Theory of Action References

Discovery Education, in collaboration with Empirical Education, developed a logic model built on foundational theories of action. Theories of action are statements that are supported by research in the field and explain how change can lead to improved practices in teaching and learning. These statements serve to underpin the findings from literature in the field that highlight specific actions and changes outlined in Discovery Education's logic model.

This document includes research to support the following **Theory of Action** statements:

1. When school and district administrators invest in, prioritize, and support the use of research-based, digital learning resources by teachers and students, engagement and achievement increase.

2. When teachers and administrators fully engage with professional learning designed to improve teaching and learning, efficacy in instructional practice increases.

3. When high-quality, high-interest digital content is integrated into the daily learning routine in the classroom, students are more engaged and more motivated to work through challenges, thus deepening learning.

4. When lessons include multiple means of representation and expression, students are more engaged, and deeper understanding and active learning takes place.

5. When students have more opportunities to engage with learning experiences that connect to the real world, learning has deeper meaning and authenticity.

6. When teachers have access to formative assessment data, they are able to better understand the unique needs of their students and differentiate instruction to meet learners where they are academically.

7. When students are given access to detailed and timely feedback on assignments, they can more easily self-monitor, reflect on their learning path, and expand agency of their own learning.

Theory of Action Statement 1

When school and district administrators invest in, prioritize, and support the use of research-based, digital learning resources by teachers and students, engagement and achievement increase.

The following studies and papers support this theory of action statement and provide guidance to our product development and product design, professional learning and partner success teams when creating, developing, and implementing our program.

1. Best Practices of Leadership In Educational Technology

Brown, L. (2014). Best practices of leadership in educational technology. Journal of Educational Technology, 11(1), 1-6. URL

"Leadership in Educational Technology is a relatively new field that is changing as fast as technology itself. Success for an educational leader includes maintaining a firm grasp of how to diagnose the needs of a district, a school, or a classroom while aligning policies, procedures, and protocols into a format that will empower the individual teacher efficacy and student learning outcomes. Being a leader in educational technology includes more than incorporating new technologies into the classroom. Leadership in educational technology requires an outlook that views technology not as a tool for every occasion, but as a tool that when used, will enhance the learning process. An approach of best practices is essential to maintain effectiveness as an educational leader, and yet there is very little research that includes a synthesis of the best practices or approaches that are certain to increase an educational leader's effectiveness. A best practices approach that relies on the use of constructivist teaching method, that strives for continuous improvement through the use of professional learning networks and communities, and that utilizes online professional development will produce the kind of effectiveness in teachers that is associated with positive student learning outcomes." -Abstract

2. Beyond the Classroom: A Framework for Growing School Capacity in a Digital Age

Haynes, C. A., & Shelton, K. (2018). Beyond the classroom: A framework for growing school capacity in a digital age. Journal of Research on Technology in Education, 50(4), 271-281.

"Rapid technological advancements promise unprecedented educational opportunities to foster student-centered and personalized learning, yet many schools are underprepared, lacking comprehensive organizational strategies for technology enhanced learning. This study sought to provide a framework to guide K-12 school leaders to build and evaluate digital-age school capacity by identifying essential criteria for digital learning in schools, resulting in the development of the Digital Learning Implementation Framework for Education (D-LIFE). Geographically dispersed digital learning experts contributed to a six-round Delphi study gaining consensus on 148 essential criteria for school administrators and policymakers to appraise strategic evaluation of technology implementation. When compared to prominent frameworks, D-LIFE confirmed high-level alignment with ISTE Essential Conditions, providing a comprehensive evaluation framework for K–12 schooling not addressed in prominent standards or frameworks." -Abstract

3. Leading Technology-Rich School Districts: Advice from Tech-Savvy Superintendents

McLeod, S., Richardson, J. W., & Sauers, N. J. (2015). Leading technology-rich school districts: Advice from tech-savvy superintendents. Journal of Research on Leadership Education, 10(2), 104-126. URL

"Superintendents' instructional leadership is critical to the academic success of school systems. In addition to traditional work complexities, today's superintendents must navigate rapid and significant technological transformations. In this study, an exploratory sample of "technology-savvy" superintendents was interviewed to ascertain advice about how to navigate the complexities that surround successful district-level technology leadership strategies and mind-sets. Participants highlighted issues such as budgets, professional development, and instructional leadership, and affirmed the value of personally modeling technology use. They also emphasized both personal and organizational risk-taking and shared how communities of practice can help alleviate skill and knowledge gaps." -Abstract

4. Leadership Practice in a One-to-one Computing Initiative: Principals' Experiences in a Technology Driven, Second-order Change

Pautz, S., & Sadera, W. A. (2017). Leadership practice in a one-to-one computing initiative: Principals' experiences in a technology driven, second-order change. Computers in the Schools, 34(1-2), 45-59.

"School districts have been placed under increasing pressure to equalize student access to technology and equip students with the skills necessary to be competitive in a global economy. In response, a growing number of schools have sought an irreversible and dramatic departure from past practices, a second-order change, to learner-centered environments powered by one-to-one computing. While one-to-one computing has drawn the attention of researchers

for more than 30 years, the field has not examined principals' experiences in leading the implementation of such an initiative. Yet leadership research continually affirms the importance of the principal in effective change implementation. This article discusses the findings of a study that explored principals' experiences leading the changes associated with a one-to-one initiative and the contexts or situations that influenced those experiences. Using a phenomenological method, this study explored how eight elementary school principals leading a one-to-one initiative viewed their role and responsibilities, promoted change, and responded to successes and challenges. This study provides new insights into change leadership that will inform practice in the leadership of one-to-one computing initiatives." -Abstract

5. District Technology Leadership Then and Now: A Comparative Study of District Technology Leadership from 2001 to 2014

Richardson, J. W., & Sterrett, W. L. (2018). District technology leadership then and now: A comparative study of district technology leadership from 2001 to 2014. Educational Administration Quarterly, 54(4), 589-616. URL

"This article focuses on district superintendents who were recognized as eSchoolNews Tech-Savvy Superintendents. Research Methods: Using interviews, this study compares data from superintendents who won this award between 2001 and 2010 in contrast to those who won the award between 2011 and 2014. The focus of the study is on understanding how discussions of challenges and successes within this population have shifted over nearly 15 years…A key finding is that these district-level leaders have shifted away from first-order changes of implementing technology initiatives and toward second-order changes of supporting teaching and learning that is supported with modern digital technologies." -Abstract

6. The Principal's Role in Supporting a School's Technology Culture: A Mixed Methods Study

Sawicki, J. H. (2021). The Principal's Role in Supporting a School's Technology Culture: A Mixed Methods Study (Publication No. 28648377). [Doctoral dissertation, Delaware Valley University. ProQuest.

