

**IMPACT-BASED RESEARCH:
CROSS-SECTOR INSIGHTS TOWARD ALIGNING EDUCATION RESEARCH AND REAL-WORLD IMPACT**

Grant Summary

This initiative will bring together pioneering government, academic, philanthropic and industry leaders to inform the development of an impact-based research methodology (IBR); a new approach to enabling a more direct and overt connection between academic research and the development of educational products and services that are making sustainable, scalable real-world impact. IBR is a service-oriented research approach that aligns key stakeholders around impact outcomes accomplished through clearly articulated theories of change that are continually optimized through sustained, capital efficient, real-world implementations and shared best practices across a committed community of practice. We have been developing the IBR methodology in the context of our core focus, game-based-learning, but believe the methodology applies to any tech-enabled, research-based educational initiative.

At this point in our research, IBR is a proposed thesis with some initial work around key assumptions and process, as well as some aligned initiatives that leverage and inform the emerging IBR tenets. Through this NSF-EAGER support we will invite colleagues carrying out related work, examine existing promising projects from others, and engage in a critical examination of our own work to further substantiate this thesis. We will also carry out a series of case studies on identified exemplar projects, including our current game-infused digital teacher initiative. With multiple stakeholders and already over 2M in investment, this initiative creates a timely opportunity to iterate the framework given its focus on building, optimizing, and scaling a suite of game-infused products and services.

To be clear, while our particular focus is targeted on the production of sustainable and scalable outcomes through game-infused products and services, the goal of this proposal is to develop an impact-based methodology that will be relevant to a broader NSF STEM portfolio. Such IBR methodologies are essential in the current financial times to ensure that large research expenditures of dollars are resulting in research that is being turned into innovative products and services with the potential for broad sustainable and scalable impact. The work to be carried out through this EAGER proposal will provide the essential foundation for justifying and iterating the IBR methodology to ensure it has intellectual merit. Such grounding is a necessary next steps before embarking on a larger initiative and advocating for its widespread utility.

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I. Project Overview

As the world becomes increasingly complex, interconnected and changes at a pace unprecedented in history - every sector has been forced to continually adapt to meet their objectives, whether they are service focused (e.g. philanthropic and public interest sectors), commercial focused (e.g. business sectors) or a combination of both. Learning Sciences is no different. A key premise underlying the need for this proposal is that educational products and services need to be not only grounded in good learning sciences, but that they also need to be designed to be effectively implemented, sustained and continually optimized in an educational landscape that is undergoing dramatic changes. The sector will have to develop new and agile methodologies that can be continually tuned and optimized across differing and shifting contexts to drive toward meaningful, scalable learning outcomes. It is our responsibility as a community committed to connecting learning sciences work to real-world learning impact that we conduct our research (and that we prepare the upcoming generation of learning scientists to conduct their research) in a manner that is methodologically rigorous and results in theoretically useful claims and innovations that address society's pressing educational challenges.

The goal of this initiative is to bring together pioneering government, academic, philanthropic and industry leaders to inform the development of an impact-based research methodology (IBR); a new approach to enabling a more direct and overt connection between academic research and the development of educational products and services that are making sustainable, scalable real-world impact. A key objective of IBR is to help close the gap between the great potential of educational research and the lack of research-based products and services that are making impact at scale in the fast-moving, constantly evolving formal and informal educational channels. Building on the intellectual merit and applied focus of design-based research (DBR) as well as best practices from the commercial software-as-service and impact-focused social entrepreneurship sectors, IBR is a service-oriented research approach that aligns key stakeholders around impact outcomes accomplished through clearly articulated theories of change that are continually optimized through sustained, capital efficient, real-world implementations and shared best practices across a committed community of practice. IBR will build on these cross-sector insights by developing a tighter connection between the research methodology and the continual optimization of impact outcomes.

