

Twenty Years of Research on the Academic Performance Differences Between Traditional and Distance Learning: Summative Meta-Analysis and Trend Examination

Mickey Shachar

TUI University
Cypress, CA 90630, USA
mshachar@tuiu.edu

Yoram Neumann

United States University
National City, CA 91950, USA
yneumann@usuniversity.edu

Abstract

This meta-analysis research estimated and compared the differences between the academic performance of students enrolled in distance education courses, relative to those enrolled in traditional settings, as demonstrated by their final course grades/scores, within the last twenty year (1990-2009) period, further broken down to four distinct sub-periods. A large $k=125$ of experimental and quasi-experimental studies met the established inclusion criteria for the meta-analysis (including data from over 20,000 participating students), and provided effect sizes, clearly demonstrating that: (1) In 70% of the cases, students taking courses by distance education outperformed their student counterparts in the traditionally instructed courses; (2) The overall effect size 'd+' (random method) was calculated as 0.257 ($0.17 < 95\% \text{ CI} < 0.35$); and (3) a clear upward trend of overall effect size 'd+' exists for the 2000-2009 decade after a decline in the second half of the 1990s. A polynomial regression confirmed a parabolic solution with a clear minimum point. The research, theoretical, and policy implications of these results are discussed.

Keywords: Traditional Learning, Distance Learning, Meta-Analysis, Summative Evaluation, Trend Analysis, Academic Performance.

Introduction

The last decade of the 20th Century and the first of the 21st have seen dramatic changes due to the exponential proliferation of telecommunications and the Internet to all aspects of life. Said technological changes have also influenced education systems to pursue the development, incorporation, and blending of new and innovative methods of and for delivering education.

The transformation from the traditional Face-to-Face (FTF) classroom mode to new delivery methods and platforms (correspondence, Internet-online, one-way, two-way audio and video) collectively known as Distance Education (DE), led some experts so far as to predict that the 'residential based model,' that is, students attending classes at prearranged times and locations, will disappear in the near future (Blustain, Goldstein & Lozier, 1999; Drucker, 1997 as cited in O'Malley, 1999). It is beyond doubt that distance education has progressed in concept and practice (to encompass where applicable) from an "anywhere" to an "anytime" to an "any pace" delivery method.

The advent of these highly technological methods was not easily accepted by the academic and training communities, which continuously examined, assessed, criticized, hallowed and demonized them. The major concern about DE programs was and is its quality relative to FTF classroom education in four domains of coursework delivery: (1) student attitude and satisfaction, (2) interactions of students and faculty, (3) student learning outcomes, and (4) faculty satisfaction (Gallagher & McCormick, 1999). This concern has resulted in extensive research into the factors that affect the quality of these programs. Consequently, a plethora of new scholarly articles on the subject emerged, examining various aspects of teaching and learning in a comparative FTF vs. DE setting in diverse topics / subjects and across

academic (primary, secondary, tertiary) and professional (medical clinical and management training and development) levels. (Dessler, 1997; Mondy, Noe & Premeaux, 1999; Westwood, 2001).

As there are 'broad' measures pertaining and affecting the instructional efficacy and student learning in both situations and as the many individual study findings varied in scope, magnitude and contradictory directions, a confusing and inconclusive response to the overall question of effectiveness was commonly reported. (Dellana, Collins & West, 2000; DeSantis, 2002; Phipps & Merisotis, 1999).

To overcome this, a second "wave" of research emerged focusing on the synthesis of multiple studies and the examination of the differences between the two methods of delivery, utilizing meta-analytical (MA) methods and procedures.

But MA studies also differ amongst themselves in their study design, scope, and most importantly in the definition of their dependent variable. Although the Meta-Analysis Concept and Procedures are detailed in-depth in the methods section, a brief explanation is presented here: A meta-analysis on a given research topic is directed toward the quantitative integration of findings from various studies. Each study serves as the unit of analysis; the findings between studies are compared by transforming the results to a common standardized metric called an effect size (ES). Once all effect sizes of the individual studies are acquired, the overall (for all studies) pooled mean effect size estimate 'd+' is calculated.

Of those with a final learning outcome/academic achievement as their DV of choice and sound statistical procedures, the most notably and assiduously executed are: (a) Shachar (2002) and Shachar & Neumann (2003) with $k=86$ and a $d+=.366$, Bernard et al. (2004) with $k=318$ and a $d+=.013$, and a most recent U.S. Department of Education Report (2009) with an overall $k=51$ and a $d+=.24$ (of which $k=28$ 'pure' Online vs. Traditional studies yielded a $d+=.14$, and $k=23$ 'blended' online/FTF vs. Traditional studies yielded a $d+=.35$).

The purpose and aims of this study extend beyond the scope of all previous MA studies and are threefold: (a) to provide a summative answer to the question of the differences on academic performance between traditional and distance learning programs in the last twenty years, (b) to identify distinct educational periods in the last two decades, and (c) to examine the trend across the distinct educational periods on the academic performance dependant variable. Hence, the following research questions (RQ) were defined:

RQ1: Is there a difference in the Final Academic Performance of students enrolled in distance-learning programs relative to those enrolled in traditional FTF programs for the last twenty year period and its distinct sub-periods?

