by race/ethnicity and SES. *Developmental Psychology, 51*, 889-904. https://doi.org/10.1037/a0039274

Hamilton, H. A., & Slate, J. R. (2019). Differences in Grade 3 reading by the economic status of students of color: Much cause for concern. *Asian Journal of Interdisciplinary Research, 2*(4), 97-104. https://doi.org/10.34256/ajir19410

Harris, L. (2018). *Differences in the reading performance of Texas Grade 4 students as a function of economic status, gender, and ethnicity/race: A multiyear statewide study.* Doctoral Dissertation, Sam Houston State University, Huntsville, TX.

Hernandez, D. J. (2011). *Double jeopardy: How third-grade reading skills and poverty influence high school graduation* (NICHD, R24 HD044943). Retrieved from The Annie E. Casey Foundation website: https://www.aecf.org/resources/double-jeopardy/

Johnson, R. B., & Christensen, L. B. (2017). *Educational research: Quantitative, qualitative, and mixed approaches* (6th ed.). Thousand Oaks, CA: Sage.

McGown, J. A. (2016). *Differences in reading performance of Texas elementary school students as a function of economic status, gender, and ethnicity/race: A multiyear statewide study.* Doctoral Dissertation, Sam Houston State University, Huntsville, TX.

National Assessment of Educational Progress. (2019). *NAEP report card: Reading.* Washington, DC: U.S. Department of Education.

National Center for Children in Poverty. (2017). *Putting research to work for children and families.* Retrieved from http://www.nccp.org/profiles/TX_profile_7.html

Onwuegbuzie, A. J., & Daniel, L. G. (2002). Uses and misuses of the correlation coefficient. *Research in the Schools, 9*(1), 73-90.

Reardon, S., Valentino, R., & Shores, K. (2012). Patterns of literacy among U.S. students. *Future of Children, 22*(2), 17-37. https://doi.org/10.1353/foc.2012.0015

Schleeter, G. D. (2017). *Differences in the reading achievement of Texas Grade 3 English Language Learners as a function of their economic status, ethnicity/race, and gender: A multiyear statewide study*. Doctoral Dissertation, Sam Houston State University, Huntsville, TX.

Slate, J. R., & Rojas-LeBouef, A. (2011). *Calculating basic statistical procedures in SPSS: A self-help and practical guide to preparing theses, dissertations, and manuscripts.* Ypsilanti, MI: NCPEA Press.

Stanovich, K. E. (2017). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Journal of Education, 189*(2), 23-55. https://doi.org/10.1177/0022057409189001-204

Stinnett, M. (2014). The influence of poverty on literacy achievement. *Illinois Reading Council Journal, 42*(3), 65-69.

Texas Administrative Code. (2019). *Chapter 110. Texas Essential Knowledge and Skills for English Language Arts and Reading.* Retrieved from http://ritter.tea.state.tx.us/rules/tac/chapter110/ch110a.pdf

Texas Assessment. (2019). *All about the STAAR test*. Retrieved from https://texasassessment.com/families/all-about-the-staar-test/

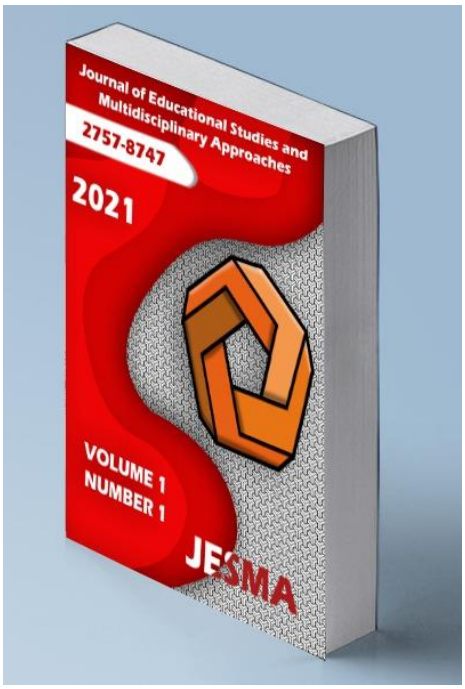
Texas Education Agency. (2003). *Enrollment in Texas Public Schools*. Retrieved from https://tea.texas.gov/sites/default/files/Enroll_2001-02.pdf

Texas Education Agency. (2017). *STAAR performance labels and policy definitions.* Retrieved from https://tea.texas.gov/sites/default/files/STAAR_Performance_Labels_and_Policy_Definitions.pdf

Texas Education Agency. (2019a). *Economically Disadvantaged Status Reports*. Retrieved from https://rptsvr1.tea.texas.gov/adhocrpt/adstc.html

Texas Education Agency. (2019b). *House Bill 3*. Retrieved from https://tea.texas.gov/sites/default/files/HB3_2-Pager.pdf

Texas Education Agency. (2019c). *Texas Essential Knowledge and Skills*. Retrieved from https://tea.texas.gov/Academics/Curriculum_Standards/TEKS_Texas_Essential_Knowledge_and_Skills



Journal of Educational Studies and Multidisciplinary Approaches (JESMA)
ISSN:2757

www.jesma.net

TRANSFORMATIVE LEARNING THEORY – IS IT TIME TO ADD A FOURTH CORE ELEMENT?

Frances Schnepfleitner[1], Marco Ferreira[2]

[1] University of Liverpool, UK
[2] Higher Institute of Education and Sciences, ISEC Lisboa, Portugal

Corresponding author: Marco Ferreira, marco.ferreira@iseclisboa.pt

To cite this article:

Schnepfleitner, F.M. & Ferreira, M.P. (2021). Transformative learning theory – is it time to add a fourth core element? *Journal of Educational Studies and Multidisciplinary Approaches (JESMA),* 1(1), 40-49. https://doi.org/10.51383/jesma.2021.9

Journal of Educational Studies and Multidisciplinary Approaches (JESMA)
Volume 1, Issue 1 Year 2021 ISSN:2757

Transformative learning theory – is it time to add a fourth core element?

Frances Schnepfleitner https://orcid.org/0000-0002-1239-4006

Marco Ferreira https://orcid.org/0000-0002-5547-4188

ARTICLE INFORMATION
Original Research Paper
https://doi.org/10.51383/jesma.2021.9

Received 17 February 2021
Accepted 06 March 2021

ABSTRACT (Times New Roman typeface and 10 points)
The aim of this paper is to present a research-based analysis on Mezirow's theory of transformative learning, by first outlining the foundations of the theory and its status and trends, and then highlighting the role played in adult education by the core elements of transformative learning: critical reflection, dialogue, and individual experience. The concept of this essay is to present the current knowledge, including substantive findings, as well as theoretical and methodological contributions on Mezirow's theory of transformative learning. This essay reviews the collective evidence of the theory of transformative learning, looking for similarities and differences in competing findings. The analysis shows that none of the core elements of transformative learning stand-alone, but each supports and enhances the rest, suggesting a more holistic approach to future research. While these elements must be present for transformative learning to occur, a new and lesser researched element - the context – is also suggested. By developing awareness and appreciation of personal and sociocultural context, educators can better facilitate transformative learning situations within existing contextual constraints. The need to help learners actively participate and engage with the concepts presented in the context is the key message to be taken from Mezirow's theory of transformative learning.

Keywords: Transformative learning, Reflection, Dialogue, Individual experience, Context.

Introduction - the foundations of transformative learning:

As the world's average human life span increases, and people can choose to change their employment direction more often, it makes sense that interest in adult and continuing education is growing and continues to grow. Included in that growth of interest is the concept of transformative learning, a teaching approach based on promoting change and challenging learners to "critically question and assess the integrity of their deeply held assumptions about how they relate to the world around them" (Mezirow & Taylor, 2011, p.xi). Spending even a short time watching international news channels will show how relevant and pertinent understanding this kind of learning is, on levels even beyond education, as not just individuals but whole nations are being thrown into types of chaos that require them to adjust or change their inherent frames of reference.

In 'An Overview on Transformative Learning', Mezirow (2009) describes how, in 1978, he introduced the concept of transformative learning into the field of adult education with the publication of research findings from a comprehensive study of women returning to community colleges in the USA. In this initial stage, Mezirow's research was influenced by several concepts such as conscientisation paradigms, consciousness raising, the experiences of his wife, and themes from philosophy and psychiatry (Mezirow, 2009). In this later work, he sums up his understanding of transformative learning as "the process by which we transform problematic frames of reference (mind-sets, habits of mind, meaning perspectives) - sets of assumptions and expectations - to make them more inclusive, discriminating, open, reflective and emotionally able to change" (Mezirow, 2009, p.92).

This differs from informational learning, which increases our skills or existing cognitive structures, thereby giving more of our available resources to an established frame of reference (Kegan, 2009). As a theory with constructivist underpinnings, transformative learning predisposes that a person's established and taken-for-granted frames of reference are in fact capable of change and are then able to guide a "deep, structural shift in basic premises of thought, feelings, and actions" (Transformative Learning Centre, as cited in Kitchenham, 2008, p.104; Mathis, 2010; Mezirow, 2011). At one extreme, transformations can occur suddenly and be epochal and life-changing, involving profound shifts in a person's understanding of themselves, of knowledge and of the world (Snyder, 2008). At the other extreme, a transformation can arise from an accumulation of insights that gradually change a point of view or habit of mind. At whichever extreme it occurs, it will involve, to some degree, parts of the three core elements of critical reflection, individual experience, and voluntary dialectical discourse (Mezirow, 1997, 2009, 2012). There are also ten identified phases, variations of which the process will include, either fully or in part and not necessarily in sequence (Isopahkala-Bouret, 2008). They are: "1. A disorientating dilemma; 2. Self-examination; 3. A critical assessment of assumptions; 4. Recognition of a connection between one's discontent and the process of transformation; 5. Exploration of options for new roles, relationships, and action; 6. Planning a course of action; 7. Acquiring knowledge and skills for implementing one's plan; 8. Provisional trying of new roles; 9. Building competence and self-confidence in new roles and relationships; 10. A reintegration into one's life on the basis of conditions dictated by one's new perspective". (Mezirow, 2011, p.19)

A person undergoing a perspective transformation may therefore encounter disorientation, self-examination, critical assessment of current assumptions, realisation that those assumptions may no longer serve them best, exploration of the options, trying on new ideas or roles, and integration of the new perspective into their lives (Brock, 2010; Kitchenham, 2008; Mezirow, 1994, 1997). This implies that people habitually think and do things they have intentionally or unintentionally assimilated as part of their context or culture. However, with suitable educational input, transformative learning can begin with people first looking at old things in new ways, then moving through a process of looking at new things in new ways, and finally doing new things in new ways (The E, 2010).

The status and trends of transformative learning

In the almost 40 years since Mezirow's first publication, a transformative learning movement has evolved, first in North America, but in the last decade spreading through dedicated international conferences and the publication of numerous journal articles and books. Research on transformative

learning is still most prevalent in formal educational settings, but there is growing interdisciplinary interest, with the concept broadening into fields such as teacher, corporate, online, religious or medical education; agriculture, sciences, media and archaeology; into other qualitative studies such as living with HIV/AIDS or breast cancer, the context of suicide, and even into such spaces as emancipation and promoting female empowerment in third world countries (Dirkx, Mezirow, & Cranton, 2006; Dix, 2016; Malkki & Green, 2014; Mezirow & Taylor, 2011; Sands & Tennant, 2010; Taylor & Snyder, 2012; Tisdell, 2012).

This kind of diversity has raised the question of why transformative learning is confined to being an adult theory and why it does not include the whole life span (Kegan, 2009). Such questions and criticisms are in order and a rite of passage for a still-evolving theory (Taylor & Snyder, 2012). For instance, there are those of the opinion that some aspects of transformative learning, such as capturing if the experience has occurred, have been researched to the point of redundancy (Cranton & Taylor, 2012; Malkki & Green, 2014; Taylor & Laros, 2014) and most doubts and questions should now centre on what is lacking or still unknown about the transformative process.

While Mezirow refined and modified his theory over the years and was still active and publishing until his death in 2014, he put little emphasis on the factors that trigger or bring about transformative learning in a consistent way. These have been less clearly identified, and remain elusive and ever-shifting; nor are the challenges that individuals face which cause hindrance to their capability of bringing about their own transformations, especially as not all adults are self-directed learners (Baumgartner, 2012; Kegan, 2009; Taylor, 2011; Taylor & Laros, 2014). Furthermore, because transformative learning is being explored in so many fields, there are researchers who feel Mezirow's original theory does not fully capture all the nuances or assumptions on which their research is based. This has led to a strong current trend which sees transformative learning theory becoming more holistic and unified, integrating different perspectives under one theoretical umbrella (Baumgartner, 2012; Cranton & Taylor, 2012; Taylor & Snyder, 2012). While there have been some studies using surveys and questionnaires, qualitative research is still dominant. The shift has been towards greater specificity in their design, with examples of action research, narrative enquiry, collaborative inquiry, and case study becoming more common (Cranton & Taylor, 2012; Taylor & Snyder, 2012).

To continue with this more holistic and integrated trend, there are claims that the theory needs to take into account psycho-developmental and psychoanalytical approaches, the sociocultural context, and the importance of spirituality, emotion, general context, intuition, relationships, culture, childhood experiences and socialisation (Baumgartner, 2012; Dirkx, Mezirow, & Cranton, 2006; Dix, 2016; Isopahkala-Bouret, 2008). However, Taylor and Snyder (2012) suggest the trend is not without risks if there is a lack of alignment between underlying assumptions about the nature of transformative learning or a lack of acknowledgement of how the theories may either complement each other or contain inherent tensions.

Mezirow himself acknowledged there needs to be greater understanding with respect to what promotes transformative learning and the role played by emotions and imagination, but was less accepting of the major criticism, that he had created a decontextualized model (Baumgartner, 2012; Mezirow & Taylor, 2011; Taylor, 2001). He suggested that the influence of contextual elements - including "ideology, culture, power and race-class gender differences" - while important, could be rationally assessed and addressed when warranted (Mezirow, 2011, pp.95, 96). In contrast, his close colleague and fellow author Taylor, suggests that "awareness of context" is of equal significance to the other core elements of critical reflection, individual experience, and dialogue (Taylor, 2011).

The core elements of transformative learning

1) The Role of Critical Reflection –

Nairn, Chambers, Thompson, McGarry and Chambers (2012, p. 196) describe how reflective practice "transcends mere doing" and therefore helps to guard against superficial learning, and especially against making the mind up quickly and without due consideration, thereby stifling development or any transformative change. If critical reflection is needed for a person to examine personal values or beliefs, and if it can act as a catalyst for transformative learning, it can be advocated as the most effective method on which to concentrate, especially as it has the potential to unearth the underlying reasons as

to why a value system is being held (Brookfield, 2011; Fullerton, 2010; Mezirow, 1998; Nairn et al., 2012).

In the case of transformative learning, Brock (2010 p.123) describes the type of critical reflection Mezirow was referring to as more in keeping with "perspective reflection or reframing", because it goes beyond the exclusively cognitive functions of critical reflection and includes dimensions of the emotional and spiritual, the context and relationships. Both Taylor (2011) and Kitchenham (2006) state this is akin to "premise reflection", which shows an awareness of why we perceive things as we do and examines the "presuppositions underlying our knowledge of the world" (Taylor, 2011, pp.7, 8; Kitchenham, 2006). When we are brought to the edge of our comfort zone regarding challenges to our perspectives (Malkki, 2010), it is in the unconscious human nature to resist this kind of emotional change or reframing of our existing worldview. We do this by using defence mechanisms such as intellectualisation or denial. However, by using this deepest kind of critical reflection, we can "become more aware of their presence and influence in our lives" (Dirkx, 2012, p.403), which must leave us better informed as to whether we will intentionally change or maintain those frameworks.

The literature clearly shows critical reflection as one of the core elements of transformative learning, but some go so far as to say the transformative learning process relies upon its occurrence. (Lewis, 2009; Snyder, 2008; Taylor, 1998, 2007). It is therefore essential to instruct students in the process and to encourage or make time available for this first core element to occur within the learning experience of transformative education (Keeling, 2004). The next core element to be discussed is dialogue.

2) The Role of Dialogue –

Mezirow (1997) posed the interesting question of how can we judge the authenticity, the intent, or the meaning behind a statement such as 'I love you'? He contended the only way is to "engage in discourse to validate what is being communicated", because it is through reflective discourse that a person can better examine the evidence, arguments and any alternative points of view (Mezirow, 1997, p.6; Fullerton, 2010; Mezirow, 1994, 2011). Mezirow based his answer on the views of Habermas, who believed that discourse could lead to a consensus and thereby establish a belief's validity (Mezirow, 2009). While no one truth exists, the more interpretations or points of view we have to dialectically sift through, the greater the likelihood we will discover a better or more dependable interpretation that can be maintained as a worldview or frame of reference - until we encounter yet new evidence, arguments or perspectives (Ciporen, 2008; Mezirow, 2009). This dialogue with others is the "safety net for an individual's newfound or revised assumptions", because they are reassured of their objectivity, and it becomes the medium to be able to put critical reflection into action (Lewis, 2009, p.9; Taylor, 1998).

Therefore, transformative learning can be based, in addition to critical reflection, on a dialogue that occurs between the conscious and the unconscious, where we can better understand or become aware of our internal self and how we project that to the world (Kucukaydin & Cranton, 2012). Because a critically reflective form of either inner or outer dialogue has been identified by modern research as one of the integral components of personal transformation, it can be respected as a useful way to facilitate the potential for personally transformative learning (Fullerton, 2010; Snyder, 2008; Taylor, 2007; Taylor & Laros, 2014). The meaning of a transformative concept becomes significant to a learner through mutual, voluntary discourse with others (Kitchenham, 2008; Morgan, 2011; Taylor & Laros, 2014). However, there is also a completely individual aspect to any transformation, which will be looked at next.