Whereas DBR is quite valuable for evolving theory and examining its instantiation within a particular site, IBR is intended to capture the full-life cycle necessary for bringing about sustainable and scalable products and services—moving from usable theory to sustainable, scalable impactful products and services. The need for successful methodologies that result in sustainable and scalable services that come out of research investments is clear. IBR is focused on building scalable innovations that are carefully calibrated for sustainable ecosystem integration and market need as well as continually optimized as 'services' for learning impact and scaled, sustainable implementations through multi-stakeholder partnerships. Similar to tech-enabled software-as-a-service and social entrepreneurship sectors, IBR uses rigorous analytics not simply to support one-off products but rather to optimize on-going services where the inputs of any given research initiative are both right-sized and fine-tuned to maximize the on-going outputs as well as the longer

term outcomes that are desired by the key stakeholders.

In addition to the Learning Sciences field, our evolving IBR methodology draws on the commercial tech-enabled services sector, which has developed insights and best practices around agile design, development and publishing that is helping to drive some of the most globally impactful products and services. Additionally, we will examine non-profit social sector practices for achieving positive social impact because of the new and innovative entrepreneurial approaches this community is advancing for making, measuring and optimizing real-world impact. In our own work, we have begun developing the IBR framework specifically to address the gap between the potential of game-based-learning and the reality that very little of the promising research is turning into scalable, sustainable services. Millions of dollars have been invested in impact and research-based games that remain underutilized for many reasons. Projects ran out of money; developers ran into technical troubles, products did not address a clear need or caused too much friction for adoption, or simply had limited reach due to ineffective marketing and distribution; and often a combination of these reasons.

In evolving the IBR framework, we will explore these and other related challenges by bringing together and drawing upon insights from pioneers in the fields of tech-enabled services, double-bottom line entrepreneurship, social entrepreneurs, and applied academic research, each providing insights on building agile, impact-focused, sustainable and scalable research, design, development, publishing and optimization methodologies. In addition to a series of cross-sector meetings with these diverse stakeholders, we will also conduct targeted analyses of a handful of exemplar initiatives and a more in-depth case study of our digital savvy teacher initiative to further ground the emerging framework. Key activities will include:

- (1) a series of cross-sector meetings with diverse expertise,
- (2) a targeted landscape/opportunity analyses of exemplar impact-based-research innovations,
- (3) a case study on our suite of game-infused products and services initiatives that are leveraging an impact-based research methodology, and
- (4) a white paper and interactive worked examples to advance an impact-based research methodology along with grounded exemplars of lessons learned.

Such IBR methodologies are essential in the current financial times to ensure that large research expenditures of dollars are resulting in research that is being turned into innovative products and services with the potential for broad sustainable and scalable impact. This work will provide the essential foundation for justifying the methodology as having both intellectual merit and broad impact potential, both of which are necessary for embarking on a larger initiative and research project.

II. Statement of the Problem

The ultimate goal of the field of Learning Sciences and, more broadly, educational research is to help foster meaningful, scalable and sustained positive impact on learning outcomes; ensuring that we are most effectively and efficiently preparing our youth to realize their potential in a complex and fast moving 21st Century by truly instilling a lifelong love of learning. Clearly there are very real gaps in reaching this goal at all levels of education.

Despite the billions of dollars spent on early intervention in literacy, only 34% of all fourth graders are reading at grade level and just 17% of fourth graders who qualify for free lunch are reading at

grade level (National Center for Education Statistics [NCES], 2011). More generally, U.S. students have fallen behind other industrialized countries in everything from math and science scores to the proportion of young people with college degrees. Every 9 seconds, an American high school student drops out of school, more than a million every year. These young people struggle to find meaningful employment: many become disaffected. If the dropout problem persists, over the next 10 years it will cost the nation more than \$3 trillion in lost wages, productivity and taxes, plus untold personal suffering and loss of potential.