RQ2: Is there a statistically significant difference in the Final Academic Performance of students between and across the last twenty years' sub-periods?

RQ3: Are the changes observed and calculated across time consistent, and can directional patterns be identified?

Note: RQ1 and RQ2 were hypothesized and statistically tested by Meta-Analysis and ANOVA respectively. RQ3 is examined for pattern and trend by the polynomial regression.

Methodology

The Meta-Analysis Concept and Procedures

Concept. In order to synthesize the various studies, a statistical technique called 'Meta-Analysis' (MA) developed by Glass, McGraw and Smith (1981) has been implemented in this study. A meta-analysis on a given research topic is directed toward the quantitative integration of findings from various studies. Each study serves as the unit of analysis; the findings between studies are compared by transforming the results to a common standardized metric called an effect size (ES) (Becker, 1998; Cook, Heath & Thompson, 2000; Lemura, Von Duvillard & Mookerjee, 2000). In the simplest form, the ES as denoted by the symbol 'd,' is the mean difference between groups in standard score form, i.e., the ratio of the difference between the means to the standard deviation. (Yu, 2001). Furthermore, "Glass argued that literature review should be as systematic as primary research and should interpret the results of individual studies in the context of distributions of findings, partially determined by study characteristics and partially random." (Bangert-Drowns & Rudner, 1991). Caveat - As in many other fields, the concept in itself, does not promise accurate or true results. It is the strict adherence to the procedures, and systematic treatment and analysis of the data, which will ensure acceptable statistical findings.

Meta-Analytic Approach Implemented. Within the field of MA, there are different approaches to the procedures, computations, and interpretation of results. Hence, the need to briefly describe the meta-analytic research type, approach and parameters chosen and implemented for this study: (1) Inclusion rules were more selective. Studies with serious methodological flaws were excluded. (2) The study is the unit of analysis, i.e., one effect size was computed for each study pertaining to a well defined dependent variable – final course grade. (3) Effect sizes are of separate and independent studies. (4) Hunter and Schmidt's (1990) corrections for sampling error, measurement error, range restriction, and other systematic artifacts were applied to the distribution of effect sizes. (5) Effect sizes were examined 'within' each stratum and 'across' all of the studies/strata.

Meta-Analytic Procedures Followed and Executed in the Study. The meta-analysis procedures described below follow the Campbell Collaboration Statistical Analysis (2004) standards, and the Meta-Analysis Reporting Standards (MARS), as required by the American Psychological Association (APA) (2008).

- 1. Domain of Research.** The Independent variable is the method/mode of delivery, operationalized as: (1) Distance education mode, and (2) The traditional Face-To-Face (FTF) mode. The dependent variable Final Academic Performance (final grade of course studies). Note - Grades are the measure of choice in numerous studies in higher education to assess learning and the course impact on the cognitive development of the student in the subject-matter (Anaya, 1999).
- 2. Criteria for Including Studies in the Review:** Criterion 1 - The time period covered in the review: from 1990 to 2009. Criterion 2 - The quality of a study – Only studies showing no severe methodological flaws were included. Criterion 3 - Control group - Each primary study had a control or comparison group. Criterion 4 - Sufficient Quantitative Data - The results in these studies all provided sufficient quantitative data for the two groups: sample size, mean, standard deviation, and/or "t", "F", or "r" correlation statistics, from which effect sizes were calculated.
- 3. Searching for Relevant Studies.** The search for study materials was carried out using several different approaches: Computer Search - All searches were for published, un-published, dissertations, conference papers, and study reports, principally in the English, German, French, Spanish and Italian languages, utilizing electronic search engines Pro-Quest, Google Scholar, ERIC, and MedLine. The electronic library and inter-library data banks and services of TUI University, and Tel Aviv University were scanned as well. Compilations, Reference Lists, and Authors – have been the source for many valuable references. When studies presented incomplete statistical data, direct email requests were sent out to the study authors for additional data.
- 4. Data Extraction, Coding, and Selection of Final Set of Studies.** All studies were compiled into a master database (MDB), within a MS-Excel spreadsheet file (after being assigned a unique 'I.D. Number'). Studies were reviewed for relevant information and note-worthy characteristics that might be related to the effect size pertinent to this study. Data on variables of interest were extracted, recorded and appended to the MDB and coded for the following main characteristics: factors in research design, list of sample characteristics, and exact type of dependent variable. Yield – Over 1,850 comparative papers were reviewed, but subject to strict initial inclusion criteria screening, only 125 studies qualified for this study.
- 5. Individual Effect Size.** Different statistical methods exist for combining the data, but there is no single 'correct' method (Egger, Smith & Phillips, 1997). In this study, based on the statistical methods described in Buchan (2000), the estimation of the individual study effect size was calculated by following Hedges and Olkin (1985, P.78-81) for estimating the 'g' effect size: Modified Glass statistic

with pooled sample standard deviation:
$$g = \frac{Me - Mc}{\sigma_{pooled}}$$
, and correcting its sample bias to obtain the

unbiased estimator 'd' effect size (Caveat - not to be confused with Cohen's 'd') by:

$$d \cong \left(1 - \frac{3}{4N - 9}\right)g$$
. Note: For both 'g; and 'd', 95% confidence intervals (CI) were calculated,

utilizing a statistical computing software program (Stats Direct LTD (2009)). Note: By convention the subtraction of the means (M) of the 2 groups (experimental and control), is done so that the difference is 'positive' if it is in the direction of improvement or in the predicted direction and 'negative' if in the direction of deterioration or opposite to the predicted direction.