3) The Role of Individual Experience –

Adventure stories often relate an experience through the eyes of the hero or heroine as they face challenges in new and strange lands, and have also been used to illustrate the journey or transformation from a boy to a man (Malkki & Green, 2014). Understanding the meaning of such experiences is a defining condition of being human (Mezirow, 1997). However, these first-person perspectives of current or previous experiences are conditioned and formed by the lens through which we interpret and make sense and meaning of the world (Malkki & Green, 2014; Mezirow, 2012; Snyder, 2008; Taylor & Laros, 2014). Mezirow (1990) described how we acquire most of our meaning perspectives through cultural assimilation, by which we learn such things as how to differentiate a French person from a British person, or a pretty design from an ugly one, or become familiar with what constitutes liberal, radical or conservative viewpoints in our own culture. Stereotypes such as what it means to be a man

or a woman, a leader or a member of a racial group, are usually unintentionally learned, whereas specific stances, such as "positivist, behaviourist, Freudian, or Marxist perspectives, may be intentionally learned" (Mezirow, 1990, p.1; Snyder, 2008).

Perhaps without realising it, we are all trapped within and moulded by our meaning perspectives and therefore we can never make an interpretation of our individual experience free from bias. It is only by exposing our ideas or experiences to critical reflection and dialogue and comparing them to the lived experiences of others that we can begin to uncover those biases or reassure ourselves of their objectivity. This is one of the driving forces of transformative learning (Fullerton, 2010; Lewis, 2009; Mezirow, 1990, 1997). However, it is not as simple as exposing ourselves to new meaning perspectives, such as when travelling to foreign destinations, because not every traveller will "exhibit the same potential for transformation in the same places or on the same journey" (Morgan, 2011, p.256). Exposure is only half the story; the other half concerns the mind-set of the traveller. If we are only looking to briefly escape our normal experience, new perspectives will only be a temporary novelty and we will not be open to a change in our frame of reference (Biallas, 2002). In this way, none of the core elements of transformative learning stands alone, but each supports and enhances the rest (Taylor & Snyder, 2012). As our opinion is that context also plays an integral part in the transformative learning experience, we will now briefly turn our attention to the role of context.

4) The context – the suggested new core element of transformative learning

Mezirow (1994, 2011) did not dismiss the importance of context, but at the same time did not seem to agree heartily with researchers such as Brookfield, whom he aligned with other post-Marxist and postmodern critics who believe that learning theories are dictated by contextual interests. Rather, he stated that the contextual culture enables, inhibits, and dictates who learns what, how and when. The work of transformative learning is to get adults to think for themselves and reassess the factors that support that contextual culture.

But this may be underplaying the constraints of diverse social contexts and material constraints on behaviour, especially as there is a paucity of studies focusing on informal or non-formal educational settings (Morrice, 2012; Nairn et al., 2012; Taylor, 2007). For instance, Clark and Wilson (1991), commenting on Mezirow's initial research study, felt that he took the experiences of the research participants as if they "stood apart from their historical and sociocultural context, thereby limiting our understanding of the full meaning of those experiences." Morgan (2011, p.253) points out that some contexts are surely more likely to be "efficacious" than others, as they will help to bring about the right mind-set for transformation to occur, so it is not just about what is possible but what is feasible (Nairn et al., 2012). Even the most mundane aspects of context, such as time and temporal constraints, or the place and setting within which learning takes place, may play an influential role in the transformative learning process or outcome (Taylor, 1998; Taylor & Cranton, 2012). This stance is in keeping with the more recent unified view of transformative learning that aims to develop a deeper appreciation of personal and sociocultural factors and an awareness of the emotional, moral, cultural and social aspects of our personal being (Baumgartner, 2012; Dirkx, Mezirow, & Cranton, 2006; Taylor & Jarecke, 2011; Taylor & Cranton, 2012; Tisdell, 2012).

Concluding remarks - factors known to foster transformative learning

Mezirow puts less emphasis on the fostering of transformative learning and describes adult learning as "an organised effort to assist learners who are old enough to be held responsible for their acts to acquire or enhance their understanding, skills, and dispositions" (2012, p.89). However, he and others outline what they consider some ideal conditions for transformative adult learning.

Firstly, the conditions should be learner-centred, participative, interactive or constructivist in nature (Christie, Carey, Robertson, & Grainer, 2015). Secondly, as one of the main requirements for transformative learning is open and voluntary discourse, to examine and validate assumptions, values, beliefs, ideas and feelings, it is logical that ideal conditions would include opportunities for learners to engage in such dialogue and group problem solving. However, this should not be without assistance regarding how to participate in such groups or discussions freely (Mezirow, 1994, 1997, 2012; Taylor & Laros, 2014). Thirdly, opportunity to critically reflect, either individually or as part of facilitated group work, is of paramount importance. There should also be opportunity to make, within reason, more

autonomous choices and to act based on that reasoned, critical reflection, even if the action is only to decide. Educators can assist in this by developing authentic relationships with students and helping them overcome situational or knowledge constraints, and by giving emotional support (Mezirow, 1994, 2012; Nairn et al., 2012; Snyder, 2008).

Of the ten precursor steps a person may go through during a transformation, Brock (2010) suggests that the three most effective to bring about a transformative learning experience are disorienting dilemmas, especially about social roles, trying on new roles and critical reflection on assumptions. Taylor and Jarecke (2011) have identified the following list of elements that they feel will form general principles for fostering transformational learning in an educational setting, as long as they are placed in relation to the core elements of critical reflection, group dialogue, individual experience and an awareness of context: A purposeful and heuristic process; Confronting power and engaging difference; An imaginative process; Leading learners to the edge; Fostering reflection; Modelling (Taylor & Jarecke, 2011). Finally, Poutiatine (2009) suggests that, as a basic underlying principle, individuals must first be consensual to the process of education and transformation, because lack of assent may be a real hindrance to openness to transformation of any kind.

The key message to be taken from this analysis of Mezirow's theory of transformative learning is the need to help learners actively participate and engage with the concepts presented within the context of their own lives and both independently and with others critically examine the justification of new knowledge. There is ample scope and justification for further, interesting research into diverse educational, social, and corporate fields and contexts because in the end it has the potential to aid further transformations of the human consciousness.

References

Baumgartner, L.M. (2012). Mezirow's theory of transformative learning from 1975 to present. In Taylor, E. W., & Cranton, P. (Eds.). *The Handbook of Transformative Learning: Theory, Research, and Practice*. John Wiley & Sons.

Brock, S. E. (2010). Measuring the Importance of Precursor Steps to Transformative Learning. *Adult Education Quarterly, 60*(2), 122–142. https://doi.org/10.1177/0741713609333084

Brookfield, S. (2011). Engaging critical reflection in corporate America. In Mezirow, J., & Taylor, E. W. (Eds.). *Transformative Learning in Practice: Insights from Community, Workplace, and Higher Education.* John Wiley & Sons.

Christie, M., Carey, M., Robertson, A., & Grainger, P. (2015). Putting transformative learning theory into practice. *Australian Journal of Adult Learning, 55*(1), 9–30.

Ciporen, R. (2008). The role of personally transformative learning in leadership development: A case study examining the transfer of learning from an executive education program (Ed.D.). Teachers College, Columbia University, United States -- New York. Retrieved from: http://search.proquest.com.ezproxy.liv.ac.uk/dissertations/docview/304626813/abstract/357C1A6AB292408BPQ/1?accountid=12117

Clark, M.C. & Wilson, A. (1991). Context and rationality in Mezirow's theory of transformational learning. *Adult Education Quarterly 41*(2), 75 – 91. https://doi.org/10.1177/0001848191041002002

Cranton, P. & Taylor, E.W. (2012). Transformative learning theory: Seeking a more unified theory. In Taylor, E. W., & Cranton, P. (Eds.). *The Handbook of Transformative Learning: Theory, Research, and Practice.* John Wiley & Sons.

Dirkx, J. M. (2012). Self-Formation and Transformative Learning: A Response to 'Calling Transformative Learning into Question--Some Mutinous Thoughts,' by Michael Newman. *Adult Education Quarterly: A Journal of Research and Theory, 62(*4), 399–405. https://doi.org/10.1177/0741713612456420

Dirkx, J. M., Mezirow, J., & Cranton, P. (2006). Musings and Reflections on the Meaning, Context, and Process of Transformative Learning: A Dialogue Between John M. Dirkx and Jack Mezirow. *Journal of Transformative Education, 4*(2), 123–139. https://doi.org/10.1177/1541344606287503

Dix, M. (2016). The Cognitive Spectrum of Transformative Learning. *Journal of Transformative Education, 14*(2), 139–162. https://doi.org/10.1177/1541344615621951

Fullerton, J. R. (2010). *Transformative learning in college students: A mixed methods study.* Retrieved from http://digitalcommons.unl.edu/cehsdiss/65/

Isopahkala-Bouret, U. (2008). Transformative learning in managerial role transitions. *Studies in Continuing Education*, 30(1), 69–84. https://doi.org/10.1080/01580370701841556

Keeling, R. P. (Ed.). (2004). Learning reconsidered: A campus-wide focus on the student experience. Washington, DC: The National Association of Student Personnel Administrators (NASPA) and the American College Personnel Association (ACPA).

Kegan, R. (2009). What "form" transforms? A constructive-developmental approach to transformative learning. In Illeris, K. (Ed.), *Contemporary Theories of Learning: Learning Theorists ... In Their Own Words.* Routledge.

Kitchenham, A. (2006). Teachers and Technology: A Transformative Journey. *Journal Of Transformative Education, 4*(3), 202–225. https://doi.org/10.1177/1541344606290947

Kitchenham, A. (2008). The Evolution of John Mezirow's Transformative Learning Theory. *Journal of Transformative Education, 6*(2), 104–123. https://doi.org/10.1177/1541344608322678

Kucukaydin, I., & Cranton, P. (2012). Critically Questioning the Discourse of Transformative Learning Theory. *Adult Education Quarterly, 63*(1), 43–56. https://doi.org/10.1177/0741713612439090

Lewis, M. N. (2009). Transformative Learning in the Multiple Sclerosis (MS) Community an Ethnographic Study examining how and in what ways transformative learning is realized and lived out among members of an MS community. *National-Louis University, ProQuest, UMI Dissertations Publishing, 7.*

Malkki, K. (2010). Building on Mezirow's Theory of Transformative Learning: Theorizing the Challenges to Reflection. *Journal of Transformative Education, 8*(1), 42–62. https://doi.org/10.1177/1541344611403315

Malkki, K., & Green, L. (2014). Navigational Aids: The Phenomenology of Transformative Learning. Journal of Transformative Education, 12(1), 5–24. https://doi.org/10.1177/1541344614541171

Mathis, D. (2010). Transformational learning: Challenging assumptions in the workplace. *Development and Learning in Organisations, 24*(3), 8–10. https://doi.org/10.1108/14777281011037227

Mezirow, J. (1990). *Fostering critical reflection in adulthood.* Jossey-Bass San Francisco. Retrieved from: http://wwwprod.ln.edu.hk/osl/conference2011/output/breakout/4.4%20%5Bref%5DHow%20Critical%20Reflection%20triggers%20Transformative%20Learning%20-%20Mezirow.pdf

Mezirow, J. (1994). Understanding Transformation Theory. *Adult Education Quarterly, 44*(4), 222–232. https://doi.org/10.1177/074171369404400403

Mezirow, J. (1997). Transformative learning: Theory to practice. *New Directions for Adult and Continuing Education,* (74), 5–12. http://dx.doi.org/10.1002/ace.7401

Mezirow, J. (1998). On Critical Reflection. *Adult Education Quarterly, 48*(3), 185–198. https://doi.org/10.1177/074171369804800305

Mezirow, J. (2009). An overview on transformative learning. In Illeris, K., (Ed.), *Contemporary Theories of Learning: Learning Theorists ... In Their Own Words,* 90-105. Routledge.

Mezirow, J. (2011). Transformative learning theory. In Mezirow, J., & Taylor, E. W. (Eds.) and Associates, *Transformative Learning in Practice: Insights from Community, Workplace, and Higher Education.* John Wiley & Sons.

Mezirow, J. (2012). Learning to think like an adult: Core concepts of transformative theory. In Taylor, E. W., & Cranton, P. (Eds.). *The Handbook of Transformative Learning: Theory, Research, and Practice.* John Wiley & Sons.

Mezirow, J., & Taylor, E. W. (2011). Transformative Learning in Practice: Insights from Community, Workplace, and Higher Education. John Wiley & Sons.

Morgan, A. D. (2011). Journeys Into Transformation: Travel to An 'Other' Place as a Vehicle for Transformative Learning. *Journal of Transformative Education, 8*(4), 246–268. https://doi.org/10.1177/1541344611421491

Morrice, L. (2012). Learning and Refugees: Recognizing the Darker Side of Transformative Learning. *Adult Education Quarterly: A Journal of Research and Theory, 63*(3), 251–271. https://doi.org/10.1177/0741713612465467

Nairn, S., Chambers, D., Thompson, S., McGarry, J., & Chambers, K. (2012). Reflexivity and habitus: opportunities and constraints on transformative learning. *Nursing Philosophy, 13*(3), 189–201. https://doi.org/10.1111/j.1466-769X.2011.00530.x

Poutiatine, M. I. (2009). What is Transformation?: Nine Principles Toward an Understanding of the Transformational Process for Transformational Leadership. *Journal of Transformative Education, 7*(3), 189–208. https://doi.org/10.1177/1541344610385249

Sands, D., & Tennant, M. (2010). Transformative Learning in the Context of Suicide Bereavement. *Adult Education Quarterly, 60*(2), 99–121. https://doi.org/10.1177/0741713609349932

Snyder, C. (2008). Grabbing Hold of a Moving Target: Identifying and Measuring the Transformative Learning Process. *Journal of Transformative Education, 6*(3), 159–181. https://doi.org/10.1177/1541344608327813

Taylor, E. (1998). The theory and practice of transformative learning: A critical review. *Information Series no. 374.* ERIC Clearinghouse on Adult, Career, and Vocational Education, Columbus, OH.

Taylor, E. W. (2001). Transformative learning theory: a neurobiological perspective of the role of emotions and unconscious ways of knowing. *International Journal of Lifelong Education, 20*(3), 218–236. https://doi.org/10.1080/02601370110036064

Taylor, E. W. (2007). An update of transformative learning theory: A critical review of the empirical research (1999-2005). *International Journal of Lifelong Education, 26*(2), 173–191. https://doi.org/10.1080/02601370701219475

Taylor, E.W. (2011). Fostering transformative learning. In Mezirow, J., & Taylor, E. W. (Eds.). *Transformative Learning in Practice: Insights from Community, Workplace, and Higher Education.* John Wiley & Sons.

Taylor, E. W., & Cranton, P. (2012). The Handbook of Transformative Learning: Theory, Research, and Practice. John Wiley & Sons.

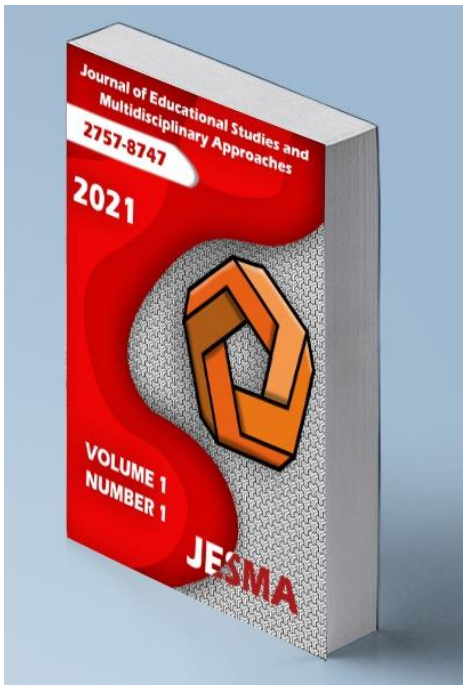
Taylor, E.W. & Jarecke, J. (2011). Looking back by looking forward. In Mezirow, J., & Taylor, E. W. (Eds.). *Transformative Learning in Practice: Insights from Community, Workplace, and Higher Education.* John Wiley & Sons.

Taylor, E. W., & Laros, A. (2014). Researching the practice of fostering transformative learning: lessons learned from the study of andragogy. *Journal of Transformative Education, 12*(2), 134–147. https://doi.org/10.1177/1541344614548589

Taylor, E.W. & Snyder, M.J. (2012). A critical review of research on transformative learning theory, 2006-2010. In Taylor, E. W., & Cranton, P. (Eds.). *The Handbook of Transformative Learning: Theory, Research, and Practice*. John Wiley & Sons.

The E (2010). *Designing Transformational Learning.* Retrieved 12 October 2013 from: http://theenews.edublogs.org/2010/05/28/designing-transformational-learning-further-feedback-required/

Tisdell, E.J. (2012). Themes and variations of transformative learning: Interdisciplinary perspectives on forms that transform. In Taylor, E. W., & Cranton, P. (Eds.). *The Handbook of Transformative Learning: Theory, Research, and Practice.* John Wiley & Sons.