The challenges are equally significant at the post-secondary level. According to the recent American Dream 2.0 report (HCM Strategists [HCMS], 2013), 46 percent of college students and 63 percent of African American students across the nation do not graduate with any credential within six years, while 58 percent of Hispanics fail to graduate in the same time period. In the past 10 years the amount of money students have borrowed has doubled from \$56 billion in 2002 to \$113 billion in 2012. With this crushing debt, many students are wondering if the time and expense of college is really worth it. And it is not just the U.S. Throughout the world, schools are struggling to keep curriculum relevant in an increasingly complex, interconnected and rapidly changing world where students will be pursuing jobs that do not currently exist, leveraging technologies that have not yet been invented and addressing local and global challenges that we only just beginning to understand.

It is often hard for learning scientists to really see the impact of their research on these and other thorny and continually evolving education challenges. Equally important, it is not clear that much of the current Learning Sciences research is effectively being translated into educational products, services and practices that are making a meaningful dent in these complex – and constantly evolving – challenges. Across the philanthropic, governmental and commercial sectors – communities of practice have had to continually adapt to the rapid change that is happening all around them in order to survive and thrive. The field of Learning Sciences, and the research methodology toolbox that the field uses is no different.

III. Impact-Based Research

This proposal will advance the methodology of impact-based-research (IBR) as a natural extension of design-based research (DBR) (Barab & Squire, 2004; Brown, 1992; Cobb et al., 2003; JLS, 2004), exploring the relevant cross-sector practices that can inform the IBR methodology and evolving best-practices to ensure that we are making real, sustainable progress toward the pressing challenges in the education sector. We see DBR as a necessary, but insufficient component of an IBR undertaking if the goal is to inform both theory and the creation of sustainable and scalable educational technology-infused products and services. Whereas DBR is quite valuable for evolving theory and examining its instantiation within a particular site (Confrey, 2006), IBR is intended to capture the full-life cycle necessary for bringing about societal change. This work is a complex undertaking, but one that we believe is imperative if we are going to move from large-scale investments that simply result in local theories, limited implementations, and non-sustainable research products.

Ultimately, if the field of Learning Sciences is to pioneer new models that are going to articulate, inspire, foster and drive meaningful real-world learning impact, we believe it is critical that the sector avoid becoming too insular. We also hope that, over time, the methodologies and best practices that emerge from the field of Learning Sciences can become models for new research

methodologies that help inform the broader social impact sector, as Maxwell (2004) pointed out is necessary, and Reeves and Hedberg (2003, p. 265) point out occurs too infrequently with much educational research. In developing the IBR framework, we have attempted to integrate the relevant best practices from three different, but related, communities of practice;

- the tech-enabled services sector with a particular focus on the emerging best practices around agile, 'lean-start-ups';
- the social impact sector (both public interest government and philanthropic funding) with a particular focus on the emerging best practices around 'social entrepreneurship';
- the learning sciences and educational research sector with a particular focus on the emerging best practices around 'design-based-research'

Lean-Start-Up - We chose the lean start-up entrepreneurial approach to tech-enabled services because this community-of-practice has developed insights and best practices around agile design, development and continual optimization that are helping to drive some of the most globally impactful products and services like Facebook, Twitter and Google (Ries, 2011). While their methodologies are mostly about developing and growing successful for-profit businesses, there is a great deal that can be learned from how these organizations are developing agile design and development best practices to quickly and efficiently understand if a product or service is working in the market and continually adapting to respond to both user feedback and shifting dynamics in the market.

Social Entrepreneurship - We chose the social entrepreneurship (Abu-Saifan, 2012) approach to making a positive social impact in the world because this community-of-practice is pioneering new and innovative entrepreneurial approaches to making, measuring and optimizing the real-world impact of their interventions. While there are many different ways that these organizations are choosing to measure and optimize their impact, they all share a desire to make sure that the *inputs* of any given social impact initiative (e.g. the human and financial costs of the initiative) are both right-sized and fine-tuned to maximize the on-going outputs (measurable evidence of positive impact deemed credible by key stakeholders), as well as the less achieved outcomes (the long-term impact sought by the key stakeholders and broader community-of-practice).