6. **Overall Effect Size 'd+'.** Once all effect sizes of the individual studies were acquired, the overall (for all studies) pooled mean effect size estimate 'd+' was calculated using direct weights defined as the inverse of the variance of 'd' for each study/stratum. A 95% approximate confidence interval for 'd+' is given with a chi-square statistic with the probability of this pooled effect size being equal to zero (Hedges & Olkin, 1985). Consequently and conservatively - the null hypothesis is rejected if the probability for 'd+' being equal to zero is smaller than 0.01.
7. **Heterogeneity and Inconsistency.** Two separate statistical models: fixed methods and random methods (differing in the way the variability of the results between the studies is treated), were run on the 'd+' statistic. The classical measure of heterogeneity is Cochran's 'Q', which is distributed as a chi-square statistic with $df = k-1$. The 'Q' statistic has low power as a comprehensive test of heterogeneity especially when the number of studies is small. Hence, the 'I²' inconsistency statistic was calculated ($I^2 = 100\% \times (Q-df / Q)$), yielding and describing the percentage of the variation across studies that is due to heterogeneity rather than chance. When 'I²' was found to be high, the random method model was chosen of the two (DerSimonian & Laird, 1986).
8. **Homogeneity, Bias, and Fail Safe N Analyses.** As a synthesis of a variety of studies and data was conducted, each with its own method of calculation, it was necessary (for the results to be accepted), to examine the robustness of the findings to different assumptions, by conducting a 'Homogeneity and Bias' analysis:
 - a. **Homogeneity.** The individual trials will show chance variation in their results, therefore, it was necessary to explore whether the differences were larger than those expected by chance alone. One of the main concerns in conducting meta-analysis is that there would be a publication bias arising when trials with statistically significant results are more likely to be published and cited, and are preferentially published in English language journals (Jüni, Holenstein, Sterne, Bartlett & Egger, 2001). The outcome of which would be that plots of trials' variability or sample size against effect size would be usually skewed and asymmetrical in the presence of publication bias and other biases (Sterne & Egger, 2001), and are more likely to affect small trials. Hence, all MA iterations were completed by bias plotting the sample sizes against effect estimate, and visually (see Figure 2) examined for left-right asymmetry caused by bias (Buchan, 2000; StatsDirect, 2009).
 - b. **Fail Safe N.** Since mostly published studies are the ones analyzed, there is the 'file drawer problem,' that is, how many studies with non-significant findings, were not published? Therefore, the Fail Safe N (NFS) is the number of non-significant studies that would be necessary to reduce the effect size to a non-significant value. Based on Orwin's (1983) formula, an NFS was calculated for each meta-analysis iteration on a 'd+' critical level of 0.01.
9. **Qualitative Interpretation of Effect Size (d+).** Interpreting the results of a meta-analysis requires the understanding of the standards employed that allow for meaningful interpretation of effect sizes. The statistical community is not of one voice in regard to the interpretation of the effect sizes and although judgments about whether a specific effect size is large or small are ultimately arbitrary, some guidelines for standards do exist in the literature, to assess the meaningfulness of an effect size - on one hand, and for conventional measures- on the other, e.g. Cohen (1977) suggested 0.2, 0.5, and 0.8 as minimal, moderate, and meaningful effect respectively; Lipsey (1990) categorized effect sizes into three groups: Small<0.32; 0.33<Medium<0.55; and Large>0.56.

Research Results

Following the review and examination of all study publications in the data bank, $k=125$ studies (encompassing about 20,800 students: traditional $n=11,500$ vs. distance learning $n=9,300$), met all required criteria and were, therefore, the works under consideration for this study. Data extraction and analysis from these works produced 125 calculated 'g' effect sizes. These 125 effect sizes are the 'base' of the meta-analysis iterations conducted to answer the study's research questions.

The 19 year span of 1990-2009 was broken down into 4 distinct sub-periods: Period I: 1991-1998, Period II: 1999-2000, Period III: 2001-2002; and Period IV: 2003-2009, with studies/effect sizes totaling: 38, 33, 29, and 25 respectively. Said breakdown of periods (although uneven in length) and their corresponding number of studies, allowed the conduct of four meta-analysis iterations (for at least $k \geq 25$), and period comparisons for and on all four sub-periods.