Journal of Educational Studies and Multidisciplinary Approaches (JESMA)
ISSN:2757

www.jesma.net

Lessons learned from a project examining the learning outcomes and experiences in 360º videos

Emmanuel Fokides[1], Penelope Atsikpasi[2], Paraskevi Anna Arvaniti[3]

[1]University of the Aegean, Greece, fokides@aegean.gr
[2]University of the Aegean, Greece, pred17015@aegean.gr
[3]University of the Aegean, Greece, vivi.arv@gmail.com

Corresponding Author: Emmanuel Fokides, fokides@aegean.gr

To cite this article:

Fokides, E., Atsikpasi, P., & Arvaniti, P. A. (2021). Lessons learned from a project examining the learning outcomes and experiences in 360º videos. *Journal of Educational Studies and Multidisciplinary Approaches (JESMA), 1*(1), 50-70. https://doi.org/10.51383/jesma.2021.8

Journal of Educational Studies and Multidisciplinary Approaches (JESMA)
Volume 1, Issue 1 Year 2021 ISSN:2757

Lessons learned from a project examining the learning outcomes and experiences in 360º videos

Emmanuel Fokides https://orcid.org/0000-0003-3962-0314

Penelope Atsikapasi https://orcid.org/0000-0002-1764-9223

Paraskevi Anna Arvaniti https://orcid.org/0000-0001-7122-7411

ARTICLE INFORMATION

Original Research Paper
https://doi.org/10.51383/jesma.2021.8

Received 05 February 2021
Accepted 06 March 2021

ABSTRACT

Advances in technologies associated with virtual reality provide interesting tools for e-learning. One such is 360° videos. Although their educational potential is supported by a number of researchers, there is limited empirical evidence backing such a claim, given that they have recently become popular. The study at hand presents the results of a project in which 360° videos were used by primary school students. Eighty-four students, aged ten to eleven, participated in the experiment. The results demonstrated that 360° videos helped them to acquire more knowledge compared to printed material. Then again, no statistically significant differences were noted when comparing 360° and regular videos. 360° videos provided a more immersive, motivational, and enjoyable learning experience. However, the low-cost head mounted displays used for viewing 360° videos and the applications in which they were embedded, were considered the least easy to use. Moreover, participants expressed the view that all tools fostered their learning. Overall, while the results give support to the hypothesis that 360º videos provide positive educational experiences, their actual impact on learning has to be further explored.

Keywords: 360º videos, enjoyment, immersion, learning, motivation, primary school

Introduction

Videos are among the predominant forms of entertainment, also having a significant educational value (Smith et al., 2012). Their success, both as educational and entertainment tools, probably lies in the fact that viewers identify themselves -to some extent- with what they are watching (Carr-Chellman & Duchastel, 2001). On the other hand, videos, in their current form, have certain limitations. For instance, what viewers see is actually what the director or the cameraman chose to record. They cannot view a scene from a perspective/angle of their choice because multiple cameras should have been used for simultaneously recording the same scene.

In recent years, technological advancements have offered an interesting alternative to regular videos, that of omnidirectional panoramic videos, also called 360º videos. Although they surfaced as a research technology almost two decades ago (Pintaric et al., 2000), only recently they have been transformed into a product widely available to the masses. In short, the cameras that are used for capturing such videos are able to record images from a field of view that covers a whole sphere; hence, the term "360º videos." For processing/editing them, similar techniques to that of regular videos are followed. Viewers can watch them using computers, smartphones, and head-mounted displays (HMDs). In the last two cases, users are placed at the center of the video-sphere, turn their smartphones or heads in any direction they like, the built-in gyroscopes and accelerometers track the movement, and the portion of the sphere that corresponds to the direction they are looking at is displayed. Moreover, additional content (e.g., images, text, audio, and scene transitions) can be added with which users can interact by triggering hotspots embedded in the video. Users can activate these hotspots by either keep looking towards the direction of a hotspot and holding their position for a few seconds or by point-and-clicking using hand-held controllers.

There are several types of HMDs, that can roughly fall into three categories: (i) tethered to a computer, having their own mini LCD/OLED displays and electronics, but it is the computer that is responsible for all the image processing; (ii) untethered, also having their own mini LCD/OLED displays, but they are -more or less- miniaturized computers because the image processing is done by the device itself; and (iii) low-cost/low-tech Google cardboard compatible devices; their main body (made of cardboard or plastic) houses two lenses and no electronics, a smartphone (inserted into a compartment) displays the video and does all the image processing. Out of the above, it was the Google cardboard devices that made 360º videos and other virtual reality (VR) applications accessible to millions of people (Curcio et al., 2016).

360º videos present environments that are real and not based on graphics (as are VR applications). For that matter, they have found their way in areas in which a high degree of realism is necessary (e.g., Biology, Engineering, and Health Sciences), as well as in education (Ardisara & Fung, 2018). With regard to education, a number of studies reported a positive impact on learning (e.g. Pham et al., 2018; Ritter et al., 2019), and on learning facilitating factors (e.g., enjoyment and motivation; Lee et al., 2017; Wu et al., 2019; Xie et al., 2019). That is because, besides the imposing presentation of the visual material, the use of HMDs removes external stimuli, allowing users to feel immersed in the environment that is presented to them (Rupp et al., 2019), which, in turn, significantly enhances their learning experience compared to other less immersive technologies.

Considering the above, it seems that 360º videos might be an important supplement to existing teaching frameworks. In fact, their educational use is on the rise, as they are easily produced, provide a low-cost solution, and are widely available (Sun et al., 2018; Zhou et al., 2017). Then again, given that they were recently commercialized and, consequently, the body of knowledge on their educational use is limited (Rupp et al., 2016), leaves plenty of room for additional research. Having that in mind, we decided to implement a project, having as a target group primary school student, with the objective to investigate whether they can outperform, in terms of learning outcomes, other tools commonly used in teaching, such as printed material and regular videos. In addition, we examined what were the views and feelings of students regarding their use. The following sections present the existing research on 360º videos' educational potential, the reasoning behind the research questions we examined, the experimental setup, the results from the experiment, and their subsequent discussion.

360º videos

Research on the educational uses of 360º videos, while not yet adequately systemized, seems to cover a rather wide and diverse set of learning domains and sciences. They are commonly used for delivering virtual tours to places of interest, museums, and archaeological sites (e.g., Argyriou et al., 2020; Fokides et al., 2020; Skondras et al., 2019), as well as for presenting experiments and medical procedures (e.g., Ardisara & Fung, 2019; Sankaran et al., 2019). They have been also used for the teaching of subjects related to Ecology (e.g., Fokides & Kefalinou, 2020; Ritter et al., 2019), Physics (Wu et al., 2019), Physical Education (Kittel et al., 2020; Paraskevaidis & Fokides, 2020), Religion Education (Johnson, 2018), language learning (Berns et al., 2018; Xie et al., 2019), Public Health Education (Dawson et al., 2019), Safety Education (Pham et al., 2018), and for delivering virtual courses (Lee et al., 2017).

360º videos have similarities with regular videos, as well as with VR applications. Because of their resemblance with the former, the theoretical frameworks guiding their educational use are probably the same, namely Mayer's (2009) multimedia learning theory and Sweller's (2005) cognitive load theory. Mayer postulated that humans use a channel for processing visual stimuli (e.g., images, printed text, or text displayed on a screen) and a channel for processing audio stimuli (e.g., speech). Due to the limited capacity of the brain, not many "chunks" of information can be processed at the same time. Moreover, he assumed that learning involves the selection of what is relevant, organizing it into models (verbal and visual), which are later integrated into prior knowledge. He suggested -among other things- that individuals learn better when: (i) the inessential material is removed, and (ii) graphics/images are presented together with narration, something that holds true for both regular and 360º videos. Central to Sweller's theory is the concept of "schemas", which represent organized blocks of information retained in long-term memory. The instructional material should help students to develop those schemas by not overloading them with unnecessary information. In fact, he suggested that cognitive load can be: (i) extraneous, which is the (wasted) effort for learning something unrelated to the learning objectives), (ii) intrinsic, meaning the effort one has to put for representing the material into their working memory, and (iii) germane, which is the required effort for understanding the material. While the first two types of cognitive load should be avoided, the germane load has to be promoted because it helps the transfer of schemas to long-term memory. Although research suggested that multimedia learning material is likely to increase all types of cognitive load, including the undesirable ones, research related to the use of 360º videos found increased levels of germane cognitive load compared to the other two types (Lin et al., 2019).

360° videos also share some features with VR that led researchers to label them as VR experiences (e.g., Rupp et al., 2019), despite the fact that the former are based on real-life recordings while the latter is based on 3D graphics. Because HMDs can be used in both cases, users are cut-off from the distractions of the outside world, allowing them to be immersed in the virtual experience, and, thus, be more engaged with the content (Dede, 2009). Reduced distraction and engagement with the content, offered by the sense of immersion, were correlated with better conceptual learning (Dede et al., 2017; Tüzün & Özdinç, 2016). Moreover, researchers argued that immersion, by offering -somehow- direct experiences, allows situated learning to take place and the transfer to the real world of what was learned in the virtual environment (Dede et al., 2017). The emotions evoked by a virtual experience also contribute to the above (Diemer et al., 2015). For example, the emotional responses to a virtual car accident proved to have a significant impact on the training of individuals learning to drive (Sheridan, 2016). Closely connected with immersion is the feeling of presence, the illusion of "being" in the virtual environment, perceiving it as real (Slater, 2009). Because of that, the perceptual cues offered to the users are more accurate, allowing them to improve their performance (Slater & Sanchez-Vives, 2016).

However, the role of immersion is rather unclear in 360º videos. As viewers can explore their surroundings by watching different parts of the scene and focus their attention on details that otherwise could have been passed unseen, we can argue that 360º videos are more immersive than regular videos. In fact, research has demonstrated that, in 360º videos, the feelings of immersion and presence were rather strong (e.g., Argyriou et al., 2017; Berns et al., 2018; Elmezeny et al., 2018; Fokides & Kefalinou, 2020; Higuera-Trujillo et al., 2019) and that students were able to better understand concepts, processes, and problems (e.g., Chang et al., 2019; Dawson et al., 2018; Fokides & Arvaniti, 2020). However, research has suggested that 360º videos do not offer high levels of immersion and that the quality of

experience is lower than that of VR experiences based on 3D graphics (e.g., Rupp et al., 2019). Others argued, that because 360º videos lack student-user agency, they limit situated learning (Dede et al., 2017). Moreover, immersion might be negatively affected when low-tech HMDs (such as Google Cardboard) are used, leading to a diminished impact on learning (Rupp et al., 2019).

As for the learning outcomes per se, either when 360º videos were used as the only tool or when they were compared with other teaching tools, the results, although promising, were mixed. Several researchers reported a positive impact on learning (e.g., Chang et al., 2019; Pham et al., 2018; Wu et al., 2019) and the acquisition of skills (e.g., Parmaxi et al., 2018). Then again, others reported that their impact was not that significant (e.g., Fokides et al., 2020; Karageorgakis & Nisiforou, 2018; Ulrich et al., 2019). The lack of a teaching framework that fully exploits their potential (e.g., Fokides et al., 2020; Fowler, 2015; Hodgson et al., 2019) and lack of understanding whether they foster self-directed learning and self-assessment (e.g., Whittleston et al., 2018) were also noted. Another issue that probably does not allow the full comprehension of 360º videos' impact, is that the majority of the studies we cited above mostly targeted university students and young adults, as they constitute a rather convenient sample; research on younger ages (e.g., primary school students) is rather scarce (e.g., Fokides & Arvaniti, 2020; Wu et al.,2019).

Besides attributing the positive learning outcomes to immersion and presence, researchers attributed the results to other learning facilitating factors as well. For example, they noted that the novelty of the experience (Lin et al., 2019) led to increased levels of enjoyment, satisfaction (e.g., Chang et al., 2019; Lee et al., 2017), and motivation (Fokides & Arvaniti, 2020; King-Thompson, 2017; Xie et al., 2019). In fact, students' responses regarding their experiences were highly positive, characterizing them as positive, useful, engaging, and that 360º videos facilitated their comprehension/learning of the subjects they were taught (Fung et al., 2019; Huang et al., 2019; Ulrich et al., 2019). On the negative side, distraction and/or disorientation are significant issues (Ardisara & Fung, 2018). For example, students might be looking at a certain part of the scene because something irrelevant draw their attention and miss something important taking place in another part of the scene. Overexcitement because of the novelty of the experience might also act as a distraction factor (Rupp et al., 2016). In low-tech HMDs some usability problems were noted, probably because navigation is not that easy without the use of hand-held controllers (Fokides et al., 2020). Symptoms of severe discomfort, vertigo, and nausea (called simulator sickness) were reported in a number of studies. Researchers theorized that this problem is more prominent in low-tech HMDs, as the lower display quality causes more severe mismatches between the simulated movement (the movement the user sees in the video) and the vestibular system (the lack of movement perceived by the user's inner ear) (Rupp et al., 2019). Logically enough, the learning experience is negatively affected by this unpleasant situation (Lackner, 2014).

Statement of the problem, formation of the research questions

The On the basis of the research we presented in the preceding sections and considering the fact that 360º videos can be used in a wide range of scientific disciplines and teaching scenarios, we can support the view that they have interesting educational potential. Then again, it is also true that research on this matter is still at its infant stage, given that its volume is not extensive and the underlying technology is constantly evolving. Moreover, just a few of the studies were methodologically sound; most seemed to be concerned with testing prototypes or initial ideas, the sample sizes were small, the number of interventions/tests was small, and comparisons with alternative tools were not that common. We also noted that most studies had adults as their target group (e.g., professionals and university students); very few targeted young students. In addition, the body of research that examined differences between sexes or took into consideration participants' prior knowledge on the subject matter they were trying to learn was rather limited.

Having these in mind, we decided to implement a project to answer whether 360º videos have a measurable impact on primary school students' learning and whether the results are better (or worse) compared to printed material, which is the most commonly used educational tool. We also thought that it would be interesting to compare their impact with that of regular videos, so as to examine whether 360º videos have significant advantages over their less advanced predecessors. In addition, we

considered it important to examine the learning experience they offer (again, in relation to other tools) more comprehensively, given that much of the research, although it explored similar issues, usually focused on one or two factors that shape one's learning experience. Thus, we addressed the following research questions:

- *RQ1. After controlling for the initial primary school students' knowledge level, are there any statistically significant differences in the learning outcomes produced from the use of printed material, regular videos, and 360º videos? Does sex have an impact on the results?*
- *RQ2a-e. With regard to the above tools, are there any statistically significant differences on students' views and feelings for their (a) usefulness, (b) impact on motivation to learn, (c) easiness of use, (d) immersiveness, and (e) the enjoyment they offer while learning? Does sex have an impact on the results?*

Method

In previous studies, we used 360º videos within a teaching framework (e.g., Fokides & Arvaniti, 2020; Fokides et al., 2020). In these studies, that were related to the teaching of environmental issues and historical events, we examined the impact of 360º videos on students' performance, while comparing the learning outcomes to the ones produced by the use of other tools such as printed material and regular videos. The results indicated that the students who used 360º videos were able to outperform the students who used conventional teaching tools. We also noted increased levels of immersion, motivation and enjoyment. These findings led us to theorize that the better learning outcomes of the 360º videos, compared to other tools, can be attributed to the above factors. While the above-mentioned studies allowed us to test (and ultimately recommend) effective teaching strategiesthat utilize them, we were unable to discern to what extent the results were due to the teaching framework, the teachers, or the 360º videos. Therefore, we decided that it was necessary to examine what is the exact impact of 360º videos per se, without including other factors that might play a significant role. We elaborate further on this issue in the "Procedure" section.

We decided to follow a within-subjects research design with three conditions. This means that the same subjects/students used three different tools (i.e., printed material, regular videos, and 360º videos) in order to be informed about subjects related to the environment (as presented in the "Materials and apparatus" section). We selected the within-subjects design over the between-subjects approach because literature suggested that it is efficient while requiring smaller sample sizes (Greenwald 1976; Keren 2014). Not only that, but the confounding effects of individual differences are not a cause of concern, as the same individuals participate in all treatments. Finally, group variances are not an issue, given that participants function as their own controls (Gravetter & Forzano, 2018). In addition, to address the disadvantages of this research design, we took a series of measures as discussed in sections "Materials and apparatus" and "Procedure."

Materials and apparatus

For this experiment, we used audiovisual and printed material developed (and tested) for the needs of previous studies in which we examined the use of 360º videos in the context of environmental education (Figure 1). We decided to reuse it because of its information density and because the videos it included (regular and 360º) were of high production quality. As in the aforementioned studies, the research design was an important consideration; we had to take into account that the same participants were going to use three different tools. This meant that the material could not be the same across tools, because with each subsequent tool students were going to learn a bit more, rendering the results invalid. On the other hand, if each tool presented different subjects, was also a threat, as they are incomparable. To overcome these problems, we followed the same set of measures we did in our previous studies. Firstly, we decided to conduct three sessions for each tool (nine in total), so as to increase the reliability of our data. Secondly, we rechecked whether the material, in terms of quality, quantity, cognitive load (e.g., number of terms/facts/figures/names/concepts and amount of text/narration), and difficulty level,

was the same in all tools. Thirdly, the subjects included in one tool had matching subjects in the other two tools (Table 1). Lastly, we rechecked whether the presentation and organization of the material followed the same rules in all tools. As a sidenote, interactive hotspots (for displaying additional texts and images, and for transitions between scenes) were placed in both 360º and regular videos. In the printed material we used multiple screenshots taken from the corresponding videos.