"This mixed methods exploratory sequential study investigated the principal's role in supporting a school's technology culture. In light of the 2019-2020 worldwide pandemic, schools around the world saw a significant increase put on technology tools to facilitate instruction virtually. As building leaders, the administrators led the transition to fully virtual instruction by supporting their teachers..the researcher collected data from K-12 principals and assistant principals in a targeted six county area of eastern Pennsylvania. This study used a survey along with semi-structured interviews. The pandemic closure of 2019-2020 provided a unique opportunity to understand principals' knowledge of the ISTE-EL Standards, to identify how they demonstrate implementation of the ISTE-EL Standards, to see if they value technology as curriculum tool, and to see how prepared building leaders were for the sudden shift to fully virtual instruction.

Overall, this study revealed that administrators have knowledge of the ISTE-EL standards as measured by their responses to 45 questions on the survey. Two themes emerged from the interview data that highlighted elements of the principals' implementation of the ISTE-EL Standards: access to the internet and professional development and collaboration. Interview data revealed that these administrators, as a whole, value technology as a curriculum tool. In schools where one-to-one programs were already in place, their perception was that they were prepared to make the shift to fully virtual instruction." -Abstract

7. An Analysis of Factors which Influence High School Administrators' Readiness and Confidence to Provide Digital Instructional Leadership

Shepherd, A. C., & Taylor, R. T. (2019). An Analysis of Factors Which Influence High School Administrators' Readiness and Confidence to Provide Digital Instructional Leadership. International Journal of Educational Leadership Preparation, 14(1), 52-76. URL

"School leaders are to be instructional leaders within a digital environment, just as they are expected to do in the non-digital environment. The purpose of this study was to analyze the factors which high school administrators perceive to influence their knowledge and confidence to lead in a digital school environment. Findings suggest that administrators should seek professional development opportunities, knowledgeable and confident colleagues, and opportunities to supervise others to increase knowledge and confidence." -Abstract

8. Reimagining the Role of Technology in Education: 2017 National Education Technology Plan Update

"The National Education Technology Plan (NETP) sets a national vision and plan for learning enabled by technology through building on the work of leading education researchers; district, school, and higher education leaders; classroom teachers; developers; entrepreneurs; and nonprofit organizations. The principles and examples provided in this document align to the Activities to Support the Effective Use of Technology (Title IV) Part A of the Elementary and Secondary Education Act (ESEA), as amended by the Every Student Succeeds Act (ESSA). To illustrate key ideas and recommendations, the plan includes examples of the transformation enabled by the effective use of technology. These examples include both those backed by rigorous evidence as well as emerging innovations. The identification of specific programs or products in these examples is designed to provide a clearer understanding of innovative ideas. The NETP also provides actionable recommendations to implement technology and conduct research and development successfully that can advance the effective use of technology to support learning and teaching. This 2017 update to the NETP is the first yearly update in the history of the plan." -Abstract

Theory of Action Statement 2

When teachers and administrators fully engage with professional learning designed to improve teaching and learning, efficacy in instructional practice increases.

The following studies and papers support this theory of action statement and provide guidance to our product development and product design, professional learning and partner success teams when creating, developing, and implementing our program.

1. Can Professional Development Make the Vision of the Standards a Reality? The Impact of the National Science Foundation's Local Systemic Change through Teacher Enhancement Initiative

Banilower E. R., Heck, D. J., & Weiss, I. R. (2007). Can professional development make the vision of the standards a reality? The impact of the National Science Foundation's Local Systemic Change through Teacher Enhancement Initiative. Journal of Research in Science Teaching, 44(3), 375-395.

"Professional development is seen as one of the major levers for aligning science instruction in the USA with the vision put forth by national standards documents. Although there is a growing consensus regarding what constitutes effective professional development, there is little empirical evidence to support this consensus. This study examines the impact of professional development that is content-based, situated in classroom practice, and sustained over time on teacher attitudes, perceptions of preparedness, and classroom practices. It utilizes longitudinal data from the National Science Foundation's Local Systemic Change through Teacher Enhancement Initiative (LSC), collected from 42 projects over a span of 7 years. The professional development model used in the LSCs differed from previous initiatives in that it targeted all teachers in a jurisdiction and emphasized preparing teachers to implement project-designated instructional materials. Analyses of the data provide evidence that this model for professional development has an impact on teachers and their classroom practices. In addition, the analyses found that teachers' perception of principal support for 'Standards'-based science instruction is an important predictor of these outcomes." -Abstract

2. Effective Teacher Professional Development

Darling-Hammond, L Hyler, M. E., & Gardner, M. (2017). Effective teacher professional development. Learning Policy Institute. URL

"Teacher professional learning is of increasing interest as one way to support the increasingly complex skills students need to learn in preparation for further education and work in the 21st century. Sophisticated forms of teaching are needed to develop student competencies such as deep mastery of challenging content, critical thinking, complex problem-solving, effective communication and collaboration, and self-direction. In turn, effective professional development (PD) is needed to help teachers learn and refine the pedagogies required to teach these skills.

