Meeting of the Directorate for Education and Human Resources (EHR)
Advisory Committee
Wednesday, November 3, and Thursday, November 4, 2021
Location: Virtual

Advisory Committee Members Present: Stephanie Adams, Hyman Bass, Thomas Brock, Melissa Collins, Kaye Husbands Fealing, Okhee Lee, David Monk, Ada Monzón, Becky Wai-Ling Packard, Jeremy Roschelle, Nicole Smith, James Spillane, Laurel Vermillion, and Marilyn Strutchens (Chair)

Designated Federal Officer: Sylvia Butterfield; **Executive Secretary:** Bonnie Green

Day 1 – November 3, 2021
12:00 PM – 5:00 PM

12:00 PM – 12:45 PM	**WELCOMING REMARKS FROM THE EHR AC CHAIR & THE EHR ACTING ASSISTANT DIRECTOR**
	Marilyn Strutchens, Chair, EHR Advisory Committee, & Emily R. & Gerald S. Leischuck Endowed Professor, Mildred Cheshire Fraley Distinguished Professor, Department of Curriculum and Teaching, Auburn University **Sylvia Butterfield**, Acting Assistant Director, EHR

Dr. Strutchens welcomed AC members to the virtual meeting and noted that she is looking forward to engaging in thoughtful and robust discussions over the next two days. She began the meeting with an introduction of EHR's newest AC member, Dr. Jeremy Roschelle, and added that member, Dr. Hyman Bass, a seasoned AC member would be rotating off. Dr. Strutchens facilitated an introduction of all AC members. After brief introductions, Hyman Bass moved to approve the Spring 2021 AC meetings minutes. There were no discussions and the Committee unanimously approved minutes. Dr. Strutchens then provided an overview of the agenda. Meeting topics included exploring innovations through partnerships and through broadening participation in STEM; and a conversation with NSF Director Sethuraman "Panch" Panchanathan and Chief Operating Officer Karen Marrongelle.

Dr. Butterfield welcomed the AC members and provided updates since the last EHR AC meeting that included changes to EHR senior leadership, staffing, Biden Administration/OSTP Priorities Alignment, Partnerships, and EHR Highlights. She noted that EHR has continued to work to address inequities in STEM education. Additional updates included NSF leadership introductions and staffing updates; Directorate for Technology, Innovation, and Partnerships

(TIP): the President's fiscal year 2022 Budget request that includes $1.28 billion for EHR to strengthen STEM education; the Administration's Immediate priorities that include racial equity, climate change, COVID-19 response, and economic recovery and how EHR initiatives align; Partnership with IES for two National AI Research Institutes; new funding opportunities in EHR that include *DCL: TCUP STEM Innovative Faculty Support, DCL: Research to Improve STEM Teaching, Learning, and Workforce Development for Persons with Disabilities*, and *DCL: Persons with Disabilities – STEM Engagement and Access*; along with several EHR highlights: Sian Proctor, Inspiration4 mission crewmember, Sian Proctor, was an ATE project participant; SciGirls, NSF sponsored series on Twin Cities PBS earned a Gracie Award from the Alliance for Women in Media Foundation for Family Series; the release of the NSF INCLUDES Shared Measures platform; NSF's COVID-19 Diversity, Equity and Inclusion Challenge; and, Joshua Miele (a blind/adaptive technology designer and STEM+C grantee) named as 2021 MacArthur Fellow. Dr. Butterfield closed by noting the success of HRD's 30th anniversary distinguished lecture series.

12:45 PM – 1:45 PM	**SESSION 1: UNDERSTANDING THE NEW DIRECTORATE FOR TECHNOLOGY, INNOVATION, AND PARTNERSHIPS (TIP)**
	Moderator: Lee Zia, Acting Division Director, Division of Graduate Education, EHR **Presentation** • **NSF Technology, Innovation, and Partnerships** Dr. Gracie Narcho, Senior Advisor, Office of the Director **Session 1 Discussion**

Dr. Lee Zia opened the session and shared that we will learn more about the new directorate TIP that is in the process of being established. The purpose of the session was to provide background context for TIP and understand upcoming plans for the new Directorate. Dr. Zia introduced Dr. Gracie Narcho, Senior Advisor in OD. Dr. Narcho indicated that TIP will be comprised of the following divisions: Innovation Ecosystems (IE), Technology Frontiers (TF), and Translational Impact (TI). These divisions span many different foci: IE will direct partnerships between NSF and external partners; TF will focus on cultivating regional and national ecosystems; and TI will bring existing NSF programs (PFI and SBIR/STTR) together with new innovative pathways that address emerging industries and societal challenges. TIP will provide translational pathways that emerge from the tech and innovation ecosystem. There will also be a Strategic Partnerships Office (PO) that spans across all TIP divisions that supports partnerships across Directorates.