Students in the condition of the 360º videos used Google cardboard compatible HMDs coupled with 6.39" smartphones running Android 10. Students wore headphones so as to have the best audio quality without any interference from background noises. Participants in the condition of the regular video used computers together with 27" full-HD monitors. As in the condition of the 360º videos, students wore headphones.

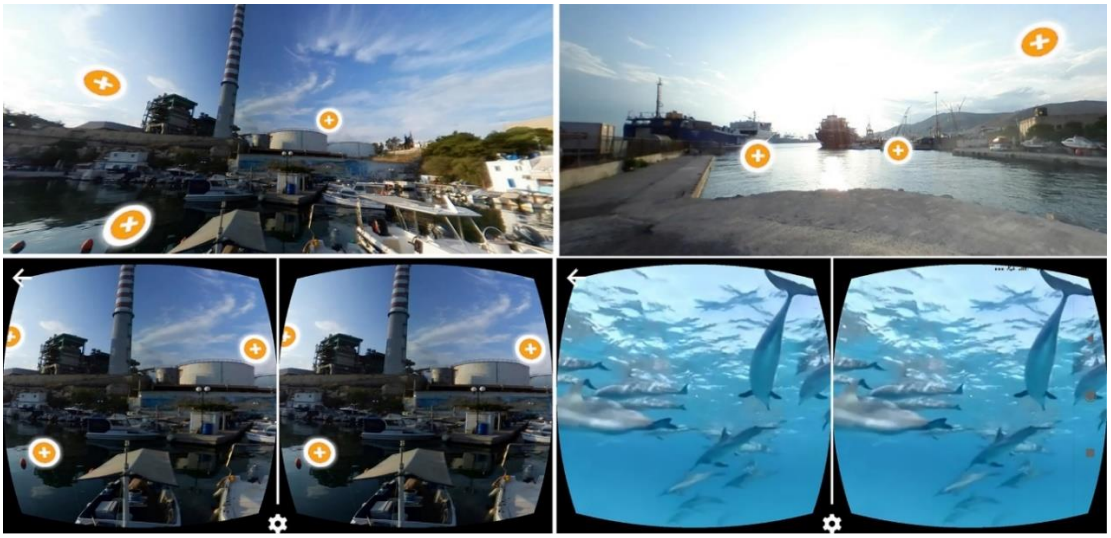


Figure 1. Screenshots from the apps

Table 1. Sessions' learning subjects

Unit	Printed material	Regular videos	360º videos
Greece's ecosystems	forest	freshwater	shoreside/sea
Pollutants and pollution prevention	land	air	water
Waste management and recycling	solid wastes	organic wastes	liquid wastes

Participants

An issue we had to resolve was related to the experiment's sample size. Our objective was the number of participants to allow us to detect even small effect sizes with more than enough power. For that matter, we performed a power analysis for sample size estimation using G*power (Faul et al., 2007). Following Cohen's (1969) guidelines, for $f_{Cohen} = .10$, $\alpha = .05$, power = 0.95, and a correlation between repeated measurements = .95, the projected sample size was at least forty-six participants.

Another decision we had to make was related to participants' age. We decided to target primary school students, as few studies had previously focused on them. Given that (i) Greece's program of study for primary schools presents/discusses issues related to the environment, for the first time, at the fourth grade (ages nine to ten) and (ii) the subjects discussed in the material we used were more advanced than those in the textbooks, we considered appropriate the sample to consist of slightly older students, aged ten to eleven (fifth grade). We contacted several fifth-grade teachers working in public primary schools in Athens, Greece. As a result, we selected forty-two boys and forty-two girls (significantly more than our initial intentions) who: (i) were never formally taught subjects similar to the ones in our study (ii) have never before used HMDs, and (iii) in terms of their academic performance they were equally

divided into three categories (i.e., low, average, and high performance), and with an equal number of boys and girls in each group.

Because the experiment involved minors, we obtained ethical clearance from the University's ethical committee. In addition, we informed students' parents of the experiment's objectives and they granted their written consent for their children's participation.

We have to note that students were given a hearing and vision screening. We tested their hearing using the hearScreen app (https://www.hearxgroup.com/hearscreen/) running on Android smartphones together with high-quality pairs of headphones. We used the apps Peek Acuity (https://www.peekvision.org/en_GB/peek-solutions/peek-acuity/) and Ishihara Color Blindness Test (available in Play Store) to screen visual acuity and deficiencies in color perception. Finally, we used the iNSIGHT Depth Perception app (http://www.polyhedronlearning.com/) together with smartphones running Apple iOS for testing depth perception. None of the students had problems preventing their participation in the experiment.

Instruments

As we had nine sessions (three for each tool) and for recording what students were able to learn, we developed an equal number of evaluation tests. Each test had twenty multiple-choice questions derived from the learning material presented in a session and each question had five possible answers but only one correct. For determining what questions to include in these tests, we created an initial question pool and we asked five students (not included in the final sample) to answer them. This allowed us to remove questions that had a high number of incorrect responses, not significantly correlated with the total score. Participants received five points for every correct answer; to discourage guessing, their score was reduced by one point for an incorrect answer. We administered each evaluation test immediately after the end of its corresponding session. In addition, for establishing participants' prior knowledge/academic level on the subjects included in all sessions, we tested them using a pre-test (having a total of forty questions), that we administered a week before the beginning of the experiment.

Moreover, we used parts of a modular validated scale developed for recording users' experiences when dealing with digital educational tools (Fokides et al., 2019). Although it includes twelve factors, we selected five of them, one for each of the five research questions we sought to answer (RQ2a-e). The scale's items (twenty-three in total) were presented on a five-point Likert-type scale (from strongly disagree = 1 to strongly agree = 5). We present the questionnaire's items in the Appendix. We administered the questionnaire three times (during the last time one of the tools was used). We also included an open-ended question in which students could report problems when viewing the 360º videos (e.g., discomfort, simulator sickness, and usability problems).

Procedure

To avoid usability issues and technical problems caused by the fact that students were inexperienced users of Google cardboard compatible HMDs and 360º videos, we allowed them to familiarize themselves to both, during a session prior to the beginning of the experiment. For that matter, we installed on the smartphones a 360º video the subject of which was not related to the other videos we used in the actual experiment. Because the sessions took place during school hours, we decided to conduct all of them on the same day of the week and at the same hour, in order to eliminate the influence of external factors such as students' loss of interest or tiredness due to previous lessons. Another measure we took, with the purpose of avoiding order effects, was to randomize the use of tools. Moreover, we did not inform students about which tool they were going to use each time.

Twenty minutes were allocated for each session. We estimated that this time was enough for an average ten-to-eleven-year old student to either thoroughly read the printed material, or carefully watch the regular/360º videos. We instructed students that their goal was to try to learn as much as they could about the subjects presented to them. The sessions were conducted on an individualized basis in offices available to students' schools. For watching the 360º videos, students sat in a swivel office chair and

had enough space to move and turn around. A desk and an office chair were used for watching the regular videos or for studying the printed material. For the evaluation tests, that immediately followed, students had fifteen minutes at their disposal. Finally, in cases of simulator sickness or discomfort, students were allowed to stay for about ten minutes for the symptoms to abate.

To remove bias, the researcher who was present for the duration of each session did not provide any help to students related to what they were learning or did not intervene for any reason other than for providing technical assistance if needed.

As none of the participants was absent in any of the nine sessions, we included in the analysis that followed data coming from all of them. We calculated three variables representing students' mean scores per tool. We also checked the questionnaires for missing or unengaged responses (none were found). We assessed the questionnaires' factors as well as their overall internal consistency. In all cases, we found that Cronbach's alpha was above the .700 threshold which is considered acceptable (Taber, 2018). Following that, we calculated fifteen variables, representing the items' means per factor (three questionnaires X five factors).

For examining the learning outcomes, we deemed that a Mixed Model Analysis of Covariance (ANCOVA) was the appropriate statistical method for determining whether significant differences exist in the learning outcomes, between boys and girls, after controlling for students' prior knowledge (as recorded in the Pre-test). The following tests examined whether the data were fit for this type of statistical analysis: (i) we assessed the assumption of normality using Q-Q scatterplots (DeCarlo, 1997); (ii) we plotted the residuals against the predicted values for evaluating homoscedasticity (Field, 2013); (iii) we assessed the assumption of sphericity using Mauchly's test (Mauchly, 1940); (iv) we calculated Mahalanobis distances and compared them to a χ^2 distribution for identifying influential points in the residuals, (Newton & Rudestam, 2012); (v) we rerun the mixed model ANCOVA by including interaction terms between each independent variable and the covariate, for assessing the assumption for homogeneity of regression slopes (Field 2013); and (vi) we conducted an ANOVA for each covariate-independent variable pair, to assess covariate-independent variable independence (Field 2013). Out of the above, only the sphericity assumption was violated [$\chi^2(2) = 26.90$, $p < .001$]. To address this issue, we used the Greenhouse-Geisser correction when calculating the p-values for the within-subjects factor and its interactions with either the between-subjects factor or the covariate (Greenhouse & Geisser, 1959).

We were to conduct a total of five Mixed Model ANOVAs with one within-subjects factor (students' mean scores in the questionnaires' factors for each tool) and one between-subjects factor (sex) to determine whether significant differences exist in students' views and opinions regarding the use of the three tools (as recorded by the questionnaires' five factors) and between boys and girls. While the assumption of homoscedasticity was not violated and there were no multivariate outliers, in three cases (i.e., immersion, enjoyment, and subjective usefulness) we found that the data were approximately normally distributed. Given that ANOVA is rather robust to moderate deviations from normality and that the sample size was more than thirty subjects, this violation did not raise any major concerns (Tiku, 1971). The sphericity assumption was violated in all cases except in the factor labeled "Immersion." For that matter, as in the ANCOVA, we used the Greenhouse-Geisser correction.

Results

We imputed the resulting data in SPSS 26 for further analysis. Table 2 presents descriptive statistics for all the study's variables.

Table 2. Means and standard deviations for the study's variables

Variable	**Boys** (n = 42)		**Girls** (n = 42)	
	M	*SD*	*M*	*SD*
Pre-test	33.07	8.46	34.93	7.68
Printed material evaluation tests	50.20	12.25	54.77	11.46
Regular videos evaluation tests	53.33	12.62	57.99	11.49

360º videos evaluation tests	53.95	12.44	58.61	11.46
Immersion-Printed material	3.46	0.91	3.18	0.92
Immersion-Regular videos	3.73	0.89	3.42	1.02
Immersion-360º videos	4.00	0.85	4.07	0.87
Enjoyment-Printed material	3.64	0.83	3.53	0.92
Enjoyment-Regular videos	4.24	0.59	4.15	0.66
Enjoyment-360º videos	4.56	0.46	4.40	0.66
Subjective usefulness-Printed material	4.10	0.60	4.05	0.59
Subjective usefulness-Regular videos	4.20	0.63	4.21	0.66
Subjective usefulness-360º videos	4.19	0.74	4.31	0.73
Ease of use-Printed material	4.32	0.53	4.31	0.45
Ease of use-Regular videos	3.81	0.67	3.81	0.64
Ease of use-360º videos	3.24	0.68	3.25	0.62
Motivation-Printed material	3.59	0.73	3.49	0.72
Motivation-Regular videos	3.87	0.67	4.01	0.60
Motivation-360º videos	4.51	0.47	4.64	0.43

Analysis of the evaluation tests

We examined the results in the evaluation tests using an alpha of .05. As it is evident in Table 3, the main effect for sex was not significant [$F(1, 81) = 2.71$, $p = .103$], indicating that the results for girls and boys were all similar after controlling for students' prior knowledge. As expected, the covariate (students' prior knowledge, Pre-test), was significantly related to the results in the evaluation tests of all tools [$F(1, 81) = 185.65$, $p < .001$]. The main effect of the within-subjects factor was significant [$F(1.56, 126.02) = 4.25$, $p = .025$], indicating significant differences between the learning outcomes of the three tools. The effect size was small ($\eta_p^2 = 0.05$). The interaction effect between students' sex and the within-subjects factor was not significant [$F(1.56, 126.02) = 0.02$, $p = .960$], indicating that the strength of the relationship between the outcome and the interaction of sex did not change significantly (for all combinations of the within-subjects factor and sex). The same applied for the interaction effect of the Pre-test [$F(1.56, 126.02) = 0.13$, $p = .828$].

Table 3. Mixed Model ANCOVA results

Source	***df***	***SS***	***MS***	***F***	***p***	η_p^2
Between-Subjects						
Sex	1	347.90	347.90	2.71	.103	0.03
Pre-test	1	23819.48	23819.48	185.65	< .001	0.70
Residuals	81	10392.41	128.30			
Within-Subjects						
Evaluation tests	1.56	53.37	33.63	4.25	.025	0.05
Sex*Evaluation tests	1.56	0.23	0.15	0.02	.960	0.00
Pre-test*Evaluation tests	1.56	1.58	1.02	0.13	.828	0.00
Residuals	126.02	998.27	7.92			

The pairwise contrasts revealed that the results in the evaluation tests assessing the outcomes from the use of the printed material were significantly less than in regular videos [$t(81) = -5.50$, $p < .001$ for boys and $t(81) = -5.39$, $p < .001$ for girls], as well as in 360º videos [$t(81) = -5.81$, $p < .001$ for boys and $t(81) = -6.32$, $p < .001$ for girls]. On the other hand, the results in the evaluation tests assessing the impact of regular videos were, statistically speaking, not different from the results in 360º videos [$t(81) = -1.71$, $p = .094$ for boys and $t(81) = -1.63$, $p = .110$ for girls] (Table 4). The effect sizes, when comparing the printed material with either regular videos or 360º videos, were very large (d_{Cohen} ranging from 0.80 to 1.06). On the other hand, the effect sizes when comparing the regular videos with 360º videos were rather small ($d_{Cohen} = 0.16$ for boys and 0.17 for girls). Thus, for answering RQ1, we can support that, after controlling for the initial students' knowledge level and regardless of participants' sex, 360º videos

produced better learning outcomes compared to printed material but not better compared to regular videos.

Table 4. Pairwise contrasts for the Mixed Model ANCOVA (Tukey comparisons)

Contrast	Difference	*SE*	*df*	*t*	*p*	d_{Cohen}
Boys						
Printed material-Regular videos	-3.13	0.57	41	-5.50	< .001	-0.80
Printed material-360º videos	-3.75	0.65	41	-5.81	< .001	-0.96
Regular videos-360º videos	-0.62	0.36	41	-1.71	.094	-0.16
Girls						
Printed material-Regular videos	-3.22	0.60	41	-5.39	< .001	-0.89
Printed material-360º videos	-3.84	0.61	41	-6.32	< .001	-1.06
Regular videos-360º videos	-0.63	0.38	41	-1.63	.110	-0.17

Analysis of the questionnaires

Coming to the questionnaires, the main effect for Sex was not significant in all cases [$F(1, 82) = 1.22$, $p = .272$ for Immersion; $F(1, 82) = 0.84$, $p = .361$ for Enjoyment; $F(1, 82) = 0.06$, $p = .809$ for Subjective usefulness; $F(1, 82) = 0.00$, $p = .978$ for Ease of use; and $F(1, 82) = 0.26$, $p = .609$ for Motivation], indicating that the results for girls and boys were similar. The main effect for the within-subjects factor was significant in all cases except in Subjective usefulness [$F(2, 164) = 23.74$, $p < .001$ for Immersion; $F(1.59, 130.55) = 81.04$, $p < .001$ for Enjoyment; $F(1.17, 140.40) = 2.55$, $p = .090$ for Subjective usefulness; $F(1.80, 147.81) = 187.23$, $p < .001$ for Ease of use; and $F(1.83, 150.14) = 136.97$, $p < .001$ for Motivation]. The interaction effect between the within-subjects factor and sex was not significant in all cases [$F(2, 164) = 2.06$, $p = .130$ for Immersion; $F(1.59, 130.55) = 0.11$, $p = .847$ for Enjoyment; $F(1.17, 140.40) = 0.61$, $p = .606$ for Subjective usefulness; $F(1.80, 147.81) = 0.01$, $p = .984$ for Ease of use; and $F(1.83, 150.14) = 2.45$, $p = .094$ for Motivation]. Table 5 presents the Mixed Model ANOVA results.