The student body per study was divided across three different levels of education with a clear majority of the college and under-graduate level: university graduate: n=24 (19%), university under-graduates and colleges: n=79 (63%), and other non-degree courses: n=22 (18%).

Overall, 70% of the studies had a positive effect size (see Figure 1), demonstrating that DL students outperformed their traditional counterparts. Note – there is a clear upward trend of higher positive ES per period across time from 63% to 84% (see Table 1).

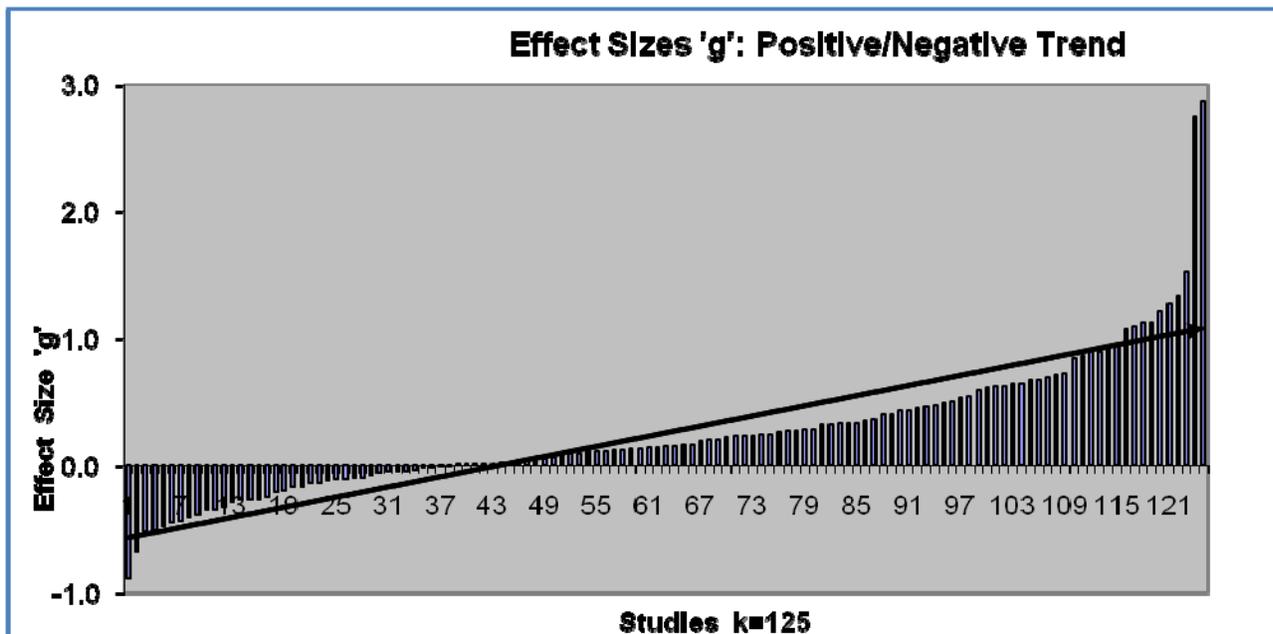


Figure 1: Positive/Negative 'g' effect sizes, k=125

Table 1: Descriptive Findings

Period	k	ES Pos. n (%)	FTF Students n (%)	DE Students n (%)	Graduate k (%)	Under Grad. + College k (%)	Other k (%)
I 1991-1998	38	24 (63%)	4,392 (50%)	4,454 (50%)	7 (18%)	21 (55%)	10 (26%)
II 1999-2000	33	22 (67%)	1,924 (58%)	1,393 (42%)	10 (30%)	20 (61%)	3 (9%)
III 2001-2002	29	20 (69%)	3,802 (64%)	2,102 (36%)	0 (0%)	27 (93%)	2 (7%)
IV 2003-2009	25	21 (84%)	1,380 (51%)	1,337 (49%)	7 (28%)	11 (44%)	7 (28%)
All 1991-2009	125	87 (70%)	11,498 (55%)	9,286 (45%)	24 (19%)	79 (63%)	22 (18%)

RQ1. Is there a difference in the Final Academic Performance of students enrolled in distance-learning programs relative to those enrolled in traditional FTF programs for the 1990-2009 period and its sub-periods?

Sample. 125 'g' effect sizes were calculated for final academic performance and corrected to obtain the un-biased 'd' (not to be confused with Cohen's 'd') effect sizes.

Pooled Estimate of Effect Size 'd+'. Five consecutive meta-analysis iterations were run on the data for: All periods (1991-2009) and the four sub-periods, computing for both the fixed and random methods, the 'I²' inconsistency and the Chi square statistics (see Table 2).

As expected (due to the diverse sources and methods of the individual studies), the 'I²' was found to be high, and so the results calculated per the random method are the appropriate ones chosen to be

considered.

All Periods. Computation of the pooled estimate of effect size 'd+' (random) for all periods yielded the final statistically significant result of 0.257 ($p < .01$), with a 95% confidence interval of 0.17 to 0.35. The Chi Square that 'd+' differs from zero ($df=1$) of 32.13 ($P < 0.0001$) is statistically significant.