Learning Sciences - We chose the design-based-research (DBR) approach to learning sciences because this community-of-practice is pioneering best practices around the close study of learning as it unfolds within naturalistic contexts impacted by interventions framed by clearly articulated theories of change (JLS, 2004). Design-based research is a natural foundation for impact-based research because it starts from the assumption that research involves empirical investigation within a naturalistic setting and focuses on how the technological innovation is used by targeted learners (i.e. users) in real world, provides a coherent and explicit chain of reasoning, seeks to demonstrate impact and share research data and methods to enable and encourage professional scrutiny and critique, and employs methodological practices that are deemed credible, trustworthy and result in useful claims.

As one example of an area that would benefit from and IBR methodology, we will conduct a case study on our Digital Savvy Teacher initiative that leverages gaming methodologies. While the games and learning sector has seen a steady growth of inputs (human and financial capital invested in the

sector) and outputs (number of games being released), the sector is still struggling to see meaningful outcomes or to solidify clearly articulated theories of change—although the NSF taskforce on Cyberlearning (2008) have some strong recommendations of important outcomes. After ten years of growing interest and millions of dollars in public and private investment, there is still a large gap between the *potential* for games and game-based solutions to make meaningful impact and the *reality* of highly engaging and sustainable game-based products and services that are actually making impact in addressing key learning and motivation challenges at scale.

Publishing engaging, impactful and sustainable computer and video games is extremely difficult and requires significant domain expertise. The process involves a complex set of competencies in software development, interactive entertainment/game design as well as a deep understanding of diverse and constantly evolving platforms, distribution channels and business models. While there is no one silver bullet to closing the numerous gaps between potential and reality for the games to achieve sustainable and scalable outcomes, we believe that an IBR methodology has value as a process for reaching such goals. As a rich opportunity to evolve the IBR methodology, we will use this work to build a case study from which to characterize one example of an IBR project.

The *Center for Games and Impact* at ASU and *E-Line Media* have joined forces to bring together leading researchers, learning scientists, game designers, developers and entrepreneurs all committed to harnessing the unique power of games to make meaningful, positive, sustainable impact. We have built the legal, business, design, and technical infrastructure, along with the human capital and necessary best practices, to effectively apply IBR in a manner that leverages gaming methodologies and technologies to achieve sustainable impact. The Digital Savvy Teacher initiative, a game-infused curriculum and community for pre-service and in-service teachers, is one of our active gaming research projects from which the IBR methodology will be applied. It involves multiple stakeholders, including Intel, Mary Lou Fulton Teachers College, the Sanford Inspire project, and E-Line Media who, collectively, have already contributed over 2M to the initiative. It creates a timely opportunity to iterate the framework given its focus on building, optimizing, and scaling a suite of game-infused products and services.

To be clear, while our particular focus is targeted on the production of sustainable and scalable outcomes through game-infused products and services, the goal of this proposal is to develop an impact-based methodology that will be relevant to a broader NSF STEM portfolio. Games and game-infused interventions are just one example of an innovation with promise for advancing learning across multiple disciplines, especially science, technology, engineering, and mathematical (STEM), which are essential to our nation's economic future, but an innovation whose aspirational potential and research expenditures exceeds its actual impact with few examples of sustainable and scalable game-based innovations.

IV. Work Plan and Timeline

To date, the Center for Games and Impact at ASU in partnership with E-Line Media has constructed a game-infused theory of change, an impact-based methodological approach, and a human and technological infrastructure necessary to develop impact-focused business models for publishing game-infused products and services that can be optimized to achieve sustainable and scalable impact. Leveraging this work, stage one of this proposal, to be completed in August, is to produce an initial draft of a white paper advancing the impact-based research methodology. However, this document is simply a working draft of a theory with limited grounding primarily based on local work and limited

iterations.

