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Extralearning Online: An Aggregate Analysis of Secondary Data and An overview of Reliability and Validity

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***Abstract* – Educators increasingly accept and embrace the role that technology can play in remediation, tutoring, and credit recovery. Extralearning Online (EO), a comprehensive K12 learning management system that utilizes an online format with self-paced learning, is very representative of a growing type of technology-based interventions currently available to K12 educators and administrators. This paper will briefly review the existing literature that supports self-paced online pedagogies, conduct an aggregate secondary data analysis of EO across multiple K12 usage sites in partnership with Reach For Tomorrow, Inc., examine EO specifically for indicators of validity and reliability as an evidence-based intervention, and suggest a more general framework for embracing the role that online and technology-based interventions like EO can play in addressing remediation and improving achievement for students who are below predicted achievement levels.**

***Keywords* – Online Learning, Self-paced Learning, Competency-based Learning, Extralearning Online, Remediation, Credit Recovery.**

I. INTRODUCTION

The quest to address the needs of students who fall behind in their learning or with significant gaps in their learning has become a defining goal in the 21st century and a recurrent discussion in the current K12 school paradigm. With recent changes to Federal education policy in the Every Student Succeeds Act (ESSA) of 2015, this quest has become more urgent than ever [1]. The impactful role of technology in providing evidence-based remedial and supportive services is increasingly recognized and sought out, and a growing number of studies have looked at shifting attitudes of both learners and educators as well as the pedagogical effectiveness of technology-based tools, ranging from more dynamic and interactive learning environments to specific software and programs [2-7].

Extralearning Online (EO) is an online learning program designed to address a variety of K12 learning needs. Those needs include but are not limited to: credit recovery, school within a school, home schooling, GED preparation, distance learning, night school, remediation, and after school programs [8]. The program is self-paced, competency-based and utilizes built-in assessments that are closely tied to individual state standards of learning. The format incorporates universal design principles, taking advantage of technology to diversify learning for a variety of student needs [9, 10]. The program's predecessor versions were first utilized by more than 800,000 K12 students in the early 1980s in a study conducted by Northeastern University with results that indicated significant grade and/or competency gains [11].

Reach for Tomorrow, Inc., a non-profit educational enterprise targeting at-risk youth for remediation that often utilizes EO, initially sought to use EO for their programs in part because of the large-scale success of the initial program at Northeastern University:

> Extralearning Online has been used for over 20 years [by RFT] to teach learners of all ages, especially in situations where learners have not succeeded in traditional education approaches. Research has recorded and demonstrated its success and is documented in a variety of ways. Northeastern University conducted a study that evaluated the first 830,000 student users of Extralearning. The results concluded, within 20 hours of instructions, students averaged a 1.0 grade level gain in reading With 40 hours of instructions, students averaged a 1.3 grade level gain in reading. With over 80 hours of instructions, students demonstrated a 1.7 grade level gain in Reading [12].

Since the initial use of the program in the 1980s, what is now known as Extralearning Online went through a significant number of iterations which focused on two important variables: first, the program evolved to take full advantage of the Internet and the subsequently evolving computer-based technology that can utilize it; secondly, the program grew in sophistication to incorporate the nuances and specifics of individual state learning objectives which dominated what is now referred to as the Age of Accountability, including the evolution of Response to Intervention (RTI) and No Child Left Behind (NCLB). The program in its current form is analyzed in this paper for the period between 1999 and 2014 encompassing 43 different K12 programs, primarily after school and summer programs.

The current form of EO utilizes courses arranged by topic and, when appropriate, by grade level. The program reflects the predominant current curricular needs in K12 and is heavily oriented toward language arts, math, and reading, although individual topics (courses) and units address a wide variety of content areas (and are also easily modified for more specificity in local use), including some vocational units and some units that can even be classified as college prep. EO consistently addresses very specific individual student needs, although it also assumes a unified pedagogy that can be categorized as blended learning, with the platform intended to work with schools who can then add their own specialized material to the

program, including additional face to face instruction and on-site learning support that is offered in tandem with the program. Discussion-based learning, for example, which is not always seen as part of an online learning environment, can by design easily be facilitated effectively through EO technology [13, 14]. Such unified or blended learning is being used increasingly at all levels of education, and is facilitated through technology-based interventions, including an explosion of online learning in competitive environments like medical school and graduate programs [15].