Sub-Periods. Computation of the pooled estimate of effect size 'd+' (random) for the four sub-periods, yielded statistically significant results for periods I, III, and IV, whereas the 'd+' of period II was small and statistically non-significant.

Note – The course and trend of the 'd+' statistics across time will be presented in the following RQ3 section.

Table 2: Meta-Analysis Findings

Period	k	'd+' Fix (CI)	'd+' Rand (CI)	'I ²	NFS $d_{c=.01}$
I 1991-1998	38	.548** (.50, .60)	.268** (.09, .45)	90 %	3,225
II 1999-2000	33	.077* (.00, .15)	.068 (-.05, .19)	57 %	725
III 2001-2002	29	.225** (.17, .28)	.310** (.16, .46)	81 %	3,750
IV 2003-2009	25	.353** (.27, .43)	.403** (.20, .60)	83 %	4,913
All 1991-2009	125	.342** (.31, .37)	.257** (.17, .35)	86 %	3,088

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

Bias Indicators Numbers and Plot

All Periods. Kendall's test on standardized effect vs. variance: $\tau = 0.0617$; $p = 0.3094$. An examination of the left-right symmetry of the plot as depicted in Figure 2 denotes that there is a small sample bias.

Sub-Periods. A visual examination of the left-right symmetry of the bias plots of the four sub-periods as depicted in Figure 3 denotes that there is a decreasing sample bias as we progress across time periods.