However, research has shown that many PD initiatives appear ineffective in supporting changes in teacher practices and student learning. Accordingly, the authors set out to discover the features of effective PD. This paper reviews 35 methodologically rigorous studies that have demonstrated a positive link between teacher professional development, teaching practices, and student outcomes. The authors identify the features of these approaches and offer rich descriptions of these models to inform those seeking to understand the nature of the initiatives. In this review, they find seven widely shared features of effective professional development. Such professional development: (1) Is content focused; (2) Incorporates active learning; (3) Supports collaboration; (4) Uses models of effective practice; (5) Provides coaching and expert support; (6) Offers feedback and reflection; and (7) Is of sustained duration."-Abstract

3. Professional Learning in the Learning Profession: A Status Report on Teacher Development in the United States and Abroad

Darling-Hammond, L., Wei, R. C., Andree, A., Richardson, N., & Orphanos, S. (2009). Professional learning in the learning profession: A status report on teacher development in the United States and abroad. National Staff Development Council and the School Redesign network at Stanford University Retrieved from Learning Forward at URL

"In 2009, [the National Staff Development Council (NSDC)] released Professional Learning in the Learning Profession: A Status Report on Teacher Development in the United States and Abroad. This report examines what research has revealed about professional learning that improves teachers' practice and student learning. The report describes the availability of such opportunities in the United States and high-achieving nations around the world, which have been making substantial and sustained investments in professional learning for teachers over the last two decades. Funding for the multiyear research effort comes from the Bill and Melinda Gates Foundation, MetLife Foundation, NSDC, and The Wallace Foundation." -Learning Forward Introduction

4. "Changing The Way I Teach": Building Teacher Knowledge, Confidence, and Autonomy

Dierking R. C., & Fox, R. F. (2013). "Changing the way I teach" building teacher knowledge, confidence, and autonomy. Journal of Teacher Education, 64(2), 129-144. <u>URL</u>

"In this article, the authors examine the effect of a National Writing Project professional development model on a group of middle school writing teachers. The authors examine how contact with other professionals in intensive week-long sessions as well as mentoring from the professional development coach affected the teachers' concept of themselves as professionals, as writers, and as colleagues, as well as how this attitudinal change affected their classrooms and students. The authors begin with an overview of recent scholarship on teacher "empowerment," efficacy, and the National Writing Project. The authors then explicate their methodology and findings from this 2-year study, including how advanced knowledge builds confidence, how autonomy sustains empowerment, and how support can strengthen teachers, whereas other disempowering forces can negatively affect teacher actions. Implications for other professional development models as well as for future National Writing Project endeavors are included." -Abstract

5. What Works in Professional Development?

Guskey, T. R., & Yoon, K. S. (2009). What works in professional development? Phi delta kappan, 90(7), 495-500. <u>URL</u>

"This article describes a model of teacher change originally presented nearly two decades ago (Guskey, 1986) that began my long and warm friendship with Michael Huberman. The model portrays the temporal sequence of events from professional development experiences to enduring change in teachers' attitudes and perceptions. Research evidence supporting the model is summarized and the conditions under which change might be facilitated are described. The development and presentation of this model initiated a series of professional collaborations between Michael and myself, and led to the development of our co-edited book, Professional Development in Education: new paradigms and practices (Guskey & Huberman, 1995), which was named 'Book of the Year' by the National Staff Development Council in 1996." -Abstract

6. Studying the Effects of Professional Development: The Case of the NSF's Local Systemic Change Through Teacher Enhancement Initiative

Heck, D. J., Banilower, E. R., Weiss, I. R., & Rosenberg, S. L. (2008). Studying the effects of professional development: The case of the NSF's local systemic change through teacher enhancement initiative. Journal for Research in Mathematics Education, 39(2), 113–152. <u>URL</u>

"Enacting the vision of NCTM's "Principles and Standards for School Mathematics" depends on effective teacher professional development. This 7-year study of 48 projects in the National Science Foundation's Local Systemic Change Through Teacher Enhancement Initiative investigates the relationship between professional development and teachers' attitudes, preparedness, and classroom practices in mathematics. These programs included many features considered to characterize effective professional development: content focus, extensive and sustained duration, and connection to practice and to influences on teachers' practice. Results provide evidence of positive impact on teacher-reported attitudes toward, preparedness for, and practice of "Standards"-based teaching, despite the fact that many teachers did not participate in professional development to the extent intended." -Abstract

7. Designing Effective Professional Development for Technology Integration in Schools

Yurtseven Avci, Z., O'Dwyer, L. M., & Lawson, J. (2020). Designing effective professional development for technology integration in schools. Journal of Computer Assisted Learning, 36(2), 160-177. <u>URL</u>

"This study aims to explore the critical factors for effective professional development (PD) activities to support teachers' technology integration and suggests a design model: flipped PD. The following questions are investigated: What are the core features of effective teacher PD, what are the implications of core features in effective technology integration PD, and what are the best practices for designing a flipped PD model for preparing teachers to integrate technology into their classrooms? First, we discuss the core features of effective teacher PD: content focus, active learning, coherence, duration, collective participation, and the role of context. Second, we explore design factors in recent technology integration PD studies: learner centered, relevance and reflection, evidence of student learning, support and follow-up, student voice, and initial implementation with teacher leaders. Finally, we present a discussion of our recommendations for a flipped model for technology integration PD." -Abstract

Theory of Action Statement 3

When high-quality, high-interest digital content is integrated into the daily learning routine in the classroom, students are more engaged and more motivated to work through challenges, thus deepening learning.

The following studies and papers support this theory of action statement and provide guidance to our product development and product design, professional learning and partner success teams when creating, developing, and implementing our program.

1. Handbook of Research on Innovative Digital Practices to Engage Learners

Bull, P. H. E., & Keengwe, J. E. (2019). Handbook of research on innovative digital practices to engage learners. Information Science Reference/IGI Global. URL

"Digital integration is the driving force of teaching and learning at all levels of education. As more non-traditional students seek credentialing, certification, and degrees, institutions continue to push the boundaries of innovative practices to meet the needs of diverse students. Programs and faculty have moved from merely using technology and learning management systems to unique and innovative ways to engage learners.

The "Handbook of Research on Innovative Digital Practices to Engage Learners" is a scholarly publication that offers theoretical frameworks, delivery models, current guidelines, and digital design techniques for integrating technological advancements in education contexts to enforce student engagement and positive student outcomes. Featuring a wide range of topics such as gamification, wearable technologies, and distance education, this book is ideal for teachers, curriculum developers, instructional designers, principals, deans, administrators, researchers, academicians, education professionals, and students." -Abstract

2. Trends in the Design, Development, and Use of Digital Curriculum Materials

Choppin, J., & Borys, Z. (2017). Trends in the design, development, and use of digital curriculum materials. ZDM, 49(5), 663-674.