EO also utilizes a number of pedagogical approaches that are now accepted as best practice for remediation and differentiation of instruction for at-risk students. Although the program is adaptable to screen readers for the visually impaired, it also utilizes a format that is visually and kinesthetically attractive to students, which research shows is often an effective approach, especially for exceptional learners [16, 17]. Students can also track their own progress without asking their teacher "how they are doing," since that feedback is provided routinely and in generally user-friendly, kinesthetic formats [18]. Research also indicates that students who get frequent feedback about their learning progress are generally more motivated and often work with greater persistence [19].

The program can even be used as a form of self-study where students explore their own interests and develop their own "trail" that they blaze into their career and academic curiosity. Because EO is highly customized to the needs of the individual, the primary focus is on what students don't know, rather than repeating what they already know. The program also caters to elements of play, competition, and games which have also shown to help students maintain higher interest and levels of focus [20]. In fact, blended technology-based programs like EO have shown benefits for all students, including students who are gifted and talented and also need differentiated instruction [21].

EO also offers a high degree of customization for individual school systems, schools, or students, with instructors having options to determine the number and type of items in multiple choice assessments, an ability to set cut scores for unit proficiency or advancement, and the option to assign grade levels and pretests to specific courses. In fact, the program itself is designed to be customizable to the point that individual schools, classes, or school systems can in essence create their own online materials and assessments, should they choose to do so. The reason this is possible is because the platform is "web based" versus more traditional online programs that are "software" based. There is no software involved in the program meaning it can be adapted locally to meet the local needs and is less costly to update and improve [8, 14].

After training school/program staff members, the basic steps in using EO involve pre-testing, immersion in initial lesson content, re-testing, remediation if necessary, and post-testing. Once a student is proficient in a lesson or unit, they can move to the next lesson or unit, ultimately completing grade levels or individual courses.

Recent research has reinforced the power of computer-based learning environments on student learning outcomes, as well as the benefits of providing the timely feedback that online environments facilitate. A meta-analysis completed by Van der Kleij and colleagues showed that larger effect sizes were associated with elaborated feedback, and more timely feedback, two features that are prominently built into EO and other types of emergent technologies in the classroom [22]. The designers of EO intentionally created an iterative program that has continued to evolve and incorporate what works in terms of feedback in the research literature, as well as taking advantage of the speed and consistency with which the technology associated with an online format allows feedback to be generated for the student.

This study specifically set out to explain the evolution of EO, track its wide use by RFT, and examine the combined results of it in programs as an educational intervention, with consideration of reliability and validity factors. Although the users and creators of the program have tracked its success in individual grant programs and schools, this is the first meta-analysis since the large initial study at Northeastern University.

II. METHOD

The data considered in this analysis spanned 43 K12 programs in a number of different locales, ranging from urban and suburban to rural school settings. The programs occurred in partnership with RFT over a period of 16 years (1998-2014), and involved a total of more than 700 students. The size of the programs ranged from a handful of students to large programs with as many as 105 students initially registered. The time frame for each program varied from a few weeks to an entire school semester or year, although the EO program itself tracks student time spent on task so that time spent working in EO can be carefully controlled for purposes of analysis.

In a number of settings, the students were given some type of normative pre-testing and post-testing measure outside of EO which not only served to confirm baselines for the students starting in the program at an appropriate level, but also in many cases gave a secondary indication to compare to gains that were generated and reported by the program itself. As will be seen in later data analysis, the Test of Adult Basic Education (TABE) was the most frequently used external measure, a well-known instrument commonly used to assess basic skills and knowledge (and which now includes an online version). Student gains in the TABE were quite analogous to those measured in EO in terms of raw scores, as well as statistically correlated in most areas [23].

To measure progress effectively the program also comes with required training for the instructors and staff using it indicating how to measure baseline, and how to monitor whether students are starting and working at the appropriate level, or continuing to use the platform correctly. The training has been standardized and is accompanied by a lengthy manual and access to EO staff at any time. Levels measured in the program are closely

tied to individual state standards, which usually correspond to grade levels, but also correspond to content-based courses at the high school level. The standards are updated regularly. Students in the programs were often administered state assessments, as well, the results of which were generally consistent with EO gains, and normative TABE scores on pre and post-tests.