Dr. Narcho explained the five priorities for the FY22 budget: enhance fundamental research and development; strengthen U.S. leadership in emerging technologies; advance equity in science and engineering; advance climate science and sustainability research; and continue construction of major NSF research facilities. She then gave examples of TIP activities that will enhance the lab-to-market platform. Dr. Narcho posited that RIA's balance scientific and technical goals with broader societal benefits. As geographical regions face different challenges, regional expertise is necessary to understand and address those challenges. A new NSF Entrepreneurial Fellowship Program will provide opportunities for one to two years along with an innovation space so that experiences can be replicated potentially leading to serial entrepreneurs.

Dr. Lee Zia opened the floor for discussion, questions, and comments. Questions and discussion included: opportunities for middle skills development in RIA's and evaluation of impact; and a discussion of the lab-to-market metaphor and the movement away from a technological push to a market pull.

Dr. Narcho asserted that RIAs engage the whole breadth of potential participants including minority serving institutions and community colleges. RIA's support collaboration between academic institutions and industry partners and can support internships, fellowships, and co-mentoring programs for technicians, innovators, etc. Dr. Narcho also shared that TIP is considering an alternative process for RFPs to reach a broader set of stakeholders that includes industry, nonprofits, state and local governments. Dr. Narcho explained that the market pull is related to RIA which will hopefully grow economies in different parts of the country and address societal challenges that are region specific where everyone has a stake. RIAs are designed to grow the geography of innovation in every possible way such as including minority serving institutions, tribal colleges and universities, and community colleges. TIP has been intentional about interpreting translation broadly and addressing DEI at the outset. For example, impacting translation in terms of education and policy which is much more than just new startups.

The AC encouraged TIP to think about engagement, equity, and accessibility. Dr. Zia transitioned to discussion amongst AC members led by Jim Spillane that included the following questions:

1. *Where do you see aspects or components of TIP that could align well with EHR's mission? What opportunities should we be paying attention to?*

   The AC expressed appreciation for TIP's focus on equity and promising partnerships with EHR particularly around startups and entrepreneurs as well as minority-led and women-led innovations.

2. *As EHR progresses alongside the new directorate, what potential challenges should be considered?*

   Some AC members were concerned about building partnerships across directorates though TIP is fundamentally about NSF creating partnerships externally which could be challenging considering geographic regions and their varied interests. The notion that partners should be involved in research design from the very beginning was raised and

several AC members cautioned against falling into traditional translational view about how science relates to improving society. Collaborations within and across institutions are known to work better. The AC encourages TIP to consider the actual application and ways to engage people to make partnerships and collaboratives that fit the needs of their communities.

Additionally, several members further noted that public communication about science is seriously undermined currently and is partly political. The Committee was not sure how trust can be created without compromising certain democratic principles. The AC felt this challenge was with public education and relevant to EHR, but TIP may or may not be the right partner. Dr. Narcho shared that TIP is trying to do many things at once such as co-funding activities with existing directorates. The role of the Partnerships Office will be to facilitate external partnerships in a coordinated and strategic way.

Another committee member referred to the notion of thinking much more broadly about education and what inclusive education means. This is a big challenge because lot of the informal learning happens in bubbles.

1:45 PM –2:00 PM BREAK

2:00 PM – 3:30 PM	**SESSION 2: DEVELOPING AND LEVERAGING PARTNERSHIPS IN STEM HIGHER EDUCATION**
	Moderator: Jolene Jesse, Acting Senior Advisor on Partnerships, EHR **Panel of Presidents:** Dr. Aaron Walton, President Cheyney University of Pennsylvania (IUSE) David Lassner, President University of Hawaii System (LSAMP, Noyce) Laura Ramerez, Vice President Pasadena City College (ATE) **Session 2 Discussion**

AC Chair Marilyn Strutchens opened the session. Jolene Jesse provided an overview of NSF Partnerships and how partnerships may be utilized by institutions of higher education. Categories of NSF partnerships include direct, catalyzed and a combination of both. Through partnership,

NSF may expand outcomes, accelerate achievements, and provide unique training and research experiences.