As a provisional thesis, this draft will be shared with experts in industry, philanthropy, and learning sciences to stimulate ideas and set the grounding for the first workshop in November to be held at the Center for Games and Impact in Arizona. Here, we will invite leaders in the three key areas for a cross-sector meeting to critique the white paper, add texture to various components, and identify fruitful exemplars to be more deeply interrogated for the worked example explorations. These will be compiled to determine Stage II priorities and focus. Questions to be interrogated through the interactive meetings, landscape analyses of particular projects, and case study include:

1. *What are some illuminative impact-based research projects that could inform the field?*
2. *What initial steps are essential for future success, and what are some of the key challenges that emerge and potentially undermine ongoing sustainability of the work?*
3. *What scale, models and partnerships are most fruitful for achieving success, especially for achieving sustainable and scalable outcomes?*
4. *What forms of social impact assessment are necessary to capture both immediate outputs and longer-term outcomes to justify the value of the work?*

Stage II will involve conducting the landscape analyses of identified exemplars, along with revisions of the initial white paper. For each of the exemplars to be examined in Stage II, there will be an analysis of target audience, desired impact, context of implementation, platform, genre, team, marketing and distribution, sustainability, scalability, and assessment of impact. We will also conduct interviews with key stakeholders where possible, to further illuminate the challenges in conducting multi-stakeholder, impact-based research. Each of these stories will become a publicly accessible worked example available to others, with more general lessons learned integrated into our evolving methodology as articulated in the core white paper.

Also, given the pragmatic focus of the white paper, we will continue iterating core assumptions and methodological recommendations in our own IBR initiatives. We have secured millions of dollars in investment to carry out a number of impact-based, game-infused research and development innovations focused on achieving sustainable and scalable impact. Specifically, we will apply the IBR methodology to our Digital-Savvy Teacher initiative. Through generous support from various sponsors, as well as ASU investment, the Center for Games and Impact and E-Line Media have been working closely with the Mary Lou Fulton Teachers College to pioneer the first game-infused digital savvy teacher curriculum and community for pre-service and in-service teachers. Adopting an IBR approach, the focus is to build a scalable suite of game-infused products and services that can be continually optimized for ecosystem integration/impact, and that is sustainable through a double-bottom line business model (e.g., meaningful, measurable learning/social impact and scalable financial returns).

More than observational or traditional case study research, and similar to design-based research methodology, we will be testing process steps and assumptions as articulated in the IBR white paper through the work, at the same time the design experiences will be used to inform the evolving methodological assumptions. All of these will be compiled into a worked example story that will be publically accessible and illuminative of the IBR process. While this case study is centered on the production of sustainable and scalable outcomes through game-infused products and services, the goal of this grant work in general is to think more broadly about an impact-based

methodology that will be relevant to a broader NSF STEM portfolio that includes various intervention topics and formats. Therefore, consistent with other design-based research accountings, the reporting out of this case study will include the sharing of experience-near happenings with an appreciation for and framing of experience-distance significance.

Stage III will take place in the spring of 2014 and will involve another interactive meeting to be held at the Cooney Center in NY. Here, the focus will be to address any remaining critiques or limitations in earlier drafts of the white paper on impact-based research, as well as shortcomings in any of the produced worked examples. Additionally, we will discuss how to best disseminate the knowledge obtained from the research meetings, landscape analysis, and case study of our own work. We will also produce a policy document for relevant stakeholders, and determine next steps for a larger research project to scale out the methodology and impact of the work.

The project manager of this grant will be Kathryn Dutchin who has the role of Creative Producer for the Center for Games and Impact and who will have 30% of her time dedicated to this project. Her role, in partnership with a graduate student who will work solely on this project, is (1) to identify the needs of all stakeholders in order to establish deliverables for the project, (2) to coordinate resources to meet those deliverables, and (3) to provide a consistent portal of communication and collaboration for the project across the various participants. The graduate student will also have primary responsibility for carrying out the day-to-day work on the landscape analysis and case study. Given the current state of our work around IBR, an unproven thesis and an evolving methodology in the beginning stages, the project PIs will have to be closely involved providing feedback, critiquing emerging assumptions, managing meetings and research direction, and ensuring the overall quality of the work.