In this study of RFT programs, the students using Extralearning Online were all classified as either elementary school, middle school or high school level, even if they were served at a community center, and were all generally averaging two grade levels behind in one or more subject areas (usually in the areas of language arts including reading, and/or math, both of which are reported in this study). Although there was demographic variation amongst the types of schools in the analysis, the large majority tended to be schools characterized by SES-related (Supplemental Education Services) qualification, and chronic under performance. EO was often an innovative and new tool for the schools to use to address underperformance.

It is important to note that EO has other uses, including GED programs and credit recovery, although this analysis focused mostly on its use with K12 students for remediation. The results reported in this study for K12 students are confirmed by EO and RFT staff to be similar to the results obtained in these other uses, and abbreviated course credit recovery statistics will be mentioned at the end of the results section. However, a fuller discussion of the other uses of EO is beyond the scope of this article.

III. Results

The majority of gains reported in this meta-analysis were gains measured by either grade level, or percentage gain, in the EO program itself, referred to from here forward as EO percentage gained, or EO grade level gained, using weighted data to account for sample sizes at each school or program. Statistical tests were also used to check for correlations between EO gains and external testing measures, like the TABE, which is a norm referenced assessment. It was expected that there might not necessarily be a strong correlations across the board between the EO gains and the TABE scores, as one is criterion referenced test and the other norm referenced. In actual fact, strong correlations existed across many aspects of these measures, as outlined in Table 1 below, giving a strong general indication that improvement in the program was not limited to criterion-based benchmarks, but also improvement in comparison to peers:

Table 1 Bivariate Correlations between Math and Language Arts Measures (Pearson)

	GL EO M	GL EO LA	% EO M	% EO LA	TABE M	TABE LA
Grade EO M	-----	-.046.	**.482****	**.126****	**.246****	**-.155***
Grade EO LA	-----	-----	.035	**.364****	**.186****	-.023
% EO M	-----	-----	-----	**.279****	**.220****	**-.195****
% EO LA	-----	-----	-----	-----	**.384****	-.115
TABE M	-----	-----	-----	-----	-----	**.543****
TABE LA	-----	-----	-----	-----	-----	-----

***Significant at the < .05 level (2-tailed)**

****Significant at the < .01 level (2-tailed)**

A curious correlation was the negative relationship between the Language Arts portion of the TABE, and all Extralearning Online gains; although the relationship between the TABE and EO scores was not the overt focus of this study, it is a result that bears further future investigation. EO staff and programmers will likely examine this more closely as a result of the findings.

When key pieces of data were missing from any single program report, that data was not included in the meta-analysis. Ultimately, 38 of 42 possible programs were included. The category of "middle school" included junior high schools as part of the analysis unit, although since EO is a criterion-based measure, and the TABE is generally administered to adults fourteen years of age or older, actual grade level in school became less important in the overall analysis. Basic tests were run to see if there were any school level effects, and none were detected using standard Analysis of Variance (ANOVA). For the sake of completeness, the basic means by school level are reported here in Table 2, noting that even high school levels seem to be numerically higher for math, the smaller sample size resulted in non-significant statistical differences:

Table 2 Mean Gains Reported by School Level (n = number of schools)

Level	LA Increase EO	Math Increase EO
Elementary ($n = 7$)	.22900	.19760
Middle ($n = 27$)	.25408	.18352
High School ($n = 6$)	.24467	.28300

Using schools as the primary unit of analysis, and then weighting the scores by school sample size, the gains generated by Extralearning Online itself increased generally between six percent and twenty percent for all cohorts. These scores are based on the internal assessment cycle built into the program which is tied directly to individual state standards of learning. The program generates percentage gains, as well as grade levels gained when appropriate. The aggregate gains for all programs included in the study are reported as follows in Table 3.