"We explore questions around the design, development, and dissemination of digital curriculum materials, the perspectives in these areas, and how these perspectives align with broader discourses in education. We identify and briefly describe four perspectives: (1) designer perspective; (2) policy perspective; (3) private sector perspective (e.g., publishers and philanthropists); and (4) user (teachers and schools) perspective. We discuss how these perspectives converge and diverge by looking at the different features of curriculum materials emphasized by each perspective and the reasons for these emphases. The discussion and findings speak to the promise of digital programs as well as limitations related to the rationales related to the development, dissemination and use of digital curriculum resources. The emergence of a dominant perspective speaks to broader concerns about educational priorities being formulated according to a market-based rationality." -Abstract

3. Voices from the Classroom, 2020

Educators for Excellence. Voices from the Classroom, 2020.

"The Voices from the Classroom 2021 survey questionnaire was developed by 12 Educators for Excellence teacher members from across the United States. The instrument was written and administered by Gotham Research Group, an independent research firm, and conducted online from Dec. 1 through Dec. 14, 2020, among a nationally representative sample of 800 full-time public school teachers." -Methodology

"Only half of all teachers report their curricula to be high quality and well aligned to learning standards. This decreases for teachers in schools reporting a majority of low-income students (44%), students of color (41%), and English Learners (33%). Furthermore, just 37% claim to receive training that enables them to implement their curricula effectively. Distance learning has made the challenges with curricula even more acute, as 31% of teachers report their curricula are easy to adapt for distance learning. Similarly, 35% think their curricula include high-quality formative assessments to measure student learning." -Relevant Findings

4. Characteristics of Digital Learning Content, Pedagogies, and Platforms that Support Young Learners: An Analysis of Existing Literature and Research

Smithsonian Center for Learning and Digital Access and Navigation North Learning Solutions. (2017). Characteristics of digital learning content, pedagogies, and platforms that support young learners: An analysis of exiting literature and research. URL

"[The] goal of this Literature Review, as a piece of a larger research effort, Understanding the Needs of Student Users of Digital Smithsonian Resources, focuses on published research, studies, reports, and articles targeting student use of digitally supported learning environments and tools…the design for this review and summary report is to lend additional insight into how digital systems, tools, pedagogy and content, can be adapted to better meet students' learning needs."-Abstract

Key Findings:

"[Findings] focus on expanding ways for learners to document their own thinking to support metacognitive processing, monitor their progress while achieving tasks and assignments, and engage in communication as a way to receive feedback and share their work approach. In reviewing these general trends, the following represent a summary of key findings and strategies that have substantial research support.

- Learning flow is more consistent and more readily supports achievement when there is a high level of correlation or alignment between content, objects/resources, visual supports or media, and tasks to aid in persistence and minimize cognitive load.

- Developing and sustaining an online learning community focused on inquiry and learning is crucial in helping students access both their instructors and peers. Sharing their thinking, their findings, and their learning processes, and having access to those of their peers, helps validate work approach, keeps students engaged, and provides an opportunity to blend social, cognitive, and teaching dynamics.

- Students' engagement and performance levels increase when quality content and activities are developed by a learner's own teacher.

- Mutual problem-solving or co-development of learning products helps young students make more meaningful connections to their learning and to one another through establishing relationships focused on learning outcomes.

- Presenting students with open-ended, deep, interesting questions and keeping those questions central and accessible to students throughout their inquiry process helps guide targeted inquiry and progress through complex tasks online."

5. Curriculum Research: What We Know and Where We Need to Go

Steiner, D. (2017, March). Curriculum research: What we know and where we need to go. Washington, D.C.: StandardsWork. URL

"In Winter 2017, the Johns Hopkins Institute for Education Policy and Johns Hopkins Center for Research and Reform in Education conducted a research review on the effects of curricular choices in K–12 education for the Knowledge Matters Campaign, a project of StandardsWork, Inc. [Findings] include:

- Curriculum is a critical factor in student academic success.

- Comprehensive, content-rich curriculum is a common feature of academically high-performing countries. » The cumulative impact of high-quality curriculum can be significant and matters most to achievement in the upper grades where typical year-on-year learning gains are far lower than in previous grades.

- Because the preponderance of instructional materials is self-selected by individual teachers, most students are taught through idiosyncratic curricula that are not defined by school districts or states.

- Research comparing one curriculum to another is very rare and, therefore, not usually actionable.

The overarching conclusions from the Johns Hopkins' review are that curriculum is deeply important, that a teacher's or district's choice of curriculum can substantially impact student learning, and that—as a result—the paucity of evidence upon which sound instructional, purchasing, and policy decisions can be made is a matter of deep concern and urgent need." -Abstract

6. A Systematic Review of Design and Technology Components of Educational Digital Resources

"With the rise of the Internet and the proliferation of online content, the design and evaluation of educational digital resources (EDRs) are pressing and challenging issues. They warrant an investigation of what exactly are the features that increase the quality of EDRs. In a previous professional development program, we trained and supported teachers in evaluating and selecting EDRs with the support of a scientifically validated rubric. In this present study, through quantitative, qualitative, and text-mining methods, we analyzed the review data of 1200 resources produced that professional development program in order to provide a big picture of the quality of currently available products, and to identify the features that characterize quality digital resources. Our findings suggest the need for digital repositories to reflect or make visible how resources fit particular instructional design models." -Abstract

Theory of Action Statement 4

When lessons include multiple means of representation and expression, students are more engaged, and deeper understanding and active learning takes place.

The following studies and papers support this theory of action statement and provide guidance to our product development and product design, professional learning and partner success teams when creating, developing, and implementing our program.