Table 5. Mixed Model ANOVA results

Factor	Source	*df*	*SS*	*MS*	*F*	*p*	η_p^2
Immersion	Between-Subjects						
	Sex	1	1.92	1.92	1.22	.272	0.01
	Residuals	82	128.63	1.57			
	Within-Subjects						
	Within factor	2	22.00	11.00	23.74	< .001	0.22
	Sex*Within factor	2	1.91	0.96	2.06	.130	0.02
	Residuals	164	76.00	0.46			
Enjoyment	Between-Subjects						
	Sex	1	0.89	0.89	0.84	.361	0.01
	Residuals	82	86.03	1.05			
	Within-Subjects						
	Within factor	1.59	34.77	21.84	81.04	< .001	0.50
	Sex*Within factor	1.59	0.05	0.03	0.11	.847	0.00
	Residuals	130.55	35.18	0.27			
Subjective usefulness	Between-Subjects						
	Sex	1	0.04	0.04	0.06	.809	0.00
	Residuals	82	61.85	0.75			
	Within-Subjects						
	Within factor	1.17	1.40	0.70	2.55	.090	0.03
	Sex*Within factor	1.17	0.33	0.17	0.61	.606	0.01
	Residuals	140.40	45.15	0.28			
Ease of use	Between-Subjects						
	Sex	1	0.00	0.00	0.00	.978	0.00
	Residuals	82	68.03	0.83			
	Within-Subjects						
	Within factor	1.80	48.36	26.83	187.23	< .001	0.70

	Sex*Within factor	1.80	0.00	0.00	0.01	.984	0.00
	Residuals	147.81	21.18	0.14			
	Between-Subjects						
	Sex	1	0.21	0.21	0.26	.609	0.00
	Residuals	82	65.53	0.80			
Motivation	Within-Subjects						
	Within factor	1.83	45.68	24.94	136.97	< .001	0.63
	Sex*Within factor	1.83	0.82	0.45	2.45	.094	0.03
	Residuals	150.14	27.35	0.18			

The pairwise contrasts (Table 6) revealed that:

- While immersion in the printed material was similar to that in regular videos [$t(41) = -1.65$, $p = .108$ for boys and $t(41) = -1.83$, $p = .074$ for girls], it was significantly less than in 360º videos [$t(41) = -3.36$, $p = .002$ for boys and $t(41) = -6.22$, $p < .001$ for girls]. Interestingly, girls considered 360º videos as being more immersive than regular videos, while boys considered them as being equally immersive [$t(41) = -1.81$, $p = .074$ for boys and $t(41) = -4.56$, $p < .001$ for girls].
- Boys and girls enjoyed the use of printed material less than regular videos [$t(41) = -5.71$, $p < .001$ for boys and $t(41) = -6.10$, $p < .001$ for girls] and 360º videos [$t(41) = -7.69$, $p < .001$ for boys and $t(41) = -7.11$, $p < .001$ for girls]. They also enjoyed the use of regular videos less than 360º videos [$t(41) = -4.66$, $p < .001$ for boys and $t(41) = -3.09$, $p = .004$ for girls].
- As we already stated, there were no statistically significant differences regarding the tools' subjective usefulness.
- The printed material was considered as being easier to use than regular videos [$t(41) = 7.99$, $p < .001$ for boys and $t(41) = 7.23$, $p < .001$ for girls] and 360º videos [$t(41) = 11.65$, $p < .001$ for boys and $t(41) = 12.51$, $p < .001$ for girls]. Also, regular videos were considered as being easier to use than 360º videos [$t(41) = 7.02$, $p < .001$ for boys and $t(41) = 7.57$, $p < .001$ for girls].
- The participating students found the use of the printed material as being less motivating than regular videos [$t(41) = -3.23$, $p = .002$ for boys and $t(41) = -5.27$, $p < .001$ for girls] and 360º videos [$t(41) = -9.55$, $p < .001$ for boys and $t(41) = -11.25$, $p < .001$ for girls]. It was also found that the use of regular videos was less motivating than the use of 360º videos [$t(41) = -7.83$, $p < .001$ for boys and $t(41) = -9.35$, $p < .001$ for girls].

Table 6. Pairwise contrasts for the Mixed Model ANOVA (Tukey comparisons)

Factor	Contrast	Difference	*SE*	*df*	*t*	*p*	d_{Cohen}
Immersion	Boys						
	Printed material-Regular videos	-0.27	.16	41	-1.65	.108	0.25
	Printed material-360º videos	-0.54	.16	41	-3.36	.002	0.51
	Regular videos-360º videos	-0.27	.15	41	-1.81	.077	0.28
	Girls						
	Printed material-Regular videos	-0.24	.13	41	-1.83	.074	0.30
	Printed material-360º videos	-0.89	.14	41	-6.22	< .001	0.93
	Regular videos-360º videos	-0.65	.14	41	-4.56	< .001	0.66
Enjoyment	Boys						
	Printed material-Regular videos	-0.60	.10	41	-5.71	< .001	0.80
	Printed material-360º videos	-0.91	.12	41	-7.69	< .001	1.01
	Regular videos-360º videos	-0.32	.068	41	-4.66	< .001	0.67
	Girls						
	Printed material-Regular videos	-0.62	.10	41	-6.10	< .001	0.87
	Printed material-360º videos	-0.87	.12	41	-7.11	< .001	0.99
	Regular videos-360º videos	-0.25	.081	41	-3.09	.004	0.48
Ease of use	Boys						
	Printed material-Regular videos	0.51	.063	41	7.99	< .001	1.49
	Printed material-360º videos	1.08	.09	41	11.65	< .001	2.10
	Regular videos-360º videos	0.57	.08	41	7.02	< .001	1.08
	Girls						
	Printed material-Regular videos	0.50	.07	41	7.23	< .001	1.46
	Printed material-360º videos	1.06	.09	41	12.51	< .001	2.36
	Regular videos-360º videos	0.57	.07	41	7.57	< .001	1.14

Motivation	Boys						
	Printed material-Regular videos	-0.27	.08	41	-3.23	.002	0.50
	Printed material-360º videos	-0.91	.10	41	-9.55	< .001	1.31
	Regular videos-360º videos	-0.64	.08	41	-7.83	< .001	1.08
	Girls						
	Printed material-Regular videos	-0.52	.10	41	-5.27	< .001	0.75
	Printed material-360º videos	-1.15	.10	41	-11.25	< .001	1.49
	Regular videos-360º videos	-0.64	.07	41	-9.35	< .001	1.34

On the basis of the above results and for answering RQ2a-e, we can conclude that students viewed all tools as being equally useful and that the 360º videos were considered the least easy to use, followed by regular videos. On the other hand, the 360º videos were the most enjoyable and motivating tool among the three tools considered in this study. Finally, although the 360º videos offered the most immersive experience compared to printed material, there was an inconsistency in the results when compared to regular videos; girls considered 360º videos as being more immersive than regular videos, while boys considered both tools as being equally immersive.

As for the open-ended question, students reported usability issues related to the 360º videos and HMDs (n = 16 and n = 13 respectively). For example, the most common problem was that students did not properly adjust the HMDs' straps so as to fit their heads. There were also cases in which the smartphones had to be restarted because of overheating. Some students could not properly trigger the hotspots (n = 9). Most of the above problems were eliminated after the first session in which the HMDs were used. Discomfort caused by the use of HMDs was also an issue (n = 11). Finally, some cases of -mild-simulator sickness were reported (n = 8).

Additional analysis

Given that the 360º videos proved to be the most enjoyable, motivating, and immersive tool among the ones we tested, we decided to conduct an additional analysis, in order to gather insights for the impact of the above factors on the learning outcomes when viewing 360º videos. For that matter, we run a two-step hierarchical multiple regression analysis. The dependent variable was students' mean scores in the 360º videos' tests, while the independent variables were Sex (entered during the first step of the regression, for controlling its effects) and the mean scores of the five factors in the questionnaire for 360º videos. We have to note that our sample size was below the minimum threshold the relevant literature recommends for this type of analysis. We acknowledge this limitation and we advise caution when interpreting our results. Nevertheless, the results (Table 7) demonstrated that immersion, enjoyment, and motivation had a significant positive impact on students' learning when viewing the 360º videos (t = 4.15, p < .001; t = 3.92, p < .001; and t = 2.94, p = .004 respectively).

Table 7. Results of the multiple regression analysis

Step 1 model summary	$F(1, 82) = 3.19$, $p = .078$, $R = .193$, $R^2 = .037$				
Step 2 model summary	$F(5, 77) = 13.74$, $p < .001$, $R = .701$, $R^2 = .491$				
Strep 1 IV	***b***	**SE B**	***β***	***t***	***p***
Sex	4.66	2.61	.19	11.95	.078
Step 2 IVs					
Sex	3.26	2.00	.14	1.63	.108
Immersion	5.04	1.21	.36	4.15	< .001
Enjoyment	7.29	1.86	.34	3.92	< .001
Subjective usefulness	1.74	1.37	.11	1.27	.208
Ease of use	1.33	1.57	.07	0.84	.402
Motivation	6.54	2.22	.24	2.94	.004

Notes. b = unstandardized beta coefficients, SE B = standard errors for b, β = standardized error coefficients, t = t test statistic, p = probability value

Discussion

For every new digital tool, it is imperative to validate its impact on learning, so as all involved in education to be able to make informed decisions about whether it can be adopted or not (Grover et al., 1996). That being said, the analysis of students' scores in the evaluation tests we presented in the preceding section, demonstrated that 360º videos have statistically significant advantages in terms of knowledge gains compared to printed material but not compared to regular videos. Also, the analysis of the questionnaires brought to light some findings regarding the five factors we examined, worthy of further discussion.

An interesting observation is made by comparing the pre-test scores and the scores in the evaluation tests for the three tools (see Table 2). In short, the comparison reveals that we can expect an improvement of around 51.5% in students' prior knowledge with the use of printed material, around 60% with regular videos, and around 63.5% with 360º videos. While these results cannot be generalized to learning subjects other than the ones included in our study (i.e., subjects related to environmental education), they provide a -rather general- idea about the impact on learning that is expected from the use of the above tools.

There are two opposing interpretations of the outcomes, that reflect the ongoing and unsettled debate concerning all educational tools (regardless if they are ICT related or not). Some might suggest that the distance between the results of the printed material on one hand and both types of videos on the other, is not that great (although, statistically speaking, it is). Moreover, considering the time and effort needed for the development of 360º videos and the cost of obtaining the necessary technological apparatus, this technology might not be so appealing as it was initially considered. The questionnaires' results regarding the tools' subjective usefulness give partial and indirect support to such claims. Indeed, students expressed the view that all tools were equally effective in facilitating their learning, despite the fact that they liked 360º videos more (as it is evident in the results concerning other factors). Yet, others, including us, might argue that education is not about how much better are the learning outcomes of a tool compared to others, but whether they are better or not. That is because, in education, small differences do count and accumulate into larger differences through the course of time. In this respect, even the 3.5% difference that we found between regular and 360º videos, though not statistically significant, might be important. Not only that, but we have to emphasize that, in this study, we examined the effects of 360º videos without embedding them (or the other tools) in a teaching framework. On the basis of the results of our previous studies in which we did exactly that and given that we used the same learning material, we can theorize that better results can be expected, as the use of 360º videos seems to be well-aligned with contemporary teaching methods.

Nevertheless, our findings confirm the existing literature reporting that 360º videos are able to produce positive learning outcomes (e.g., Chang et al., 2019; Fokides & Arvaniti, 2020; Wu et al., 2019). Thus, what we have to discuss is the "why" these outcomes were observed. In line with past research, we found that the feeling of immersion was strong in 360º videos (e.g., Berns et al., 2018; Elmezeny et al., 2018; Fokides & Kefalinou, 2020; Higuera-Trujillo et al., 2019). Furthermore, in our additional analysis, we confirmed the positive impact of this factor on the learning outcomes. Therefore, immersion offers a quite strong explanation for the outcomes, as it allows a better understanding of concepts and processes (e.g., Chang et al., 2019; Dawson et al., 2018; Fokides & Arvaniti, 2020). In addition, we found that students were more motivated to learn when viewing 360º videos and we noted motivation's positive impact on students' learning. More or less we expected this finding, as motivation to learn seems to be one of the 360º videos' key-advantages (Fokides & Arvaniti, 2020; King-Thompson, 2017; Xie et al., 2019).

Learning satisfaction is important for determining the effectiveness of a tool. Research in learning satisfaction when regular videos are used, even in its early stages, has demonstrated that they offer a quite satisfying experience (Ritchie & Newby, 1989). As 360º videos are more advanced in terms of the presentation of the visual content, we expected higher levels of satisfaction, as others suggested (e.g., Huang et al., 2019; Violante et al., 2019). We examined two aspects of learning satisfaction: (i) how valuable/useful users consider the tools in relation to their learning; this factor has been widely used for measuring the impact of technologies such as augmented reality (e.g., Akçayır & Akçayır,

2017) and (ii) the fun/enjoyment students had when using these tools. As we already mentioned in a previous paragraph and interestingly enough, we did not find any differences in the tools' subjective usefulness (see Table 5). Then again, we have to stress that students considered all three tools highly useful (see Table 2). Moreover, of the three tools considered, students' enjoyment was higher in 360º videos (see Table 6). Thus, we can conclude that learning satisfaction was higher in 360º videos. What is also of interest, is that although enjoyment was very high, we found that it was positively correlated with the learning outcomes (see Table 7). Researchers suggested that the novelty of the experience intensifies enjoyment, which, in turn, can lead to increased knowledge gains (Lin et al., 2019). Yet, others suggested that overexcitement might lead to distraction and a subsequent decrease in knowledge gains (Rupp et al., 2016). While we acknowledge that the latter case is probable, we are more inclined towards the former one, because of our study's results.

Our results suggest that 360º videos are -by far- the least easy-to-use tool (see Table 2 and Table 6). This comes as a bit of surprise since we provided students enough time (at least in our view) to familiarize themselves with the HMDs and how to navigate in 360º videos; probably we had to allocate more time. Although we did not find a negative impact on the learning outcomes due to this issue, it is possible that it is related to low-tech HMDs (as were the ones we used in our study), as navigation is implemented in a somehow "unnatural" method, namely by keep looking towards the direction of a hotspot for a few seconds rather than with the use of hand-held controllers (Fokides et al., 2020). Finally, students reported some cases of discomfort and mild simulator sickness. Although there is literature suggesting that simulator sickness can be a significant problem (Rupp et al., 2019) negatively impacting learning (Lackner, 2014), we conclude that even the low-tech HMDs can be well-tolerated by young students, at least when they are used for a limited amount of time (around twenty minutes).

Implications for research and practice

Our study extends the existing literature regarding the impact 360º videos have on learning as it: (i) quantified and contrasted their learning outcomes with that of other tools commonly used in educational settings, (ii) explored students' views and feelings regarding their use, and (iii) quantified (with limitations) the impact of certain factors (i.e., enjoyment, motivation, and immersion). Due to the above, we can suggest a number of interesting implications for all involved in the educational uses of 360º videos. For example, we noted elevated levels of enjoyment and motivation when students explored the educational material using this technology. Although this is not uncommon in educational ICTs, software developers can explore pathways for increasing them even more. The addition of game-like features is among the most common approaches for achieving this (Fokides et al., 2019). On the other hand, we think that it is advisable to balance fun and learning, given that students' overexcitement, because the novelty of the experience 360º videos offer is already a distraction factor (Rupp et al., 2016). The addition of game-like features might intensify distraction's negative effects. We also found that students considered 360º videos the least easy tool to use. As we theorized in the previous section, the way navigation was implemented was a probable cause. Given that, we advise the use of hand-held controllers or even hand-tracking devices, since navigation using them is more natural (Miller & Bugnariu, 2016). Then again, the trade-off is the additional cost of these devices and the relatively harder implementation (in terms of programming/software development). Moreover, as we used low-tech HMDs, this might have had a negative impact on immersion and, in turn, on the learning outcomes as others suggested (Rupp et al., 2019). Therefore, we underline the need for studies comparing different types of HMDs, offering different levels of immersion, in order to examine its exact impact on learning.

As for education, on the basis of our results, it seems that 360º videos offer an appealing path for presenting the learning material. Although they were as effective as regular videos, their more positive impact on motivation cannot be overlooked. Yet, some constraints regarding their integration in everyday teaching cannot be ignored. We consider the lack of reliable educational content to be the most significant one. Even though millions of 360º videos are available, most of them for free, far less are suitable for educational use, as their vast majority was recorded for recreational purposes. Initiatives for delivering educational content with the use of 360º videos are scarce (e.g., Google Expeditions). Furthermore, it is questionable whether educators are willing to dedicate the amount of time needed for

recording and editing such videos by themselves. To make things worse, the infrastructure required, even for low-tech HMDs and smartphones, is not always present, although the cost is not considerable. Thus, we believe that steps should be taken in order to convince education administrators and policymakers to take action.

Limitations and future work

Although our data suggest that 360º videos have a positive impact on learning, we have to acknowledge certain limitations of our study. Although our sample size was more than satisfactory, we targeted a rather narrow age-range (ten-to eleven years old); thus, we are not able to offer valuable insights about what the impact of 360º videos might be on younger or older students. The learning subject of the videos might also raise some concerns. That is because environmental issues are rather difficult to grasp and the cognitive load might not have been that well-suited for students of the aforementioned age. As we already mentioned in the last section of our data analysis, the results regarding the impact of certain factors on the effectiveness of 360º videos have to be viewed with caution, as the sample size was not ideal for multiple regression analysis. All the above limitations can serve as guiding principles for future research projects. In addition, it would be interesting to analyze educators' views about the introduction of this technology to their teaching. Longitudinal studies are also needed for assessing the effectiveness of 360º videos when the novelty effect wears out. Finally, we think that comparisons with other available or emerging technologies (e.g., augmented reality and fully immersive VR using high-tech HMDs) are needed, so as to understand the pros and cons of this technology.

Conclusion

An ever-growing number of either conventional or ICT related tools are utilized with the objective to improve students' learning. One such tool is 360º videos. Although the general consensus is that they are effective, the existing literature does not give definite answers regarding their exact educational potential. This was the driving force of our study. By comparing the results with the ones coming from the use of regular videos and conventional printed material, we tried to determine whether they constitute an attractive, and, at the same time, effective alternative solution for presenting the learning material. Eighty-four ten-to-eleven-year-old students participated in our experiment. On the basis of the results, we can conclude that while 360º videos produced better learning gains than printed material, they did not offer significant advantages compared to regular videos. We have to note that the above results display what the tools per se can achieve, as we did not examine them in the context of a teaching framework. Moreover, we concluded that motivation, enjoyment, and immersion play a significant role in 360º videos' effectiveness. On the negative side, we found that usability issues are a concern, as 360º videos were the least easy to use tool. In conclusion, our study adds more evidence to the body of research supporting that 360º videos have an interesting educational potential and that educators can consider using them in their daily practices.