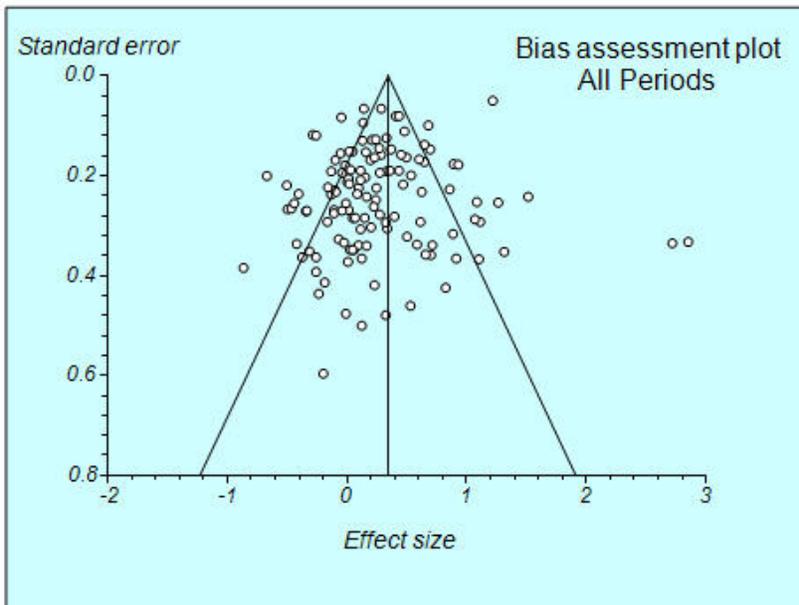


Figure 2: Bias Assessment Plot – All Periods

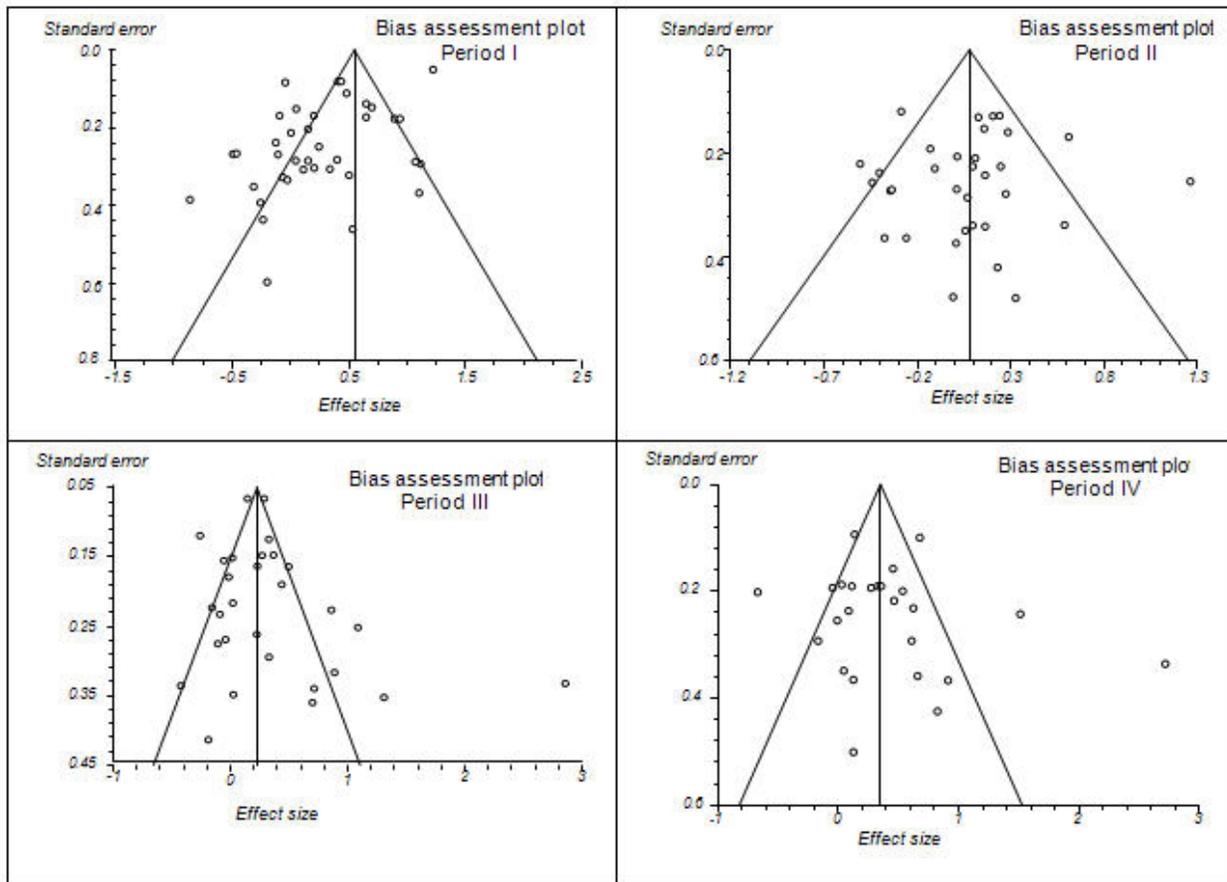


Figure 3: Bias Assessment Plot – Sub-periods

Fail Safe N. Based on Orwin’s (1983) formula for calculating the N fail safe number when the ‘critical’ criterion value of $d_c = 0.01$ is selected, about 3,088 additional unreported studies averaging a ‘null’ result are needed (existing somewhere), to ‘nullify’ the average of d^+ (random) = 0.257. The fail safe N for the overall study period and the sub-periods are in their hundreds and thousands. It is unlikely that there are that many well constructed studies sitting in file drawers to negate our results (See Table 3).

Hypothesis Decision. Based on these findings, providing an overall effect size d^+ (random) of .257 $p < .01$, from 125 studies, with a statistically significant Chi Square ($df=1$) of 32.13, ($p < .0001$), the null hypothesis that there would be no difference between the Final Academic Performance grades of students enrolled in distance-learning programs than those enrolled in traditional FTF programs is rejected. The direction of the difference between the two mediums of delivery demonstrates that the DE students outperformed their FTF counterparts across the full continuum of the study period.

Table 3: Major Findings

Period	k	ES Pos. n (%)	d^+ Rand. (CI)	NFS $d_{c=.01}$
I 1991-1998	38	24 (63%)	.268** (.09, .45)	980
II 1999-2000	33	22 (67%)	.068 (-.05, .19)	191
III 2001-2002	29	20 (69%)	.310** (.16, .46)	870
IV 2003-2009	25	21 (84%)	.403** (.20, .60)	983
All 1991-2009	125	87 (70%)	.257** (.17, .35)	3,088

**p < .01

RQ2. Is there a statistically significant difference in the Final Academic Performance of students between the 1990-2009 sub-periods?

An ANOVA test was run to assess whether the four sub-period 'd+' means (period I 1991-1998 (k=38), period II 1999-2000 (k=33), period III 2001-2002 (k=29), and period IV 2003-2009 (k=25)) differ among themselves. The between-groups' combined test results are $F_{(3,124)} = 2.657$ at the $\sigma = 0.05$ level, indicating that four distinct periods within the 1990-2009 time frame have been established. LSD post-hoc analyses revealed a significant difference between the means of periods II – III ($p=.035$), and II – IV ($p=.010$).

RQ3. Are the changes observed and calculated across time consistent, and can directional patterns be identified?

As presented above, the four sub-periods are distinctly different and provide three positive separate patterns: (a) The proportion/ratio of positive effect sizes across time, growing steadily from 63% in period I to 67% in period II, 69% in period III, and then in a larger increment to 84% in period IV, (b) The average 'g' statistics calculated for each period were: .243, .064, .354, and .433 respectively (see Figure4), and (c) the pooled 'd+' (random) was calculated as $d+=.268$ for the first period, to decline to a low of $d+=.068$ in the second, and then incline to a $d+=.310$ in the third, and continue to grow upwards to a level of $d+=.403$ in the fourth period.