Table 3 Summary of Weighted Gains across Programs tied to State Standards as Measured by Extralearning Online

Subject	# Programs	#Students*	Proficiency Gain	Grade Level Gain	% Students Time** Improved	
Math	38	595	.20397	.36901	90.20%	10.54
LA***	37	532	.23380	.69055	95.64%	9.94
TOTALS	38	1127	.21804	.52079	92.81	10.26

*Includes only students who were actively working in EO, and not students who were recruited but dropped out or never fully participated

**Measured by monitored hours spent working in the program

***Language Arts scores include Reading

The overall TABE scores are reported as follows in Table 4 and mirror closely the reported EO gains.

Table 4 TABE Scores Equivalent to Grade Levels Gained (Test of Adult Basic Education)

Content Area	# Students	Mean Grade Level Increase	Standard Deviation
LA/READING	166	0.6011	1.1119
MATH	198	1.1364	1.4035

Overall, EO Math gains which were tied closely to state standards can be summarized this way: 595 students at 38 different schools gained an average of 20.40% in Math, or roughly 2% gain for every hour spent in the program. In a similar fashion for Language Arts, 532 students at 37 different schools gained an average of 23.38% in Language Arts, or 2.4% for every hour spent in the program. This meant in effect that students could, on average, spend 40 to 50 hours with the program and advance an entire grade level or course level. This analysis is consistent with previous findings by RFT staff [24].

EO has also been successfully employed for credit recovery. In a recent report from a University of Kansas program, more than two thirds of students (67.39%) earned recovery course credit in areas like Spanish, Science, Math, and Language Arts using Extralearning Online for an average of 20.3 hours [25].

IV. Concerning Validity and Reliability

According to the EO designers and trainers, and staff at Reach For Tomorrow, Inc., Extralearning Online has uniformly reported consistent gains in part by controlling for the following testing variables: amount of training given to teachers using the program; consistent student access to and time devoted to using the program (which includes appropriate computers and Internet access); and appropriateness of student placements at initial levels (which is built into the program through intuitive pretesting tied to state standards)[12, 24]. The EO training materials and training program also indicate the important extent to which these factors assure reliable scoring [8, 14].

The Extralearning Online program in its most current form has been in use now for more than 10 years since its last major upgrade in 2004, but has been updated in minor ways and enhanced numerous times since then in elements consistent with evolving software and online technology, and often accounting for frequent changes to state learning standards. The original genesis of the EO system, as previously mentioned, predates the wide use of the Internet and learning technology, stemming from Ford Foundation grants in 1982 and 1983 to develop new remediation systems. Uniquely, EO has been adapted and used successfully in the new century, coming out of a pre-Internet tradition [11].

Confirming reliability of scores in this study primarily consisted of asking the question: are the generated EO grade level scores and percentage gains similar over time, and consistent when controlling for test administration, program functionality, subjects, and school settings [26]? Ranges of scores, standard deviations, types of schools, and the overall large numbers in total from the combination of various programs available for analysis all suggest that the program has performed remarkably consistently over time, reinforcing the overall reliability of scores. Reliability also is reinforced by the strong correlations with the TABE already reported.

Evidence for validity of scores also comes from a variety of sources, addressing both external and internal factors. Externally, the range of school environments and diversity of learners, coupled with large sample size, provides evidence that the results should be similar in other analogous circumstances. All scores from all participants during the period in question were included in the analysis, even in cases where students lost ground rather than made proficiency gains, resulting in mean scores that are quite representative of typical populations for such programs and overall results. In some individual programs, gains were much larger.

Internally, the long design history, extensive piloting, and the use of EO at multiple sites provided evidence that rival explanations for student progress are finite, and primarily limited to factors that have been continually addressed by EO and RFT staff: training, support, and dependability of the platform. In fact, researchers and educators who have used the program express respect for the strength of the overall scores given the nature of the at-risk populations with which it is consistently utilized [27-29]. The designers and trainers associated with EO have also gone to great lengths to maintain consistency in training, and the updates to the software, understanding the importance to validity. Although many schools and programs use other additional resources, like tutoring, the EO design brings primary academic focus through the online platform, with pretesting and post testing internally and often externally present, and is often further confirmed by outside normative testing. There is not software involved as the platform is web based which allows less costly and quicker changes than traditional software changes. All of these factors, combined with the appropriateness of the analyses in this paper, suggest strong evidence for internal validity [26].