References

Akçayır, M., & Akçayır, G. (2017). Advantages and challenges associated with augmented reality for education: A systematic review of the literature. *Educational Research Review, 20*, 1-11. https://doi.org/10.1016/j.edurev.2016.11.002

Ardisara, A., & Fung, F. M. (2018). Integrating 360° videos in an undergraduate chemistry laboratory course. *Journal of Chemical Education, 2018*, 1881-1884. https://doi.org/10.1021/acs.jchemed.8b00143

Argyriou, L., Economou, D., & Bouki, V. (2020). Design methodology for 360 immersive video applications: the case study of a cultural heritage virtual tour. *Personal and Ubiquitous Computing*, 1-17. https://doi.org/10.1007/s00779-020-01373-8

Argyriou, L., Economou, D., Bouki, V., & Doumanis, I. (2016). Engaging immersive video consumers: Challenges regarding 360-degree gamified video applications. *Proceedings of the 15th International*

Conference on Ubiquitous Computing and Communications and 2016 International Symposium on Cyberspace and Security (IUCC-CSS), 145-152. IEEE. https://doi.org/10.1109/IUCC-CSS.2016.028

Berns, A., Mota, J. M., Ruiz-Rube, I., & Dodero, J. M. (2018). Exploring the potential of a 360° video application for foreign language learning. *Proceedings of the Sixth International Conference on Technological Ecosystems for Enhancing Multiculturality-TEEM'18*, 776-780. ACM https://doi.org/10.1145/3284179.3284309

Carr-Chellman, A., & Duchastel, P. (2000). The ideal online course. *British Journal of Educational Technology, 31*(3), 229-241. https://doi.org/10.1111/1467-8535.00154

Chang, C. -Y., Sung, H. -Y., Guo, J. -L., Chang, B. -Y., & Kuo, F. -R. (2019). Effects of spherical video-based virtual reality on nursing students' learning performance in childbirth education training. *Interactive Learning Environments*, 1-17. https://doi.org/10.1080/10494820.2019.1661854

Cohen, J. (1969) *Statistical power analysis for the behavioral sciences*. Academic Press.

Curcio, I. D., Dipace, A., & Norlund, A. (2016). Virtual realities and education. *Research on Education and Media, 8*(2), 60-68. https://doi.org/10.1515/rem-2016-0019

Dawson, H., Alami, N., Bowen, K., & Maddah, D. (2019). The use of virtual reality for public health education with reference to Syrian refugee camps. *Proceedings of the Virtual and Augmented Reality to Enhance Learning and Teaching in Higher Education Conference 2018*, 73-81. IM Publications Open. https://doi.org/10.1255/vrar2018.ch8

DeCarlo, L. T. (1997). On the meaning and use of kurtosis. *Psychological Methods, 2(*3), 292-307. https://doi.org/10.1037/1082-989X.2.3.292

Dede, C. (2009). Immersive interfaces for engagement and learning. Science, 323(5910), 66-69. https://doi.org/10.1126/science.1167311

Dede, C. J., Jacobson, J., & Richards, J. (2017). Introduction: virtual, augmented, and mixed realities in education. In Virtual, Augmented, and Mixed Realities in Education (pp. 1-16). Springer. https://doi.org/10.1007/978-981-10-5490-7_1

Diemer, J., Alpers, G. W., Peperkorn, H. M., Shiban, Y., & Mühlberger, A. (2015). The impact of perception and presence on emotional reactions: a review of research in virtual reality. *Frontiers in Psychology, 6*(26), 1-9. https://doi.org/10.3389/fpsyg.2015.00026

Elmezeny, A., Edenhofer, N., & Wimmer, J. (2018). Immersive storytelling in 360-degree videos: An analysis of interplay between narrative and technical immersion. *Journal for Virtual Worlds Research, 11*(1), 1-13. https://doi.org/10.4101/jvwr.v11i1.7298

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*(2), 175-191. https://doi.org/10.3758/BF03193146

Field, A. (2013). *Discovering statistics using SPSS* (4th ed.). Sage Publications

Fokides, E., & Arvaniti, P. A. (2020). Evaluating the effectiveness of 360 videos when teaching primary school subjects related to environmental education. *Journal of Pedagogical Research, 2020*. https://doi.org/10.33902/JPR.2020063461

Fokides, E., Atsikpasi, P., Kaimara, P., & Deliyannis, I. (2019). Let players evaluate serious games. Design and validation of the Serious Games Evaluation Scale. *International Computer Games Association Journal, 41*(3), 116-137. https://doi.org/10.3233/ICG-190111

Fokides, E, & Kefalinou, M. (2020). Examining the impact of spherical videos in teaching endangered species/environmental education to primary school students. *Journal of Information Technology Education: Research, 19*, 427-450. https://doi.org/10.28945/4612

Fokides, E., Polydorou, E., & Mazarakis, P. (2020). Using spherical videos for teaching history to high school students. *International Journal of Smart Education and Urban Society*, *11*(4), 18-34. https://10.4018/IJSEUS.2020100102

Fowler, C. (2015). Virtual reality and learning: Where is the pedagogy? *British Journal of Educational Technology*, *46*(2), 412-422. https://doi.org/10.1111/bjet.12135

Fung, F. M., Choo, W. Y., Ardisara, A., Zimmermann, C. D., Watts, S., Koscielniak, T., Blanc, E., Coumoul, X., & Dumke, R. (2019). Applying a virtual reality platform in environmental chemistry education to conduct a field trip to an overseas site. *Journal of Chemical Education*, *96*(2), 382-386. https://doi.org/10.1021/acs.jchemed.8b00728

Gravetter, F. J., & Forzano, L. A. B. (2018). *Research methods for the behavioral sciences*. Cengage Learning.

Greenhouse, S. W., & Geisser, S. (1959). On methods in the analysis of profile data. *Psychometrika*, *24*(2), 95-112. https://doi.org/10.1007/BF02289823

Greenwald, A. G. (1976). Within-subjects designs: To use or not to use? *Psychological Bulletin*, *83*(2), 314. https://doi.org/10.1037/0033-2909.83.2.314

Grover, V., Jeong, S. R., & Segars, A. H. (1996). Information systems effectiveness: The construct space and patterns of application. Information and Management, 31(4), 177-191. https://doi.org/10.1016/S0378-7206(96)01079-8

Higuera-Trujillo, J. L., López-Tarruella Maldonado, J., & Llinares Millán, C. (2017). Psychological and physiological human responses to simulated and real environments: A comparison between photographs, 360° panoramas, and virtual reality. *Applied Ergonomics*, *65*(65), 398-409. https://doi.org/10.1016/j.apergo.2017.05.006

Hodgson, P., Lee, V. W. Y., Chan, J. C. S., Fong, A., Tang, C. S. Y., Chan, L., & Wong, C. (2019). Immersive virtual reality (IVR) in higher education: Development and implementation. *Augmented Reality and Virtual Reality*, 161-173. https://doi.org/10.1007/978-3-030-06246-0_12

Huang, H., Hwang, G., & Chang, C. (2019). Learning to be a writer: A spherical video-based virtual reality approach to supporting descriptive article writing in high school Chinese courses. *British Journal of Educational Technology*, *2019*, 1-20. https://doi.org/10.1111/bjet.12893

Johnson, C. D. L. (2018). Using virtual reality and 360-degree video in the religious studies classroom: An experiment. *Teaching Theology & Religion*, *21*(3), 228-241. https://doi.org/10.1111/teth.12446

Karageorgakis, T., & Nisiforou, E. A. (2018). Virtual reality in the EFL classroom. *The Cyprus Review*, *30*(1), 381-396.

Keren, G. (2014). Between-or within-subjects design: A methodological dilemma. In G. Keren, & C. Lewis (Eds.), A handbook for data analysis in the behaviorial sciences (pp. 257-272). Psychology Press.

King-Thompson, J. (2017). *The benefits of 360° Videos & Virtual Reality in Education*. https://blend.media/blog/benefits-of-360-videos-virtual-reality-in-education

Kittel, A., Larkin, P., Elsworthy, N., Lindsay, R., & Spittle, M. (2020). Effectiveness of 360° virtual reality and match broadcast video to improve decision-making skill. Science and Medicine in Football, 2020. (in press). https://doi.org/10.1080/24733938.2020.1802506

Lackner, J. R. (2014). Motion sickness: more than nausea and vomiting. Experimental Brain Research, 232(8), 2493-2510. https://doi.org/10.1007/s00221-014-4008-8

Lee, S. H., Sergueeva, K., Catangui, M., & Kandaurova, M. (2017). Assessing Google Cardboard virtual reality as a content delivery system in business classrooms. *Journal of Education for Business*, *92*(4), 153-160. https://doi.org/10.1080/08832323.2017.1308308

Lin, H. C. -S., Yu, S. -J., Sun, J. C. -Y., & Jong, M. S. Y. (2019). Engaging university students in a library guide through wearable spherical video-based virtual reality: Effects on situational interest and cognitive load. *Interactive Learning Environments*, 1-16. https://doi.org/10.1080/10494820.2019.1624579

Mauchly, J. W. (1940). Significance test for sphericity of a normal n-variate distribution. *The Annals of Mathematical Statistics, 11*(2), 204-209. https://doi.org/10.1214/aoms/1177731915

Meyer, J., & Land, R. (2003). Threshold concepts and troublesome knowledge: Linkages to ways of thinking and practising within the disciplines. In C. Rust (Ed.), *Improving student learning-ten years on* (pp. 412-424). OCSLD.

Miller, H. L., & Bugnariu, N. L. (2016). Level of immersion in virtual environments impacts the ability to assess and teach social skills in autism spectrum disorder. *Cyberpsychology, Behavior, and Social Networking, 19*(4), 246-256. https://doi.org/10.1089/cyber.2014.0682

Newton, R. R., & Rudestam, K. E. (2012). *Your statistical consultant*. Sage Publications.

Paraskevaidis, P., & Fokides, E. (2020). Using 360o videos for teaching volleyball skills to primary school students. *Open Journal for Information Technology, 3*(1), 21-38. https://doi.org/10.32591/coas.ojit.0301.03021p

Parmaxi, A., Stylianou, K., & Zaphiris, P. (2018). Enabling social exploration through virtual guidance in Google Expeditions: An exploratory study. *Advances in Intelligent Systems and Computing*, 397-408. https://doi.org/10.1007/978-3-319-75175-7_40

Pintaric, T., Neumann, U., & Rizzo, A. (2000). Immersive panoramic video. *Proceedings of The Eighth ACM International Conference on Multimedia-MULTIMEDIA '00*, 493-494. https://doi.org/10.1145/354384.376408

Pham, H. C., Dao, N., Pedro, A., Le, Q. T., Hussain, R., Cho, S., & Park, C. S. I. K. (2018). Virtual field trip for mobile construction safety education using 360-degree panoramic virtual reality. *International Journal of Engineering Education, 34*, 1174-1191.

Ritchie, H., & Newby, T. J. (1989, July). Instruction: Classroom lecture/discussion vs. Live televised instruction: A comparison of effects on student performance, attitude, and interaction. American *Journal of Distance Education, 3*, 36-45. https://doi.org/10.1080/08923648909526677

Ritter III, K. A., Stone, H., & Chambers, T. L. (2019). Empowering Through Knowledge: Exploring place-based environmental education in Louisiana classrooms through Virtual Reality. *The ASEE Computers in Education Journal, 10*(1).

Rupp, M. A., Kozachuk, J., Michaelis, J. R., Odette, K. L., Smither, J. A., & McConnell, D. S. (2016). The effects of immersiveness and future VR expectations on subjective-experiences during an educational 360 video. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* (Vol. 60, No. 1), 2108-2112. SAGE Publications. https://doi.org/10.1177/1541931213601477

Rupp, M. A., Odette, K. L., Kozachuk, J., Michaelis, J. R., Smither, J. A., & McConnell, D. S. (2019). Investigating learning outcomes and subjective experiences in 360-degree videos. *Computers & Education, 128*, 256-268. https://doi.org/10.1016/j.compedu.2018.09.015

Sankaran, N. K., Nisar, H. J., Zhang, J., Formella, K., Amos, J., Barker, L. T., Vozenilek, J. A., La-Valle, S. M., & Kesavadas, T. (2019). Efficacy study on interactive mixed reality (IMR) software with sepsis prevention medical education. *Proceedings of the 2019 IEEE Conference on Virtual Reality and 3D User Interfaces (VR)*, 664-670. IEEE. https://doi.org/10.1109/vr.2019.8798089

Sheridan, T. B. (2016). Recollections on presence beginnings, and some challenges for augmented and virtual reality. *Presence: Teleoperators and Virtual Environments, 25*(1), 75-77. https://doi.org/10.1162/PRES_e_00247

Skondras, E., Siountri, K., Michalas, A., & Vergados, D. D. (2019). Personalized real-time virtual tours in places with cultural interest. *International Journal of Computational Methods in Heritage Science*, *3*(1), 52-68. https://doi.org/10.4018/IJCMHS.2019010104

Slater, M. (2009). Place illusion and plausibility can lead to realistic behaviour in immersive virtual environments. *Philosophical Transactions of the Royal Society of London B: Biological Sciences*, *364*(1535), 3549-3557. https://doi.org/10.1098/rstb.2009.0138

Slater, M. & Sanchez-Vives, M. V. (2016). Enhancing our lives with immersive virtual reality. *Frontiers in Robotics and AI*, *3*. https://doi.org/10.3389/frobt.2016.00074

Smith, W., Rafeek, R., Marchan, S., & Paryag, A. (2012). The use of video-clips as a teaching aide. *European Journal of Dental Education*, *16*(2), 91-96. https://doi.org/10.1111/j.1600-0579.2011.00724.x

Sun, F.-R., Pan, L.-F., Wan, R.-G., Li, H., & Wu, S.-J. (2018). Detecting the effect of student engagement in an SVVR school-based course on higher level competence development in elementary schools by SEM. *Interactive Learning Environments*, 1-14. https://doi.org/10.1080/10494820.2018.1558258

Sweller, J. (2005). Implications of cognitive load theory for multimedia learning. *The Cambridge Handbook of Multimedia Learning*, *3*(2), 19-30. https://doi.org/10.1017/CBO9780511816819.003

Taber, K. S. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education*, *48*(6), 1273-1296. https://doi.org/10.1007/s11165-016-9602-2

Tiku, M. L. (1971). Power function of the F-test under non-normal situations. *Journal of the American Statistical Association*, *66*(336), 913-916. https://doi.org/10.2307/2284254

Tüzün, H., & Özdinç, F. (2016). The effects of 3D multi-user virtual environments on freshmen university students' conceptual and spatial learning and presence in departmental orientation. *Computers & Education*, *94*, 228-240. https://doi.org/10.1016/j.compedu.2015.12.005

Ulrich, F., Helms, N. H., Frandsen, U. P., & Rafn, A. V. (2019). Learning effectiveness of 360° video: experiences from a controlled experiment in healthcare education. *Interactive Learning Environments*, 1-14. https://doi.org/10.1080/10494820.2019.1579234

Violante, M. G., Vezzetti, E., & Piazzolla, P. (2019). Interactive virtual technologies in engineering education: Why not 360° videos? *International Journal on Interactive Design and Manufacturing*, *13*(2), 729-742. https://doi.org/10.1007/s12008-019-00553-y

Whittleston, G. S., Haynes, B. J., & Mardan, A. (2018). *Three applications of augmented reality technologies in structural engineering education*. Institution of Structural Engineers-People and Paper Awards 2018. Retrieved from http://usir.salford.ac.uk/id/eprint/51072/1/Gareth-Whittleston-Three-applications-of-augmented-reality-technologies-in-structural-engineering-education.pdf

Wu, J., Guo, R., Wang, Z., & Zeng, R. (2019). Integrating spherical video-based virtual reality into elementary school students' scientific inquiry instruction: effects on their problem-solving performance. *Interactive Learning Environments*, 1-14. https://doi.org/10.1080/10494820.2019.1587469

Xie, Y., Ryder, L., & Chen, Y. (2019). Using interactive virtual reality tools in an advanced Chinese language class: a case study. *TechTrends*, 1-9. https://doi.org/10.1007/s11528-019-00389-z

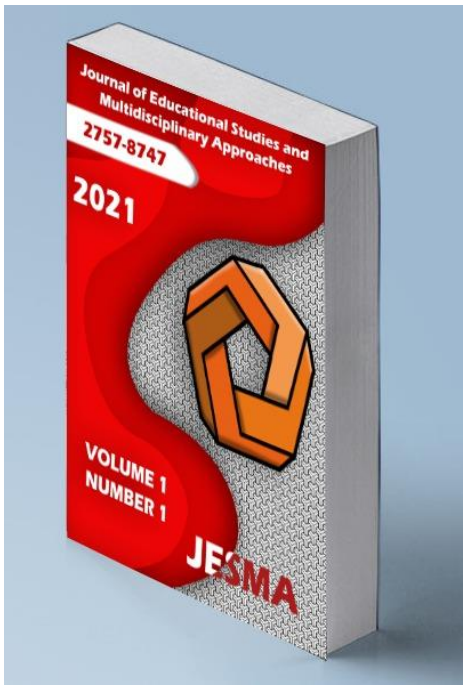
Zhou, C., Li, Z., & Liu, Y. (2017). A measurement study of Oculus 360-degree video streaming. *Proceedings of the 8th ACM on Multimedia Systems Conference*, 27-37. ACM. https://doi.org/10.1145/3083187.3083190