Specifically, Sasha Barab and Alan Gershenfeld will provide oversight to ensure that the landscape analyses and case studies are being conducted with the necessary rigor and are focused on the appropriate areas. They will also be primarily responsible for producing the white paper, and for managing the workshops. As stated above, Barab and Gershenfeld are currently completing an initial draft of the white paper as grounding for the ideas in this proposal, and for which they will continue to revise throughout the project. Michael Levine will be responsible for hosting the second workshop at the Cooney Center, and for leading the policy document as well as providing critical feedback on the whitepaper. Michael Angst will oversee impact-friendly business models, bringing a wealth of experience with double-bottom line business models, as does Gershenfeld.

V. KEY PARTNERS

The Center for Games and Impact brings together world-class researchers, game developers, and digital entrepreneurs to harness the power of computer and video games to create sustainable solutions for society's biggest social, cultural, scientific, economic, and educational challenges. By examining the full lifecycle of impact games—from research, design and development to publishing, assessment and optimization—the Center aims to stimulate positive learning, health, and social impact. Through partnerships with commercial and educational game projects, this initiative will make available a host of high quality games that have potential for deep learning and engagement.

- The Center Director, **Dr. Sasha Barab**, is a professor in the MLFTC at Arizona State University, where he holds the Pinnacle West Presidential Chair. He also holds the Pinnacle West

Presidential Chair and is a Founding Senior Scientist & Scholar of the Learning Sciences Institute. His research has resulted in numerous grants, dozens of articles, and multiple chapters in edited books, which investigate knowing and learning in its material, social, and cultural context with a focus on the power of games.

- Creative Producer, **Kat Dutchin**, is responsible for driving vision and coordination of Center initiatives towards sustainable and scalable outcomes. Kat spent several years working with corporations to create strategic programs to motivate their employee base towards goals using behavioral change theory and incentive strategy. Kat has also spent time in the game studio environment designing, creating special effects and producing.

E-Line Media is a publisher of game-based learning products and services that engage, educate, and empower, helping to prepare youth for lives and careers in the 21st century. E-Line works with leading foundations, academics, nonprofits and government agencies to harness the power of games by considering the full lifecycle of impact games - from research, design and development to publishing, assessment and optimization. E-Line is a for-profit, double-bottom-line company that was founded specifically with the mission of scaling research-based learning platforms in a manner that balances financial sustainability, affordability and reach to underserved communities. The executive team has extensive experience in the commercial game industry and deep domain expertise in the areas of digital media and web-based services.

- **Alan Gershenfeld** (E-Line's Co-founder and President) has spent the last 25 years at the intersection of entertainment, technology, and social entrepreneurship, having been a member of the management team that built commercial game publisher Activision into a profitable industry leader. At Activision, Alan served as Senior Vice President of Activision Studios where he supervised all product development at the company's Los Angeles studios.
- **Michael Angst** (E-Line's CO-Founder and CEO) is a successful private equity investor and operator at Bluefin partners where his investments included a multi-national outsourcing company that delivers service through over 70 independently owned micro-franchises in India and China (employing over 10,000 people). Prior to Bluefin, he served as the President and Chief Operating Officer of National Healthcare Resources where he supervised company growth to over \$150MM in annual revenue.

The Joan Ganz Cooney Center is an independent R & D and policy linkage organization established in December 2007 and based at Sesame Workshop. Our goal is to accelerate vulnerable children's learning through the wise deployment of digital media. The Center conducts original research, synthesizes and translates knowledge for action by educators and media designers, and informs policymakers and investors of new opportunities for reform.

- **Dr. Michael H. Levine** is the founding Executive Director of the Joan Ganz Cooney Center. Levine also serves on Sesame Workshop's leadership team, concentrating on policy and educational impact. Prior to joining the Center, Dr. Levine served as Vice President of New Media and Executive Director of Education for Asia Society, managing the global non-profit's interactive media and educational initiatives to promote understanding of Asia and other world regions, languages and cultures.