Any type of technology-oriented support service is always subject to the complications of unexpected difficulties, ranging from power outages to the use of less effective computers, and sometimes includes unexpected problems with the platform design itself. EO has evolved through a number of versions, dating back to the 1980s and the original conception of the intervention, but has enjoyed a remarkable consistency in terms of performance and outcomes.

Extralearning Online has grown in popularity specifically because it attempts to address the primary needs of the new century: accounting for the growing diversity of learners; targeting struggling learners with specific individualized help; working in tandem with teachers and specialists; providing schools with evidence of progress outside of standardized testing; and working in step with specific state learning objectives and courses, or needs. EO was created and evolved through intelligent design, rather than through experimentation, to address the benefits that technology can enhance in pedagogies already known to be successful, ranging from guided practice to kinesthetic learning.

The results have been notably consistent over time, even as modifications and updates to the program have been implemented and as technology evolves and improves. Few programs or large-scale interventions can claim such a uniformity in performance over such a period of time. Given the performance to date, one might assume that EO should be used with more and larger groups of at-risk students with the expectation of similar gains.

The limitations to a program such as EO are mainly factors that any blended learning pedagogy must address appropriately: the adequate training of the teachers and staff using the program; the continued dependability of the evolving technology; the appropriate use of the data and results; the access to proper equipment and labs that students must have; the use of supplemental resources like tutoring that facilitate the program; and the effective use of pre-testing, post-testing and parallel measures to confirm placement and adequate progress. In the programs in this study, administered by Reach For Tomorrow, Inc., the initial training was supplemented with daily feedback until the instructors demonstrated consistent performance and mastery of administrative tasks as determined by the trainers. Unlike other Internet-based programs, EO does not leave instructors completely, even after training is complete.

Controlling for the various challenges and factors, EO has a predictable track record for fostering learning gains, and challenges the notion that struggling schools do not have resources available to them to address complicated learning needs that are innovative and effective. There is strong empirical evidence that Extralearning Online, as administered by Reach For Tomorrow, Inc., in the studied programs, facilitated significant grade gains and percentage gains across variable settings.

Although there are adequate cautions to suggest that technology-based interventions are far from an educational panacea, there is also evidence that when designed and used properly, technology-based interventions free human resources to focus on more intensely personal forms of remediation—one on one tutoring, reading aloud together, mentoring, and group projects. Programs like EO do not replace actual instruction, but instead provide a means to remediate without simply repeating. This not only helps struggling students, but also potentially reduces teacher strain in highly stressful situations. EO utilizes the logic and intentionality that go into planning instruction, but allows more of the actual activities to happen independently, using the technology to monitor progress, maintain timelines and measure progress, but also freeing teachers and staff to carry out the other human roles they can play in supporting remediation.

The future of online learning has been made increasingly manifest in postsecondary settings, where everything from a Ph.D. to an automobile mechanic certification can be accomplished through primarily technology-based platforms. It remains for K12 educators to fully take advantage of the possibilities in remediation that technology-based learning makes not only more feasible, but also increasingly necessary, according to the evidence, as they promote more effective learning when combined with traditional supports.

Appendix

Notes on Variables Used in Meta-Analysis

YEAR 1/YEAR 2: Some programs were completed in one calendar year; some spanned two years due to the length of the school year or academic year; a few were longitudinal for several years.

STATE: Counting Washington DC, results were analyzed for 12 states.

SCHOOL: Specific names of schools participating in the program. School hosting the program was a primary unit of analysis.

FULL N: The total number of student participants beginning in the program.

TRUE N: The final number of students completing the program with appropriate scores; this number represents only scores that were reliable and valid for the meta-analysis; scores were weighted by sample size for schools.

LEVEL: The three school levels analyzed in this study were elementary, middle (including junior high school), and high school.

AREA: The scores analyzed in this study were specifically within the content areas of Language Arts (including Reading) and/or Mathematics.

GL INCREASE: Grade Level increases were measured using internal EO measures, and in many cases also measured normatively using the TABE. (Students also completed state test scores which were not easily gathered for this study.)

% INCREASE: Extralearning Online percentage increases generated by the program itself were included as raw scores in the data to compare with grade level gains and the TABE.

TIME: This represents the average number of hours each students invested in Extralearning Online to match with the grade level and percentage gains in the program.

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