Dr. Aaron Walton, President of Cheney University, spoke to partnership impact on student success, financial strength, and standard of excellence. Through collaboration and strategic partnerships that proved fundamental to improving strategic outcomes, Dr. Walton emphasized two guiding foci for consideration during the formation of a partnership: it is in the best interest of the students, and it preserves the mission of the University. Dr. Walton leveraged underutilized space at Cheney simultaneously attracting businesses to lease space and provide students with hands-on experiences assisting with career informed curriculum development. Through partnerships, Cheyney has balanced its budget and increased enrollment by 20% (7 to 27 students pursuing STEM degrees).

Dr. David Lassner, President of University of Hawai'i, highlighted innovative NSF projects and partnerships in STEM education at several of the University of Hawaii's campuses, specifically the Islands of Opportunity Alliance- Louis Stokes Alliances for Minority Participation (IOA-LSAMP) and Partnerships for Geoscience Education (PAGE), a bridge to the baccalaureate program. With 20 years of partnership experience, Dr. Lassner shared lessons learned and best practices that included: identifying functions of key personnel on implementation team; building trust and familiarity with each partners' process; monitoring of activities and expenditures; and engagement in shared activities. Partnership challenges included the turnover of key personnel, along with equitable alignment of budget and activities. Dr. Lassner recommended: hiring dedicated staff to manage grant activities; key personnel on each campus; and extending timely support to partners who are struggling.

Dr. Laura Ramirez, Vice President of Pasadena City College, spoke to increasing student diversity in STEM. She stressed how critical mentorship, workforce preparation, and research opportunities are for HSI students in STEM. Her partnership strategy is organized around industry needs that brings leadership and scientists together to support students. She highlighted the NSF funded Micro Nano Technology Collaborative Undergraduate Research Network that implemented regularly scheduled meetings with industry partners to explore students need. Student benefits included paid student research opportunities and internships. With more than 14 partners, the goal is to help students develop industry products with a connection to education. Educational partners: strengthen support for faculty and staff improving student support; bridge efforts from curriculum design to standard practices in research to ensure students have a common language, standards, practices in nanotechnology; and include transfer pathways to local 4-year institutions.

The panel discussed qualities of successful partnerships with the AC. Partnerships should work towards the same goals of supporting student academic and professional advancement (though strategies may differ). Dr. Walton raised the priorities of advancing student success and institutional mission. Dr. Lassner shared how students are engaged in meaningful work, and Dr. Ramirez spoke about how partnerships help provide infrastructure.

Dr. Lassner stated that university presidents can initiate partnerships yet cannot ensure success. Since the community college system is an access point for first generation and marginalized populations it is important that every school focus on the transfer rate. Also, private partners have common goals of workforce development.

One AC member inquired on how to manage traditional partnership and partnerships of the future. Dr. Walton shared that as the first HBCU in the nation, Cheyney should be the first to lead the new paradigm becoming the premier institution of excellence, creating a new educational model being adapted by other institutions across the US. Dr. Lassner responded that the University of Hawaii is building a more sustainable healthy future for the islands and all its people. Dr. Ramirez emphasized that Pasadena City College is a provider of advancement for our students and the community, whatever it means for them and whatever they need within the context of equity and diversity. Moving forward the challenges surround technology implementation, innovative curricular development, and student engagement.

Dr. Jolene Jesse transitioned to discussion amongst AC members led by Dr. Becky Wai-Ling Packard. Dr. Packard gave a summary for the session and posed the following questions:

1. *What strategic priorities should EHR consider when considering new partnerships?*
2. *What should EHR be paying attention to that would help us assess whether a partnership is valuable and effective?*
3. *Partnerships can occur with EHR and because of EHR efforts among other types of institutions. What approaches could EHR take to facilitate effective partnerships among differing institutions (e.g., K-12, non-profit, higher education, etc.)*

AC members discussed that EHR should continue to put emphasis on projects that address high needs K-12 school systems. When considering partnerships, EHR should look for equitable division of resources as well as labor as empirical evidence demonstrates that when institutions develop an equity framework for partnerships, the MSI benefits are not evident. Partnerships need to be thought about at the collective level and not for each individual partnership. The AC believes there are benefits of partnerships for students and institutions, yet consideration should be given to the risks and benefits to faculty. How do institutions the expectations of being tenured with the work needed to be done by early career faculty? How can faculty be rewarded for taking time to invest in partnerships? EHR should consider developing a partnership resource website for K-12 teachers. Additionally, an EHR resource repository should be made available about forming and evaluating research-practice partnerships. Furthermore, institutions should reach out to industries to form partnerships since many industries address social responsibility to communities and are not aware that getting students to study STEM is critical for future success, Additionally, tribal colleges, universities, and institutions have often been part of unequal partnerships and EHR should consider providing funding for tribal education departments to plan and share resources in support of their students, schools, and communities.