1. Universal Design for Learning (UDL): A Content Analysis of Peer-Reviewed Journal Papers from 2012 to 2015

"The Universal Design for Learning (UDL) framework is increasingly drawing the attention of researchers and educators as an effective solution for filling the gap between learner ability and individual differences. "Abstract:" This study aims to analyse the content of twelve papers, where the UDL was adopted. The articles were chosen from several databases and journals based on four criteria: 1) peer-reviewed papers, 2) provision of empirical results, 3) focused on UDL as a framework, and 4) published from 2012 to 2015. Then, these studies were analysed according to seven themes: type of results, study beneficiary (learners, teachers, both), sample features, geographical region, data collection techniques, data analysis techniques, and learning modes. Most of the selected studies applied the UDL in a traditional or a blended learning mode, whereas only two studies evaluated its effectiveness in online learning environments. It is noteworthy that the majority of the experiments were carried out in the USA. Additionally, positive results of UDL implementation were yielded in eleven papers. These outcomes suggest that UDL is an efficient approach for designing flexible learning environments and accessible content. Such designs can match a wide mix of learner needs, abilities, background knowledge, educational experience, and cultural differences. However, further research is required in order to confirm the positive impacts of UDL in different educational settings and cultural backgrounds." -Abstract

2. The Effectiveness of Universal Design for Learning: A Meta-Analysis of Literature Between 2013 and 2016

"Universal Design for Learning (UDL) is often promoted as an inclusive teaching methodology for supporting all students within diverse contemporary classrooms. This is achieved by proactively planning to the edges of a classroom by thinking of all the potential needs of students. To examine its effectiveness, a meta-analysis was conducted on empirical research, containing pre- and post-testing, published in peer-reviewed journals between 2013 and 2016 (N = 18). Results from this analysis suggest that UDL is an effective teaching methodology for improving the learning process for all students. The impact on educational outcomes has not been demonstrated. The implications of this study will be discussed." -Abstract

3. Multimedia Learning

"Richard E. Mayer takes an evidence-based approach to improving education using well-designed multimedia instruction. He reviews 15 principles of multimedia instructional design that are based on more than 200 experimental research studies and grounded in a cognitive theory of how people learn from words and graphics. The result is the latest instalment of what Mayer calls the Cognitive Theory of Multimedia Learning…This edition provides an up-to-date and systematic summary of research studies on multimedia learning, supplemented with complementary evidence from around the globe." -Abstract

4. Universal Design for Learning: Theory & Practice

"In the 1990s, Anne Meyer, David Rose, and their colleagues at CAST introduced universal design for learning (UDL), a framework to improve teaching and learning. Based on new insights from the learning sciences and creative uses of digital technologies. UDL can help educators improve and optimize learning experiences for all individuals. In this book, Meyer and Rose, along with David Gordon, provide the first comprehensive presentations of UDL principles and practices since 2002. This new look at UDL includes contributions from CAST's research and implementation teams, as well as their collaborators in schools, universities, and research settings." -Abstract

5. Universal Design for Learning in Pre-K to Grade 12 Classrooms: A Systemic Review of Research

"Some researchers have characterized Universal Design for Learning (UDL) as a promising framework to provide diverse students with access to the general education curriculum, but to what extent and how have UDL-based interventions fulfilled that promise? The purpose of this review was to analyze studies that investigated impacts of UDL-based instruction on academic and social outcomes for pre-K to grade 12 students. For the 13 studies that qualified for our review, we analyzed how researchers applied UDL principles as well as outcomes and efficacy of UDL-based interventions. Results of this analysis suggest that overall, UDL-based instruction has the potential to increase engagement and access to general education curriculum for students with disabilities, and improve students' academic and social outcomes. However, we found mixed results; the efficacy of UDL-based interventions varied considerably within and across many studies, with effect sizes ranging from small to large. In addition, we found that although authors noted that their interventions were UDL-based, there was considerable variance in how authors reported connections between specific UDL guidelines and components of their interventions." -Abstract

Theory of Action Statement 5

When students have more opportunities to engage with learning experiences that connect to the real world, learning has deeper meaning and authenticity.

The following studies and papers support this theory of action statement and provide guidance to our product development and product design, professional learning and partner success teams when creating, developing, and implementing our program.

1. The Impact of Project-Based Learning on Minority Student Achievement: Implications for School Redesign

Cervantes, B., Hemmer, L., & Kouzekanani, K. (2015). The impact of project-based learning on minority student achievement: Implications for school redesign. Education Leadership Review of Doctoral Research 2(2), 50-66. URL

"Project-Based Learning (PBL) serves as an instructional approach to classroom teaching and learning that is designed to engage students in the investigation of real-world problems to create meaningful and relevant educational experiences. The causal-comparative study compared 7th and 8th students who had utilized the PBL with a comparison group in which PBL was nonexistent. Using outcome measures of academic achievement in mathematics and reading, multivariate and univariate analyses of the data showed that the PBL groups performed at a higher achievement level than did the non-PBL students. Theoretical and practical implications are discussed." -Abstract

2. Realistic Authenticity

Fougt, S. S., Misfeldt, M., & Shaffer, D. W. (2019). Realistic authenticity. Journal of Interactive Learning Research, 30(4), 477-504. URL

"This study explores the concept of authenticity in education, which has been, over the last 25 years, a powerful metaphor for educational practice, particularly as a guiding principle for some technological innovations that support student learning. The concept of authenticity has a variety of meanings, although a dominant interpretation is that authenticity refers to the alignment of educational practice with activities in the real world. Based on a meta-analysis of research on the topic, Shaffer and Resnick (1999) proposed unifying the array of meanings for authenticity with their concept of thick authenticity, which included four different aspects of authentic learning: real-world, assessment, disciplinary, and personal authenticity. Thick authenticity synthesizes these different facets into a mutually interdependent whole. This study revisits this discussion two decades later, again conducting a meta-review of recent literature, and re-finding the four meanings for authenticity. However, we also identify in the current literature on authenticity a fifth meaning: teacher authenticity. We then analyze two cases of technology-based teaching to explore how teachers manage the elements of authenticity in their classrooms, what this tells us about the theoretical construct of thick authenticity, and specifically the role that teacher authenticity plays in the orchestration of authentic learning. Based on these short case studies, we argue that teacher authenticity does play a key role in the construction of authentic classroom activities, but that the different elements of authenticity also conflict with and limit one another. As a result, educators need to pay more careful attention to the relationships and contradictions inherent in authentic pedagogy, and balance the different aspects of authenticity rather than focusing on maximizing any one of them. We describe this aligned and coherent understanding of authentic learning as realistic authenticity. Thus, while the primary finding of this study is from the meta-analysis of the literature, the empirical examples illustrate the results of this meta analysis, showing the complexity of authentic learning." -Abstract

3. Culturally Responsive Teaching: Theory, Research, and Practice

Gay, G. (2018). Culturally responsive teaching: Theory, research, and practice. teachers college press.