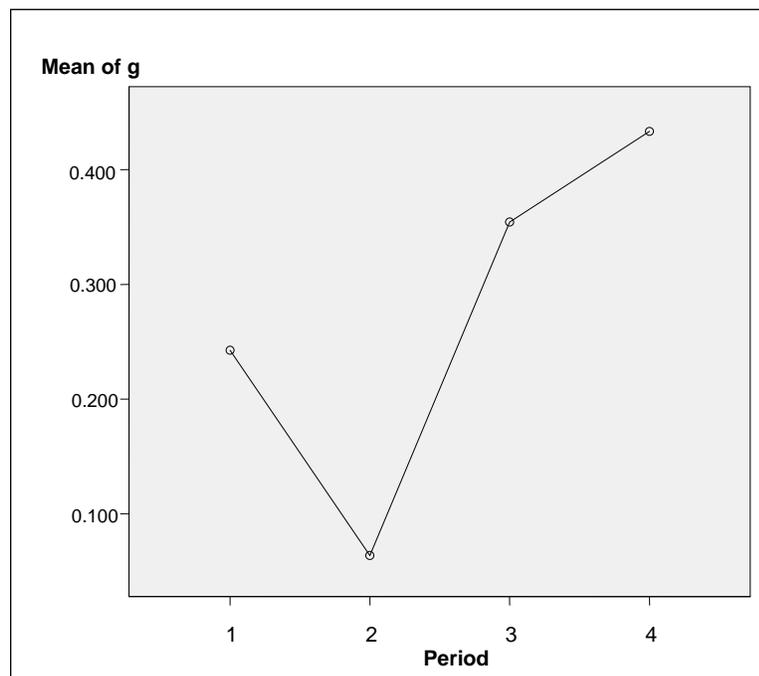


Figure 4: 'g' ES trend across periods/time (Legend: Period I: 1991-1998; Period II: 1999-2000; Period III: 2001-2002; Period IV 2003-2009.)

As observed in Figure 4, the 'g' ES trend depicts a U curve across time. A quadratic (2nd order) polynomial regression with the 'd+' as the dependent variable and the four periods as the independent variable (see Figures 4a and 4b), to obtain the following high (although statistically non-significant) R^2 results of .829 and .708 for the 'd+' (fixed) and 'd+' (random) regressions respectively. *The quadratic regression equations were:*

$$(1) \text{ 'd+' (fix) } = 1.159 - .792 \text{ Period} + .15 \text{ Period}^2 \text{ (with a 'minimum' of 2.6)}$$

$$(2) \text{ 'd+' (random) } = .467 - .302 \text{ Period} + .073 \text{ Period}^2 \text{ (with a 'minimum' of 2.1)}$$

The upward inflection point in both regressions occurred at the beginning of the 1999-2000 period.