Appendix

The questionnaire's items

Factor	Item
Enjoyment	I think the tool* I used was fun
	I felt bored while using this tool**
	I enjoyed using this tool
	I really enjoyed studying with this tool
	I felt frustrated**
Subjective usefulness	I felt that this tool can ease the way I learn
	This tool was a much easier way to learn compared with the usual teaching
	This tool made my learning more interesting
	I felt that this tool helped me to increase my knowledge
	I felt that I caught the basics of what I was taught with this tool
Ease of use	I think it was easy to learn how to use this tool
	I found this tool unnecessarily complex**
	I think that most people will learn to use this tool very quickly
	I needed to learn a lot of things before I could get going with this tool**
	I felt that I needed help from someone else in order to use this tool because It was not easy for me to understand how to use it**
	It was easy for me to become skillful at using this tool
Immersion	I was deeply concentrated when using the tool
	If someone was talking to me, I couldn't hear him
	I forgot about time passing while using the tool
	I felt detached from the outside world while using the tool
Motivation	This tool did not hold my attention**
	When using this tool, I did not have the impulse to learn more about the learning subject**
	The tool did not motivate me to learn**

Notes. * = the word "tool" was replaced by "printed material", "regular videos", and "360º videos", depending on the tool students used; ** = item for which its scoring was reversed; all items were presented in a five-point Likert type scale



Journal of Educational Studies and Multidisciplinary Approaches (JESMA)

www.jesma.net

On the Innovativeness of Textbook Teaching for Excellence in Student Scholarship and Reducing Workload Demands

Robin Attfield [1] **Rebekah Humphreys** [2]
[1] Cardiff University – UK: attfieldr@cf.ac.uk
[2] University of Wales, Trinity St. David's, Lampeter – UK: r.humphreys@uwtsd.ac.uk

***** Corresponding Author: Rebekah Humphreys, r.humphreys@uwtsd.ac.uk

To cite this article:

Attfield, Robin, and Rebekah Humphreys (2021). On the Innovativeness of Textbook Teaching for Excellence in Student Scholarship and Reducing Workload Demands. *Journal of Educational Studies and Multidisciplinary Approaches (JESMA),1* (1), 71-77.
https://doi.org/10.51383/jesma.2021.4

Journal of Educational Studies and Multidisciplinary Approaches (JESMA)
Volume 1, Issue 1 Year 2021 ISSN:2757

On the Innovativeness of Textbook Teaching for Excellence in Student Scholarship and Reducing Workload Demands

Robin Attfield [1] https://orcid.org/0000-0002-3387-0251

Rebekah Humphreys [2] https://orcid.org/0000-0001-8965-055X

ARTICLE INFORMATION

Book Review
https://doi.org/10.51383/jesma.2021.4

Received 02 February 2021
Accepted 09 March 2021

ABSTRACT

Preparing Philosophy modules and teaching materials from scratch can be a daunting task, even for the most seasoned Lecturers. But armed with the right tools, the task can be completed with comparative ease. This paper shows how a well-designed textbook, together with ingenious use of it, provide the right tools for the job.

Keywords: innovative teaching; textbook; student-centred; lecturer-focused; Ethics: an Overview; workload; higher education

Introduction

(Robin Attfield, the author of the textbook, writes:) During 2009 I was invited by the publisher Continuum (now Bloomsbury) to compose a textbook on ethics. This was to be accompanied by a digital manual for teachers, supplying summaries, learning objectives and PowerPoints for every section of the book. As I had been teaching ethics, mostly at Cardiff University (but also in Nigeria), for over forty years, I gladly accepted the invitation. My impending retirement meant that there was enough time to complete the project. There was also a colleague, Patricia Clark, willing to prepare the PowerPoints, and generally to assist with the companion manual.

Sadly, Patricia Clark died in 2010, and the job of preparing the PowerPoints for the website was undertaken by Rebekah Humphreys, the co-author of this article, then a doctoral graduate of Cardiff University. And so, in 2012 *Ethics: An Overview* was published. That same year Dr. Humphreys was appointed Lecturer in Philosophy at University of Wales Trinity St. David (Lampeter Campus) and took the opportunity to use the textbook in her teaching there (see below).

In what follows, the six chapters of the textbook are depicted, together with their possible uses in different Departments; then uses to which this book has actually been put are outlined. The website which carries the section summaries, essay titles and reading, the sets of PowerPoints, and much more besides, is: https://www.bloomsbury.com/cw/ethics-an-overview/. But in the event of that website ceasing to be functional, I would be happy to supply anyone interested with its contents.

The Six Chapters and their Uses

Within the book's covers most of the field of ethics is studied, with chapters dedicated to six specific areas. These are: history of ethics; value-theory and the good life; normative ethics; applied ethics; meta-ethics; and free will and responsibility.

The Chapter on the history of ethics presents key contributions from the thought of five leading historical figures: Aristotle, Hobbes, Hume, Kant and John Stuart Mill. It seeks to clarify key themes of these thinkers, which are related to contemporary ethical thinking both here and in the following Chapters. Thus, the thought of Aristotle is related to virtue ethics in Chapter 3. Hume's views on motivation are returned to in (for example) the debate about internalism and externalism in Chapter 5 on meta-ethics. Kant's cosmopolitanism has been a major contribution to contemporary thought, while his 'categorical imperative' is revisited in Chapter 3 on normative ethics. So is Mill's utilitarianism, studied later in the revised form of practice-consequentialism.

In this Chapter, as in every Section of the book, study questions and reading-lists are supplied, while the accompanying website carries bullet-point summaries (and so on), plus PowerPoint slides devised so as to be usable by instructors in presenting the relevant material. For some Sections it also offers case studies, charts and, for the Aristotle Section, Multiple Choice Questions (MCQs), allowing instructors to select forms of teaching and learning appropriate to their situation. The four Sections of the history of ethics Chapter could be used either separately, or as part of a longer module including the two Chapters that follow, or the Chapter on meta-ethics.

The Chapter on the good life and value-theory opens with a Section on pleasure, happiness and flourishing, and proceeds to one on moral standing, value and intrinsic value, inviting readers to develop their own stance. The Section on worthwhile life, self-respect and meaningful work takes matters further, and then the final Section (on 'The Good Life, Virtue, Needs and Morality') considers explicitly a range of issues, such as the nature of needs, and whether virtue is needed for the good life, implicitly raised in the Aristotle Section. Some students and instructors may prefer to begin their study of ethics with this Chapter. In this and the following Chapter, there are several references to my more detailed book on these matters, *Value, Obligation and Meta-Ethics* (1995/2018), which delves into the relevant issues more thoroughly (and has recently been re-issued by Brill of Leiden).

The Chapter on Normative Ethics builds on the insights about moral standing and intrinsic value of Chapter 2, opening with a Section on 'Moral Standing, Value, Rights and Rightness'. This discussion of concepts such as rightness prepares the way for the coming Sections on 'Consequentialism and Its Critics', while the following Section considers other theories of normative ethics such as deontology and contractarianism. The Section on 'Virtue Ethics' opens with a consideration of whether theories and principles are needed at all, and proceeds to consider virtue ethics, sometimes regarded as itself a move away from principles. But it goes on to argue that principles of rightness and of obligation remain crucial. The final Section introduces the possibility that the advocacy of virtue (green virtues included) can be fruitfully integrated with practice-consequentialism.

The Chapter on Applied Ethics discusses the implications of a range of normative theories (including forms of deontology, contract-theory, virtue ethics, and consequentialism) for specific practical fields. It opens with 'The Re-emergence of Applied Ethics', since applied ethics almost disappeared in the English-speaking world for approximately the first six decades of the twentieth century, and then covers factors explaining its near-eclipse and its subsequent resurrection. This Section also introduces Inter-generational Ethics and Population Ethics. The following five Sections introduce Biomedical Ethics, Animal Ethics, Development Ethics, Environmental Ethics and the Ethics of War, and explain their origins (ancient in some cases, recent in others), together with recent issues and contributions. Their bearing on matters of ethical theory is also raised, not least in connection with the wider scope of ethical concern brought to the fore by recent work in Environmental Ethics.

Some instructors and students may prefer to begin their use of the book either with this Chapter as a whole, or with one or more of its Sections. If used together with the PowerPoint slides available from the website, it could form the core of a short course on applied ethics, or (with Chapter 3) part of a longer course on normative ethics and its applications.

Particular sections of this Chapter could also be used in University Schools or Departments other than Philosophy. For example, the Medical Ethics section could be used in Medical Schools, and the Development Ethics section in Departments teaching international development or international politics. The section on Environmental Ethics could be used in Schools of Environmental Studies, and also in scientific Departments (such as departments of Genetics), where study of the Precautionary Principle and its applications is much needed and widely neglected. There again, the section on the Ethics of War could be used in connection with discussion of Just War theory, in Departments of Politics of Religious Studies.

The next Chapter explains key positions and developments in Meta-ethics. While students can sometimes feel apprehensive about this area of ethics, experience suggests that University and College students are well capable of grasping (and writing good essays or papers about) the material presented here. Issues about the meaning and status of moral discourse are philosophically important ones, including issues about whether moral claims have any kind of objectivity and can be known; and these issues are introduced in the five Sections of this Chapter. The first Section introduces and considers theories that deny the possibility of such knowledge, while the second reviews attempt to throw light on how claims about 'good' and about 'ought' can be grounded. The third appraises the case for moral realism and cognitivism, while the fourth considers arguments (originating with Hume) against these stances based on the motivating capacity (or 'practicality') of moral language. The final Section introduces ethical naturalism, and at the same time theories about the grounds of moral claims, in ways that cohere with stances presented earlier in the book.

This Chapter could be studied alone, or could be combined with the first Chapter, or the first three Chapters, in a longer course. Here the website is likely to be of help, particularly to those not previously trained in meta-ethics. The later chapters of *Value, Obligation and Meta-Ethics* (1995.2018), and of its predecessor *A Theory of Value and Obligation* (1987/2020) may also be found to serve as an amplification of this Chapter (both have been reprinted recently), alongside the many other works referenced there.

Chapter Six, on Free Will and Responsibility, has been given an historical structure to make these issues more accessible. The first of the four Sections introduces the treatment of related issues by Aristotle, and the original discovery of the problematic implications of determinism by Epicurus. This approach supplies a followable entry into the central problem and also into issues surrounding compatibilism and incompatibilism. The second Section brings in belief in laws of nature (newly introduced in the Early Modern period), together with related understandings of determinism, the stances of Hume and Kant, and the theory of agency of Reid (all of which have contemporary followers). The third covers more recent thought about these matters, including the implications of Darwinism and of quantum indeterminacy, and compatibilist attempts to analyse the key phrase 'could have done otherwise'. The final Section, 'The Future is Open', embodies arguments against compatibilism and determinism, and a suggested account (based on the recent work of Mary Midgley (1994)) of how human evolution makes libertarian freedom possible.

Once again, this Chapter could be used for a short, self-standing course. (The PowerPoint slides of the website will prove particularly useful to instructors.) Alternatively it could be used in conjunction with the first Chapter in a course on the History of Ethics, or with chapters such as the ones on the Good Life and on Normative Ethics, to which issues of the nature of character and of degrees of responsibility are also relevant. Or it could be used with the rest of the book as a whole, so as to cover all the key areas of ethics. For use actually made of this Chapter at Lampeter, see below.

This book is not, of course, comprehensive. But selectiveness has been the price of breadth and of focus on stimulating and promoting debates (particularly in the field of applied ethics) by which ethicists and their students are currently exercised. Studying this book will give its readers a good grounding in the rudiments of ethics and will offer numerous ways of taking this study further, of progressing into work of a more advanced nature, and generally of doing ethics for yourself.

Case Studies and Use of the Textbook at UWTSD, Lampeter Campus

(Rebekah Humphreys writes:) What follows is my own experience of using the textbook in my role as Lecturer of Philosophy at UWTSD from 2012 onwards. Having composed the PowerPoint slides accompanying the textbook before I started teaching at UWTSD, I was already familiar with how the book would be of help in teaching modules on ethics, but was surprised by how much the book would assist me in my teaching of other areas in Philosophy, most notably Ancient Greek Philosophy, Early-Modern Philosophy, Mind and Metaphysics, and Knowledge and Reality.

Ancient Greek Philosophy

With regards to Ancient Greek Philosophy, one of the key learning outcomes of this level 4 (year 1) module is that students should be able to demonstrate an understanding of key concepts in Aristotle's Ethics (Books 1 and 2), including the good, eudaemonia, and virtue. Pressed for time (as many lecturers are), I found (to my delight – and, I should add, relief!) that I had a suitable PowerPoint presentation to hand in the form of the slides accompanying the website component of the Aristotle section (of Chapter One: History of Ethics) of the textbook.

These slides covered the main concepts, as well as objections and counter-objections to Aristotle's account of the virtues. This content enabled me to challenge not just the weaker students, but the stronger ones too, and although I taught (and still teach) this module at level 4, I would use these slides if I were to teach the topic at level 5 or 6 (years 2 or 3). While level 4 students are expected to read the article by John Ackrill and the book by Anthony Gottlieb, students of higher levels could be expected to engage with additional secondary reading such as that of Martha Nussbaum and Roger Crisp. (References to all these readings and more are provided in the textbook and the relevant website component.)

In order for the students to demonstrate that they met the aforementioned learning outcome, they were required informally to discuss in class the two 'questions to consider' (as presented in the same section of textbook), and then to submit two assessments linked to these questions. Students particularly enjoyed engaging with the discussion questions, answers to which could be formulated via their reading of the relevant section of the textbook, alongside Aristotle's Ethics and secondary scholarship. Students enrolled on this module included (and still include) students of Classics, History, Anthropology, and Philosophy.

Thus, in respect of my delivery of the classes on Aristotle's ethics and in terms of my teaching preparation, I had everything readily available through the textbook and its relevant website component, saving me time and valuable energy. Further, the format and content of the textbook as a whole allows for a coherent, well-structured and transparent (to the students and others) teaching method that embodies the important concept of constructive alignment (see Biggs, 2003).

Early Moderns

As part of the Early Modern Philosophy module (level 5 / year 2), I teach Hume on moral sentiment. For this teaching, Section Two of Chapter 1 (History of Ethics) on Hobbes and Hume is used. Student reading material here includes the relevant sections of Hume's Treatise and Inquiry, as well as items of secondary reading (the full references to all the reading material were derived from the website component of the textbook). Essay titles and corresponding reading resources are sourced from that same component.

Thus, as with my delivery of the lectures on Aristotle's ethics, for my teaching of Hume I already had to hand materials which could be readily utilised in their current format. Indeed, I was able to 'read around' the overview of Hume's arguments regarding deriving 'an ought' from 'an is', and thus this overview provided me with 'skeleton' lecture notes. Again, students on this module included / include not just students of Philosophy, but of Anthropology and History too.

While this is a level 5 module, related themes could be taught at level 6 and at postgraduate level by incorporating content from a later Chapter (specifically, Section One of Chapter 5: Noncognitivism, Prescriptivism and Projectivism), including content on the naturalistic fallacy. Reading listed in this same section could then be added to the reading list accordingly, and the PowerPoint slides on and summary of Noncognitivism, Prescriptivism and Projectivism could then be used to deliver the lecture(s).

Should I be allocated the formidable task of teaching a module exclusively on Kant, then the textbook's Section on Kant and its corresponding website component (Section Three, Chapter One) would be a port of call in terms of preparing such teaching.

Knowledge and Reality, and Mind and Metaphysics

The other modules that are not ethics-focused, yet for which I have made good use of the textbook, are Knowledge and Reality (level 4 / year 1), and Mind and Metaphysics (level 6 / year 3). For both of these modules I have delivered (and continue to deliver) lessons on free will; lessons for which I use the PowerPoint presentation of Section Four ('The Future is Open') of Chapter Six (on free will and responsibility), found in the related website component. This includes a slide of a diagram of possible stances (compatibilism, incompatibilism, and determinism), their definitions, as well as the different forms these stances may take. The slides also present evaluations of each of the stances; these evaluations are discussed in class amongst the students. Again, the content of my lecture itself is based around the summary provided in that same website component. Essay questions and corresponding reading is also derived from this teacher's resource.

Should I deliver this topic at postgraduate level, then I would make use of all the Sections in the teacher's resource of Chapter Six (on Free Will and Responsibility) and the reading material therein. Indeed, the teacher's use of the website components can be adapted to the level taught.

Elucidating tricky concepts

So far, I have outlined four modules for which I use the textbook in teaching. With regards to some of the other modules I deliver – and to modules that are focused more obviously on ethics (including Environment Philosophy at level 5 and at postgraduate level) – the textbook is similarly used, but in addition I use the case-studies for in-class discussions. I will not discuss these modules here but will add that I also use the textbook for elucidating specific philosophical issues to students (issues which do not tend to be linked to particular modules).

For example, there is a topic with which students of all Humanities disciplines frequently struggle (or do not realise they are struggling with); that topic concerns value and its variants. Teaching students across disciplines, all in the same class, can result in students often 'talking past each other' due to concepts related to value being construed in very different, discipline-specific ways. This creates confusions and misunderstandings in class, as well as the usual heated yet healthy arguments. With regards to issues concerning value, I often direct students to Section Two of Chapter Two (on moral standing, value and intrinsic value), which outlines the different sorts of values and where they may be located. This helps me to clarify the issues to the students and make them aware of relevant conceptual distinctions. Indeed, the textbook has been of enormous help in terms of 'moving the discussion along' so that the rest of the lecture can be delivered within the time available.