"Geneva Gay is renowned for her contributions to multicultural education, particularly as it relates to curriculum design, 'professional learning', and classroom instruction. Gay has made many important revisions to keep her foundational, award-winning text relevant for today's diverse student population, including: new research on culturally responsive teaching, a focus on a broader range of racial and ethnic groups, and consideration of additional issues related to early childhood education. Combining insights from multicultural education theory with real-life classroom stories, this book demonstrates that all students will perform better on multiple measures of achievement when teaching is filtered through students' own cultural experiences." -Abstract

4. The Effect of Realistic Mathematics Education Approach on Students' Achievement and Attitudes Toward Mathematics

"This study was conducted to determine the effect of Realistic Mathematics Education Approach on mathematics achievement and student attitudes towards mathematics. This study also sought determine the relationship between student achievement and attitudes towards mathematics. This study used a quasiexperimental design conducted on 61 high school students at SMA Unggul Sigli. Students were divided into two groups, the treatment group (n = 30) namely, the Realistic Mathematics Approach group (PMR) and the control group (n = 31) namely, the traditional group. This study was conducted for six weeks. The instruments used in this study were the achievement test and the attitudes towards mathematics questionnaires. Data were analyzed using SPSS. To determine the difference in mean achievement and attitudes between the two groups, data were analyzed using one-way ANOVA test. The result showed significant differences between the Realistic Mathematics Approach and the traditional approach in terms of achievement. The study showed no significant difference between the Realistic Mathematics Approach and the traditional approach in term of attitudes towards mathematics. It can be concluded that the use of realistic mathematics education approach enhanced students' mathematics achievement, but not attitudes towards mathematics. The Realistic Mathematics Education Approach encourage students to participate actively in the teaching and learning of mathematics. Thus, Realistic Mathematics Education Approach is an appropriate methods to improve the quality of teaching and learning process." -Abstract

Theory of Action Statement 6

When teachers have access to formative assessment data, they are able to better understand the unique needs of their students and differentiate instruction to meet learners where they are academically.

The following studies and papers support this theory of action statement and provide guidance to our product development and product design, professional learning and partner success teams when creating, developing, and implementing our program.

1. Fundamentals of Formative Assessment for Classroom Teachers

Bartz, D.E. (2017). Fundamentals of formative assessment for classroom teachers. National Forum of Teacher Education Journal, 27(3), 1-10. URL

"Formative assessment is a planned process in which assessment results are used to measure students' progress toward mastering learning targets and for teachers to adjust instruction and content. The formative assessment process is composed of the following nine steps: (1) determining the content to be learned and taught, (2) identifying and clearly describing assessment criteria for the content, (3) determining instructional strategies as a reference point to commence instruction, (4) sharing with students their role in formative assessment, (5) administering a pre- assessment/pretest (if applicable), (6) implementing the instructional strategies, (7) collecting formative assessment data, (8) providing students with feedback from the formative assessment pointed toward learning targets, and (9) readjusting instruction for students based on the formative assessment feedback. Supplementing formative assessment through using technology can make it even more effective and has the potential to lighten the teacher's workload. A close and objective analysis of the state-of-the-art benchmark or interim assessments reveals that they can be useful for improving student learning." -Abstract

2. Differentiated Instruction in a Data-based Decision-making Context

Faber, J. M., Glas, C.A., & Visscher, A.J. (2018). Differentiated instruction in a data-based decision-making context. School Effectiveness and School Improvement, 29(1), 43-63. URL

"In this study, the relationship between differentiated instruction, as an element of data-based decision making, and student achievement was examined. Classroom observations (n = 144) were used to measure teachers' differentiated instruction practices and to predict the mathematical achievement of 2nd- and 5th-grade students (n = 953). The analysis of classroom observation data was based on a combination of generalizability theory and item response theory, and student achievement effects were determined by means of multilevel analysis. No significant positive effects were found for differentiated instruction practices. Furthermore, findings showed that students in low-ability groups profited less from differentiated instruction than students in average or high-ability groups. Nevertheless, the findings, data collection, and data-analysis procedures of this study contribute to the study of classroom observation and the measurement of differentiated instruction." -Abstract

3. Formative Assessment: Making it Happen in the Classroom

Heritage, M. (2021). Formative assessment: Making it happen in the classroom. Corwin Press.

"Formative assessment is a process used by teachers and students to keep learning moving forward. In the 10 years since the first edition of Formative Assessment was published, the practice has become a mainstay in classrooms, but that does not mean that it is easy. Education expert Margaret Heritage walks readers through every step of implementation and offers numerous examples that illustrate formative assessment practices across a range of subjects and grade levels. She explains how to articulate learning progressions, goals, and success criteria; select assessment strategies and provide quality feedback; engage students in self-assessment and self-management; and create an environment that values feedback as part of the learning process." -Abstract

4. The Power of Assessment for Learning: Twenty Years of Research and Practice in UK and US Classrooms

Heritage, M., & Harrison, C. (2019). The power of assessment for learning: Twenty years of research and practice in UK and US classrooms.

"Twenty years after the publication of "Inside the Black Box," the landmark review of formative classroom assessment, international education experts Christine Harrison and Margaret Heritage tackle assessment for learning (AfL) anew, with fresh insights gained from two decades of research, theory, and classroom practice. "The Power of Assessment for Learning: Twenty Years of Research and Practice in UK & US Classrooms" examines the practices and processes of formative assessment over time in both countries, evaluates the benefits accrued to teaching and learning, and considers future developments in growing and sustaining AfL practice. It features: (1) Key AfL ideas, approaches, and supports; (2)

for Learning: Twenty Years of Research and Practice in UK & US Classrooms" examines the practices and processes of formative assessment over time in both countries, evaluates the benefits accrued to teaching and learning, and considers future developments in growing and sustaining AfL practice. It features: (1) Key AfL ideas, approaches, and supports; (2) Vignettes of classroom practice that illustrate AfL in action in the U.K. and U.S.; and (3) Practice-based evidence to enrich understanding of AfL from both the teacher's and the student's perspective. Focused on student- centeredness and rich with classroom examples, this book is a 'sounding board' for educators to explore and reflect on their own AfL practices and beliefs." -Abstract