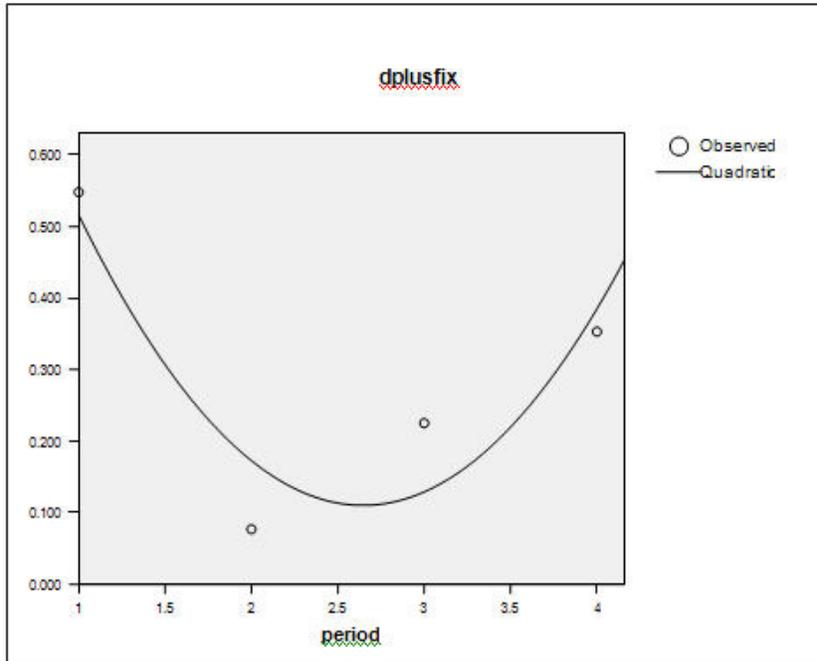


Figure 4a: 'd+' (fixed) ES trend across periods/time

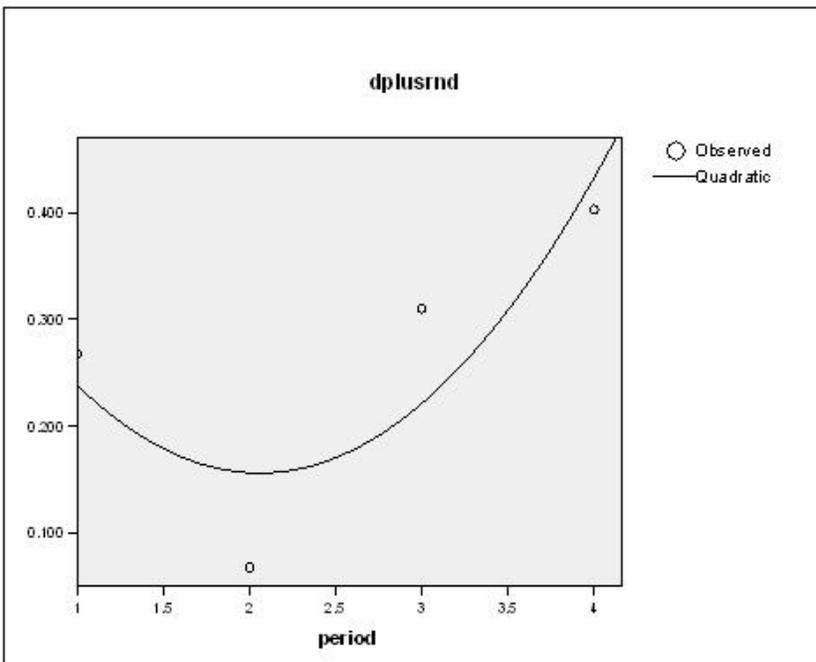


Figure 4b: 'd+' (random) ES trend across periods/time

Discussion

Aggregating and consolidating all previous findings for the research questions within one table (see Table 3) facilitates the following review and discussion.

Overall, the results of the meta-analyses, based on 125 qualifying studies and using learning outcome data from over 20,800 participating students, demonstrates a sound and statistically significant positive 'd+' statistic of .257, $p < .01$ calculated conservatively by random methods for the study period, indicating that distance education not only is comparable to traditional instruction, but also, subject to our criteria, can outperform traditional instruction.

The proportion of studies with positive effect sizes to the total number of studies per period, demonstrated a continuous growth from 63% in period I to 84% in period IV.

When the sub-periods were analyzed and their respective 'd+' effect sizes were calculated they were all positive, and due to the robustness (large k number) of the study, the power to detect said effect sizes is further confirmed by the large Fail Safe Numbers (NFS), as it is quite unlikely that there are that many well constructed studies "sitting" in file drawers.

Therefore, this study's findings completed and complemented with the previous meta-analyses of Shachar (2002), Shachar & Neumann (2003), Bernard et al. (2004) and the U.S. Department of Education report (2009), seem to finalize the ongoing debate over the quality of DE education and consequently DE should be accepted as a respectable and feasible option for education.

Even though this study did not differentiate between the educational delivery methods of time (synchronous and asynchronous) and place (same and different) dimensions, as categorized by O'Malley and McCraw (1999), or the various technological and telecommunication delivery systems, but rather remained with the general dichotomy of all distant (teacher-student geographically separated) courses, vs. all traditional courses, the trend of the four periods' 'd+', when graphed together, depicting a clear U curve graph with an upward inflection point occurring in the 1999-2000 period (see Figure 4), demand an in-depth and insightful look at the possible educational and pedagogical factors affecting said periods, e.g., in the first period the 'classic' text-book was mostly just converted as-is to a CD or web based medium vs. the fourth period where new web software applications enhanced multi-level learning styles.

Eduventures (a reputable Boston based research and consulting group in higher education) forecasts there were nearly 2.2 million U.S. students enrolled in fully online higher education programs in 2009, or about 12.1% of all students enrolled in university level degree-granting institutions that year by these estimates. This share is up significantly from approximately 1.3% in the 2000-2001 academic school year.

While distance learning in higher education may have been looked down upon two decades ago, it has clearly become well accepted and gained legitimacy over the past decade. Students, universities, and employers no longer differentiate between university degrees earned traditionally or online. In many cases, universities offer the same degrees traditionally and online while the final diploma does not even mention the mode of delivery. The improvements of technology, the widespread Internet access, the increased legitimacy of online learning within established universities and employers, and the increased participation of adult learners in higher education with clear preferences toward learning anytime and anywhere will further drive future improvements in the quality of distance learning programs. Traditional programs suffered irreparable damages during periods of economic downturns (the post dot com era in 2000-2002 and the major economic recession from 2007-2009), their levels of support have eroded substantially, and their quality did not improve at the same levels as online programs.

Therefore, one should not be surprised if the gap in academic performance between online and traditional learning will only widen in the next decade.

The findings of this study reemphasize prior results and extend it for a period of twenty years. It is clear that the experimental probability of attaining higher learning outcomes is greater in the online environment than in the face-to-face environment. This probability is increasing over time. The future should call for different treatment of online learning by policy makers and regulatory agencies – on one hand, and future research to examine DE learning by: academic subject, asynchronous / synchronous / blended methods etc. – on the other.

The paradigm of the superiority of the FTF modality over its distance learning alternative has been successfully negated. The distance learning approach is becoming the "normal science" (Kuhn, 1962). Yet, this is not fully comprehended by the various decision making institutions where the gate-keeping positions represent, by and large, the past paradigm. Therefore, distance learning is still treated as the anomaly ("step child") instead of as the emerging standard of quality in higher education. We expect that as a new generation of leaders in higher education emerges, the policy making orientation and regulatory models will change to reflect the new paradigm.

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