(Robin Attfield writes:) These case studies are as much a tribute to the ingenuity of Rebekah Humphreys as to the resources of the textbook and the teachers' manual. Certainly when I began writing it, I had no idea that it might one day be used in modules about mind or about metaphysics, although it is less surprising that it can be put to use in connection with the clarification of 'tricky concepts'. My hope is that other readers may be able to apply their own ingenuity in making use of this book, as teachers of ethics and related topics both within and beyond the philosophy curriculum.

References

Ackrill, John (1999). Aristotle on Eudaemonia. In Nancy Sherman (ed.), *Aristotle's ethics: critical essays* (pp. 57-77). Lanham: Rowman & Littlefield.

Aristotle (2000). *Nicomachean Ethics*. Roger Crisp (trans. and ed.). Cambridge, UK and New York: Cambridge University Press.

Attfield, Robin (2012). *Ethics: An Overview*. London and New York: Continuum/Bloomsbury.

Attfield, Robin [1987] (2020). *A Theory of Value and Obligation*. London and New York: Routledge

Attfield, Robin [1995] (2018). *Value, Obligation and Meta-Ethics*. Leiden: Brill.

Biggs, J.B. (2003). *Teaching for Quality Learning at University*. Second edition. Buckingham: Open University Press/Society for Research into Higher Education.

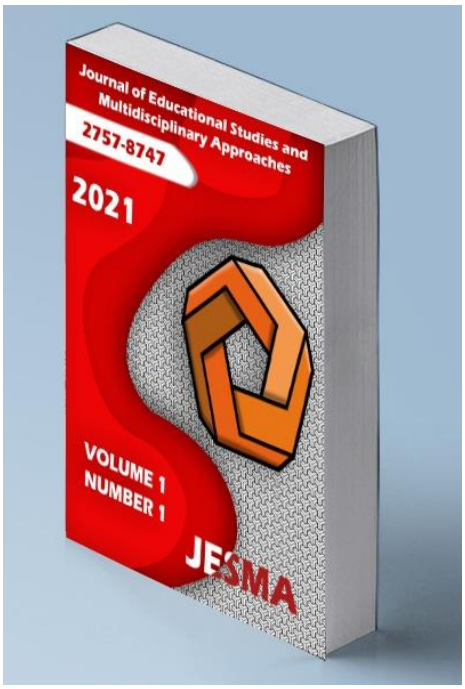
Gottlieb, Anthony (2001). *The Dream of Reason: a History of Western Philosophy from the Greeks to the Renaissance*. London: Penguin.

Midgley, Mary (1994). *The Ethical Primate: Humans, Freedom and Morality*. London and New York: Routledge.

Moravcsik, Julius (ed.) (1968). *Aristotle.* London: Macmillan.

Nussbaum, Martha (1993). 'Non-Relative Virtues: An Aristotelian Approach'. In Martha Nussbaum, and Amartya Sen (eds), *The Quality of Life* (pp. 242-76). Oxford: Clarendon Press.

Parfit, Derek (1984). *Reasons and Persons*. Oxford: Clarendon Press



Journal of Educational Studies and Multidisciplinary Approaches (JESMA)
ISSN:2757

www.jesma.net

Preparing Athletes with Consideration to the "Stages of Learning" and the "Transfer of Learning"

Colin G. Pennington[1], Ashely Evans[2], Deja Smith[3], Stefanie Cruz[4]

[1]Tarleton State University, Fort Worth, Texas, cpennington@tarleton.edu
[2]Cornell College, Mount Vernon, Iowa, Ashley.evanes@cornellcollege.edu
[3]Cornell College, Mount Vernon, Iowa, deja.smith@cornellcollege.edu
[4]Cornell College, Mount Vernon, Iowa, stefanie.cruz@cornellcollege.edu

* Corresponding Author: Colin G. Pennington, cpennington@tarleton.edu

To cite this article:

Pennington, C. G., Evans, A., Scott-Smith, D., & Cruz, S. (2001). Preparing Athletes with Consideration to the "Stages of Learning" and the "Transfer of Learning". *Journal of Educational Studies and Multidisciplinary Approaches (JESMA), 1* (1), 78-83. https://doi.org/10.51383/jesma.2021.2

Journal of Educational Studies and Multidisciplinary Approaches (JESMA)
Volume 1, Issue 1 Year 2021 ISSN:2757

Preparing Athletes with Consideration to the "Stages of Learning" and the "Transfer of Learning"

Colin G. Pennington https://orcid.org/0000-0002-5002-8197

Ashely Evans https://orcid.org/0000-0002-8460-8384

Deja Smith https://orcid.org/0000-0002-8460-8384

Stefanie Cruz https://orcid.org/0000-0003-0038-1475

ARTICLE INFORMATION

Review Paper
https://doi.org/10.51383/jesma.2021.2

Received 01 February 2021
Accepted 10 March 2021

ABSTRACT

Coaches strive to push athletes toward their full technical and physical potential while surpassing the previous generation of athletes. In doing so, comprehending how to integrate and organize various learning experiences is essential. This article seeks to describe the stages of learning (Fitts & Posner, 1967) and the transfer of learning (Perkins & Salomon, 1992) in relationship to planning and executing a practice schedule. In situations where coaches understand these phenomena, more effective instruction may result, and coaches thereby produce athletes with better personal awareness of their skills and areas of deficiency. Thus, the purpose of this research brief is to demonstrate how coaches can analyze their training of athletes to synthesize more efficient and prolific methods as a means to initiate the transfer of learning from other activities to their sport.

Keywords: sport pedagogy, athlete development, coaching instruction

Introduction:

Coaches strive to push athletes toward their full technical and physical potential while surpassing the previous generation of athletes. To meet this goal, comprehending how to integrate and organize various learning experiences is essential. Knowledge of athletes' experience, transfer of related sporting skills, and stages of learning may provide an avenue to improve coaching instruction. Particular focus on the "stages of learning" (Fitts & Posner, 1967) which includes the *cognitive* stage, *associative* stage, and the *autonomous* stage (Magill & Anderson, 2017) has shown to improve understanding of sport-related instruction. Moreover, attention to the three types of transfer of learning, *positive*, *negative*, and *neutral* transfer, is paramount in coaches' analyses of athlete improvement (Perkins & Salomon, 1992). In situations where coaches understand these phenomena, more effective instruction may result, and coaches thereby produce athletes with better personal awareness of their skills and areas of deficiency

Purpose of the Study

Thus, the purpose of this research brief is to demonstrate how coaches can analyze their training of athletes to synthesize more efficient and prolific methods as a means to initiate the transfer of learning from other activities to their sport.

Significance of the Study

While this brief will provide an outline for a soccer practice schedule, it is possible to relate these stages and transfer of learning to any sport. One of them main goals of coach is to help their athletes improve. Thus, it is hypothesized that applying these fundamental principles will help coaches be more efficacious. Additionally, a coach may gain knowledge of prior athletic experiences to teach new skills or refine previously learned skills.

The Stages of Learning

The Cognitive Stage. In 1967 Paul Fitts and Michael Posner proposed the classic "learning stages model". The first stage of learning is the *cognitive* stage. In this stage, the athlete or 'skill-learner' focuses on the cognitively related problems to the situation, on "what to do and how to do it" (Magill & Anderson, 2017, p. 274). The performer listens to instructions provided by the coach and then attempts to execute. However, in these initial learning stages many errors will be made, but it is critical to recognize the learner does not possess the knowledge or skills required to correct such errors. Thus, the coach is tasked with providing corrective feedback in an effort to aid the athletes' attempts. Important to note, during these attempts it is unlikely the athlete will perform consistently as the variation in performances is high. For this reason, corrective feedback plays a vital role in guiding the learner toward greater consistency and superior performance. Furthermore, to bolster learning, the coach should cultivate a comfortable, positive, yet individualistic learning environment (Correia et al, 2019). According to Hall (2002), cognitive functions mature alongside motor skills. Due to this relation, it is vital for coaches to present accurate and precise material for athletes to learn in the cognitive stage. If instruction is substandard and athlete learning is rendered insufficient, the long-term progression of athlete development could be hindered. In other words, poor instruction by the coach and subsequently learning from the athlete, could severely impede the athlete's future.

The Associative Stage. After an unspecified amount of practice and performance improvement in the skill, the learner graduates to the *associative* stage. In this stage, the learner begins to associate environmental cues with the movements required to achieve the skill goal. As a coach, it is imperative to allow the learner to make mistakes and use the environments' feedback to fix faults. After honing these skills, athletes demonstrate fewer and less egregious errors because of their matured knowledge.

According to Fitts and Posner's model (1964), this is also called the *refining* stage because there is room for improvement. At this point, the learner focuses on consistently and successfully performing the skill. Imagery may also be a source of skill refinement. According to Hall, mental images may be helpful in transferring the techniques from one well-learned skill to a similar skill (2002). As a coach, encouraging the players to set goals and use imagery to realize these goals can improve confidence and technique.

The Autonomous Stage. The final stage of the Fitts and Posner model is the *autonomous* stage. In this stage, motor skill proficiency is demonstrated with very little conscious awareness because it has become automated. This *implicit learning* is demonstrated when the learner performs a skill with minimal amount of attention, whereas the first stage – the cognitive stage- is *explicit* in that a considerable amount of conscious effort is applied to skill learning (Hall, 2002). In the autonomous stage, a learner becomes proficient in the designated skill and displays few errors. In the event of an error, the learner senses the fault and knows precisely what to adjust. However, contrary to popular belief, this does not mean the coach's presence is unneeded. Even though the learner is able to give themselves feedback, the trained and astute eye of a coach may still be warranted, as convoluted elements may not be easily 'felt' by learners. Lastly, while achieving autonomous skill execution is desirable, not everyone reaches this stage. Many components underpin the attainment of this level including a) the quality of instruction and practice, b) the amount of practice put in, and c) learners' motivation. If a coach employs meaningful drills and practices and the learner's practice with intentionality, the probability of achieving the autonomous stage increases.

Developing Skill Efficiency. When learning new skills, learners oftentimes recruit more musculature than needed to complete the skill. However, as learners progress, muscle recruitment is refined and decreases while coordination of muscle contraction increases. Similarly, when observing energy cost associated with the execution of the skill: more practice leads to less energy cost. Often times, while learning the skills, athletes has poor visual selective attention. This hinders their ability to assess motor performance and error detection/correction. With practice, athletes progress from considering a wide range of cues, to focusing on specific cues that assist in the success of the skill performance. The Fitts and Posner model suggests that coaches should strive for the learner to reach the fullest potential of their skill: the autonomous stage. Reaching this stage ensures the performer can execute the motor skill effortlessly and with no conscious attention. When all the stages

have been achieved, the learner then moves on to the *transfer of learning* to apply the same skills to different but similar motor skills.

The Transfer of Learning

The transfer of learning occurs when learning in one context transfers to learning in a different context (Perkins & Salomon, 1992; Seidler, 2010). The primary focus of learning transfer is connecting the similarities between different motor abilities. Transfer only occurs when the learner has been fully educated and is able to apply what they have learned in a different context (Perkins & Salomon, 1992). For example, the motor patterns of kicking a field goal in football *transfer* to a free kick in soccer. There are three types of learning transfer: *positive*, *negative*, and *neural* (Edwards, 2011; Magill & Anderson, 2017).

Positive Transfer. Coaches should aim to achieve *positive transfer* at the conclusion of teaching a new skill, which would demonstrate progress within the athlete (Magill & Anderson, 2017; Perkins & Salomon, 1992; Steinberg, Pixa, & Doppelmayr, 2016). One desirable consequence of achieving positive transfer is 'embedding' the skill within the long-term memory of the athlete. Coaches that guide athletes through the steps of learning increase the likelihood of positive transfer, and thus decrease the chance of the athlete performing the skill incorrectly in game-like scenarios (Steinberg, Pixa, & Doppelmayr, 2016; Seidler, 2010).

Negative Transfer. In some cases, athletes inaccurately perceive how a skill should be performed. For example, they believe the 'proper' way to kick a soccer ball is with the toes. In these instances, it is critical that the coach correct this perception. If left uncorrected, there is a possibility that a *negative transfer* can occur. While less common, negative transfer is when the athletes existing perception of a skill hinders their ability to learn new skills in different contexts (Magill & Anderson, 2017). For example, a soccer athlete who performs a basketball style overhead throw in a soccer game has demonstrated negative transfer. In this case, the previously learned skill became a hard-to-break- habit resulting in a performance error. When skill- or task-specific coordination movements are shared between performances, this can make skills more difficult to learn. In an effort to decrease negative transfer, the coach should clearly differentiate similar movements from one another. Using a corner kick as an example -- depending on which side of the field the corner kick is situated, the manner in which the athlete strikes the ball determines the balls' trajectory. This will result in ball movement toward or away from the goal. If confusion arises as to how one should execute a corner kick, it demonstrates the shortcomings of the coaches' instruction. In turn, this may result in a negative transfer.

Neutral Transfer. The last category of transfer is called *neutral transfer*. This occurs when previous experience has no influence on learning a new skill (Magill & Anderson, 2017). For example, if a student on the soccer team knows how to play the piano, it is unlikely this skill will transfer, in any meaningful way, to their ability to play soccer. In neutral transfer, there is simply no meaningful relationship between the two activities.

Discussion

Facilitating Positive Transfer. Evidence suggests specific conditions of involvement may facilitate a positive transfer of learning. First, the learner must understand how to pinpoint the critical elements of a situation, and then apply them to different situations (Perkins & Salomon, 1992). Conceptually, this aptitude requires a foundation of learned skills before they can be applied in different contexts or with other skills (Steinberg, Pixa, & Doppelmayr, 2016). In the soccer specific context, fundamental skills such as running, dodging, kicking, catching, throwing, punting, and jumping must be developed before moving onward. Additionally, the wise coach teaches learners not simply how to apply the strategy but to monitor their own thinking processes in uncomplicated ways (Perkins & Salomon, 1992). Learners must be free to reflect on their thinking processes and self-monitor their progress. For example, in soccer, athletes can observe a filmed session of open and closed-circuit drills to observe the quality of their movement and skill execution in various environments. Understanding how the environment affects skill performance is beneficial because it informs the athlete, helps facilitate positive transfer of learning, and propels learners toward autonomous performance. Lastly, learners must be able to focus and practice mindfulness. Simply put, coaching is less effective when athletes are cognitively preoccupied. Players may not be able to recognize their distraction during drills, but coaches may become aware of a lack of focus and attention when the athletes continuously demonstrate errors and are unable to recognize and correct mistakes. Coaches can assist athletes by discussing the importance of focus and intentionality in practice.

Conclusions

While this brief provided an outline for a soccer practice schedule, it is possible to relate these stages and transfer of learning to any sport. One of them main goals of coach is to help their athletes improve. Thus, it is hypothesized that applying these fundamental principles will help coaches be more efficacious. Additionally, a coach may gain knowledge of prior athletic experiences to teach new skills or refine previously learned skills. Coaches may then monitor the transfer of learning by observing if practice activities are demonstrated in game-like scenarios (Steinberg, Pixa, & Doppelmayr, 2016). Furthermore, it may take hours of practice to achieve this and make it work successfully, but as movement becomes more adaptable through learning experiences, it becomes less resistant to external perturbation (Seidler, 2010). In other words, if the athlete does not learn the skill in the same environment that they will be using it in, the skill is less likely to be performed successfully in game scenarios. Therefore, athlete development specialists are urged to use the stages of learning and knowledge of skill transfer when planning their practices.

References

Correia, V., Carvalho, J., Araújo, D., Pereira, E., & Davids, K. (2019). Principles of nonlinear pedagogy in sport practice. *Physical Education and Sport Pedagogy*, *24*(2), 117-132.

Edwards, W. H. (2011). *Motor learning and control: From theory to practice*. Belmont, CA: Wadsworth Cengage Learning.

Fitts, P. M., & Posner, M. I. (1967). Human performance.

Hall, J. C. (2002). Imagery practice and the development of surgical skills. *The American Journal of Surgery*, *184*(5), 465-470.

Magill, R., & Anderson, D. I. (2017). *Motor learning and control: Concepts and applications*. New York: McGraw-Hill.

Perkins, D. N., & Salomon, G. (1992). Transfer of learning. *International encyclopedia of education*, *2*, 6452-6457.

Seidler, R. D. (2010). Neural Correlates of Motor Learning, Transfer of Learning, and Learning to Learn. *Exercise and Sport Sciences Reviews*, *38*(1), 3-9.

Steinberg, F., Pixa, N. H., & Doppelmayr, M. (2016). Mirror visual feedback training improves intermanual transfer in a sport-specific task: A comparison between different skill levels. *Neural Plasticity*, *2016*(1), 1-12.

JESMA

Journal of Educational Studies and Multidisciplinary Approaches

Journal of Educational Studies and Multidisciplinary Approaches (JESMA) is an international scientific, high quality open access, peer viewed scholarly journal provides a comprehensive range of unique online-only journal submission services to academics, researchers, advanced doctoral students and other professionals in their field. JESMA publishes original research papers, theory-based empirical papers, review papers, case studies, conference reports, book reviews, essay and relevant reports twice a year (March and October) in online versions.

ISSN: 2757-8747

jesma.net