5. From Evidence to Action: A Seamless Process in Formative Assessment?

Heritage, M., Kim, J., Vendlinski, T., & Herman, J. (2008). From evidence to action: A seamless process in formative assessment? (CRESST report 741). Educational Measurement: Issues and Practice, 28(3), 24-31. <u>URL</u>

"Based on the results of a generalizability study (G study) of measures of teacher knowledge for teaching mathematics developed at The National Center for Research, on Evaluation, Standards, and Student Testing (CRESST) at the University of California, Los Angeles, this report provides evidence that teachers are better at drawing reasonable inferences about student levels of understanding from assessment information than they are in deciding the next instructional steps. We discuss the implications of the results for effective formative assessment and end with considerations of how teachers can be supported to know what to teach next." -Abstract

6. Effective Formative Assessment for Elementary Grade Classrooms: A Research Review

Klute, M. M., & Apthorp, H. S. (2018). Effective Formative Assessment for Elementary Grade Classrooms: A Research Review. AERA Online Paper Repository. <u>URL</u>

"This paper discusses practical implications of formative assessment effectiveness research in grades one through six. Formative assessment effectiveness is a timely topic for state and district leaders as they develop implementation plans for Every Student Succeeds Act (ESSA), including their approaches to supporting school-based practitioners (Shepard, Penuel, & Davidson, 2017). This paper addresses one overarching research question: What effectiveness claims can we responsibly make about formative assessment? To improve on prior research, we adopted Bennett's (2011) recommendations for conducting research on the effectiveness of formative assessment, including: precisely defining formative assessment, considering whether studies of the impact of formative assessment were conducted with sufficient quality to support causal inferences, and describing concrete instantiations of effective formative assessment." -Abstract

7. Formative Assessment and Elementary School Student Academic Achievement: A Review of the Evidence

Klute, M., Apthorp, H., Harlacher, J., & Reale, M. (2017). Formative Assessment and Elementary School Student Academic Achievement: A Review of the Evidence (REL 2017-259). Regional Educational Laboratory Central. <u>URL</u>

"[This] review identifies studies that examine the effectiveness of formative assessment and provides an overall average estimate of its effectiveness. This review also compares the effectiveness of different types of formative assessment… The review team identified 23 studies that it determined had been conducted rigorously enough to have confidence that the formative assessment interventions caused the observed effects on student outcomes. Twenty-two of the studies compared academic outcomes for students participating in formative assessment with academic outcomes for students who did not participate in formative assessment. Nineteen of the 22 studies provided enough information to calculate an effect size, which describes the magnitude of the effect of the intervention. When examining the results across these 19 studies, the review team concluded that: (1) Overall, formative assessment had a positive effect on student academic achievement. On average across all the studies, students who participated in formative assessment performed better on measures of academic achievement than those who did not; (2) Formative assessment used during math instruction had larger effects, on average, than did formative assessment used during reading and writing instruction; (3) Across all subject areas (math, reading, and writing), formative assessment had larger effects on student academic achievement when other agents, such as a teacher or a computer program, directed the formative assessment; (4) For math, both student-directed formative assessment and formative assessment directed by other agents were effective; (5) For reading, other-directed formative assessment was more effective than student-directed formative assessment; and (6) For writing, the effect of other-directed formative assessment on student academic achievement was small, and not enough evidence was available to determine the effectiveness of student-directed formative assessment." -Abstract

8. The Bridge Between Today's Lesson and Tomorrow's

Tomlinson, C. A. (2016). The bridge between today's lesson and tomorrow's. On Formative Assessment: Readings from Educational Leadership (EL Essentials), 14.

"A lot of people talk about the value of formative assessment, but Carol Ann Tomlinson points out that, too often, it is reduced to a mechanism for raising end-of-year-test scores when it should be an ongoing exchange between a teacher and his or her students designed to help students grow. When aligned with current content goals, it can help teachers and students make near-term adjustments so that student learning can proceed. Tomlinson offers 10 principles to help teachers apply sound formative assessment practices: (1) Help students understand the role of formative assessment; (2) Begin with clarity about what students need to know, understand, and be able to do; (3) Make room for student differences; (4) Provide instructive feedback to students; (5) Make feedback user-friendly; (6) Assess persistently; (7) Engage students with formative assessment; (8) Look for patterns; (9) Plan instruction around content requirements and student needs; and (10) Repeat the process." - Abstract

9. Assessment in a Differentiated Classroom

Tomlinson, C. A., & Moon, T. (2014). Assessment in a differentiated classroom. Proven programs in education: Classroom management and assessment, 1-5. URL

"It's generally accepted that one mission of schooling is to help learners develop competence and confidence with important knowledge, understanding, and skills designed to help them relate more meaningfully to the world they live in and prepare them to be good stewards of that world. Fundamental to that mission is ensuring that educators have a sound understanding of the roles of curriculum design, assessment, and instructional planning in student success. This paper highlights attributes of quality classroom practice within and among these three areas. It pays particular attention to critical intersections between formative assessment and instructional planning for teachers who seek to support the success of a broad range of learners in today's culturally and academically diverse classrooms." -Introduction

Theory of Action Statement 7

When students are given access to detailed and timely feedback on assignments, they can more easily self-monitor, reflect on their learning path and expand agency of their own learning.

The following studies and papers support this theory of action statement and provide guidance to our product development and product design, professional learning and partner success teams when creating, developing, and implementing our program.

1. Self-Regulation in Learning: The Role of Language & Formative Assessment

Bailey, A. & Heritage, M. (2018). Self-Regulation in Learning: The Role of Language & Formative Assessment. Harvard Education Press. URL

"In their new book, Alison L. Bailey and Margaret Heritage illustrate how to help students become more self-regulated learners--that is, to be able to monitor and take charge of their own learning when working independently and in groups. Language provides the foundation for the development of self-regulatory skills, enabling students to express themselves and negotiate interactions with others; the demands of these self-regulatory processes in turn can support the development of rich vocabulary and social language skills. The authors also emphasize the role of formative assessment as a means of supporting students in engaging in language-rich, self-regulated learning. "Self-Regulation in Learning" shows how classrooms can be intentionally designed to support ambitious learning. Detailed vignettes from real-life classrooms illustrate the teacher's role in helping students gradually master the processes of self-regulation, socially shared regulation, and coregulation. Each chapter also includes strategies for addressing the needs of English learners in the general education classroom. Students' capacity for self-regulation is central to the set of outcomes that compose college and career readiness: communicating and collaborating effectively, problem-solving, setting goals and following through on them, and applying knowledge in deep and rigorous ways. "Self-Regulation in Learning" represents an invaluable contribution to research-based classroom practice." -Abstract

2. Enhancing Formative Assessment Practice and Encouraging Middle School Math Engagement and Persistence

Beesley, A.D., Clark, T.F., Dempsey, K., & Tweed, A. (2018). Enhancing formative assessment practice and encouraging middle school math engagement and persistence. School science and mathematics, 118(102), 4-16. URL

"In the transition to middle school, and during the middle school years, students' motivation for mathematics tends to decline from what it was during elementary school. Formative assessment strategies in mathematics can help support motivation by building confidence for challenging tasks. In this study, the authors developed and piloted a professional development program, Learning to Use Formative Assessment in Mathematics with the Assessment Work Sample Method (AWSM) to build middle school math teachers' understanding of the characteristics of high-quality formative assessment processes and increases their ability to use them in their classrooms. AWSM proved to be feasible to implement in the middle school setting. It improved teachers' practice of formative assessment, especially in their feedback practices, regardless of their pedagogical content knowledge at entry. Results from focus groups suggested that teachers were better able to implement ungraded practice and student self- and peer-assessment after AWSM, and that students were more willing to engage in complex problem solving." -Abstract

3. Formative Assessment Techniques to Support Student Motivation and Achievement

Cauley, K. M., & McMillan, J. H. (2010). Formative assessment techniques to support student motivation and achievement. The clearing house: A journal of educational strategies, issues, and ideas, 83(1), 1-6. URL

"Formative assessment can have a powerful impact on student motivation and achievement. This article discusses five key practices that teachers can use to gather important information about student understanding, provide feedback to students, and enable students to set and attain meaningful learning goals. Each of the techniques can enhance student motivation as well as achievement." -Abstract

4. The Power of Feedback

Hattie, J., & Timperley, H. (2007). The power of feedback. Review of educational research, 77(1), 81-112. URL

"Feedback is one of the most powerful influences on learning and achievement, but this impact can be either positive or negative. Its power is frequently mentioned in articles about learning and teaching, but surprisingly few recent studies

have systematically investigated its meaning. This article provides a conceptual analysis of feedback and reviews the evidence related to its impact on learning and achievement. This evidence shows that although feedback is among the major influences, the type of feedback and the way it is given can be differentially effective. A model of feedback is then proposed that identifies the particular properties and circumstances that make it effective, and some typically thorny issues are discussed, including the timing of feedback and the effects of positive and negative feedback. Finally, this analysis is used to suggest ways in which feedback can be used to enhance its effectiveness in classrooms." -Abstract

5. The Association between Teachers' Use of Formative Assessment Practices and Students' Use of Self-Regulated Learning Strategies

"Three Arizona school districts surveyed more than 1,200 teachers and more than 24,000 students in grades 3–12 in spring 2019 to better understand the relationship between their teachers' use of formative assessment practices and their students' use of self-regulated learning strategies, to help shape related teacher development efforts moving forward. Descriptive results indicated that students regularly track their own progress but less frequently solicit feedback from teachers or peers. On the other hand, teachers regularly give students feedback but less frequently provide occasions for students to provide feedback to one another. There was only a small, positive association between the number of formative assessment practices teachers used and the average number of self-regulated learning strategies among their students. The correlation was stronger in elementary classrooms and in STEM classrooms than in others. Some of teachers' least-used formative assessment practices— facilitating student peer feedback and student self-assessment—had the strongest, positive associations with the average number of self-regulated learning strategies their students used. The more that teachers reported using these particular practices, the more self-regulated learning strategies their students reported using." -Abstract

6. Better Being Wrong (Sometimes): Classroom Assessment That Enhances Student Learning and Motivation

"An important element of the classroom assessment event and student performance occurs when students are wrong, which is often denigrated in our success-oriented secondary schools where only being right is valued and reinforced. This article argues that being wrong (sometimes) is an essential experience that enhances learning and motivation. Research in three fields -- neurology, mindsets, and self-regulation -- is reviewed briefly to show how making mistakes and learning errors are essential to achievement, as well as the development of positive dispositions such as persistence, resilience, and risk-taking. Two assessment-related dynamics -- the being wrong environment in the class and the nature of classroom assessment -- are discussed to show how teachers can foster experiences in which being wrong (sometimes) is an integral part of learning and motivation." -Abstract

7. Setting Formative Assessments In Real-World Contexts To Facilitate Self-Regulated Learning

"Some writers (Black and Wiliam in Phi Delta Kappan 80(2):139–148, 1998; Clark 2012; Panadero and Jonsson in Educational Research Review 9:129–144, 2013) have hypothesized a link between formative assessments (FA) and self-regulated learning (SRL). FA give students an opportunity to play an active role in their learning exercise, in other words to exercise SRL, while SRL gives the learners the will and skill to take advantage of the feedback offered by FA to progress. This paper provides empirical evidence of this link through interviews of 13 students (aged 16–17) from an all- girls school who were assigned two tasks which tested the same cognitive skills but set in contrasting contexts: one was a paper-and-pen class assignment while the other, in a live online forum. Data were gathered through one-to-one interviews which probed students' use of SRL in the 3 phases (Forethought, Performance, and Self-reflection) based on Zimmerman's cyclical model of self-regulation (2000). The findings helped shed light on how different FA contexts can affect students' use of SRL, specifically in terms of their motivation, metacognition, and behavior." -Abstract

8. Embedded Formative Assessment

William, D. (2017). Embedded formative assessment (Second edition). Solution Tree Press. URL

By integrating classroom formative assessment practices into daily activities, educators can substantially increase student engagement and the rate of student learning. The second edition of this best-selling book by Dylan Wiliam presents new research, insights, and formative assessment strategies and techniques teachers can immediately apply in their classrooms. Updated examples and templates are included to help teachers elicit evidence of learning, provide meaningful feedback, and empower students to take ownership of their education.

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