3:30 PM –3:45 PM BREAK

3:45 PM – 4:45 PM	SESSION 3: BUILDING A NEW INFRASTRUCTURE FOR PARTNERSHIPS WITH EHR & TIP
	Moderator: Evan Heit, Acting Deputy Assistant Director, EHR **Presentation** **Advancing STEM Educational Innovations** Eric Knuth and Michael Steele, DRL Program Officers **Session 3 Discussion**

Dr. Evan Heit, Acting Deputy Assistant Director for EHR introduced the session's focus on ways in which K-12 can be involved in partnerships along with the work of the DRK12 program. Evan introduced the next part of the meeting, David Monk's overview of the AC Subcommittee on Partnerships. Dr. Heit also stated that this work of this committee was visionary and began before TIP was an idea.

David Monk gave a bit of history about the AC Subcommittee on Partnerships which was formed in 2017. Dr. Liz Boylan was the original chair and Dr. Monk became chair in fall 2019. There have been many changes in NSF staff and AC members since 2017. He and Dr. James Spillane are the only current AC members on that subcommittee. The charge had three parts: recommend strategies for building partnerships; provide guidance for decision making with respect to partnerships; characterized EHR's role in these partnerships. Dr. Monk gave an overview by categories of nine recommendations made during the November 2019 meeting: making changes in how EHR functions to make private partnerships more viable including recommendations to augment staff with expertise since at that time, that was no one's specialization at EHR. Another group of recommendations were about setting priorities. There were admonitions (Monk used that term) to be creative and extra emphasis given to potential industry partners including those not directly involved in education such as venture capital endeavors and philanthropic organizations both large and small.

Dr. Monk shared that he was puzzled over focus on private sector partnerships to the exclusion of public-public partnerships such as those with other federal agencies, state education departments, and local school districts. Over time he realized that there may have been the perception that NSF already had lots of experience with public-public partnerships and that needed to be balanced by giving more attention to the private sector. With the new directorate (TIP) there appears to be renewed focus on public-public partnerships. It will be important to figure out the best balance for public-public and public-private partnerships.

Dr. Heit then introduced the presenters for the session, Dr. Eric Knuth, lead of the ECR program and Dr. Michael Steele, lead for DRK-12. Dr. Heit explained that there is an important role for

ECR and DRK-12 in translation, innovation, and both direct and catalyzed partnerships. Dr. Heit added that the ECR and DRK-12 portfolios also address broadening participation in K-12 and beyond.

Dr. Steele began the presentation and gave an outline for the discussion: thinking through the idea of partnerships in the K-12 space and potential interesting workplaces for the intersection between TIP and EHR. Dr. Steele explained that many grants feature partnerships between K-12 school districts and higher education. Now there is consideration about how to scale the work in ways such as getting innovations that has been proven effective in a small number of classrooms in the hands of practitioners, schools and districts to increase the number classrooms. Scale is also thought of what it takes to implement, sustain, and nurture innovation over time.

From the DRK-12 perspective, the bulk of funded projects are in the design and development categories. At the project's endpoint the question then becomes how to continue designing professional development that supports implementation, examining the efficacy of those engaged in professional development, and then designing and redesigning the implementation of innovation in ways that are responsive to evolving needs. Dr. Steele then explained that the protentional work of partnerships are related to three distinct yet interrelated areas: small scale (local) running of the innovation. The next is larger scale (national) running of the innovation. The last was publication, promotion, revision, and monetization.

Dr. Knuth and Dr Steele then discussed examples of three projects that are illustrative of innovation success stories. Dr. Knuth talked about the Connected Mathematics Project (CMP) first. The second was Project LEAP and Dr. Knuth was the Principal Investigator (PI). Dr. Steele discussed the third project for which he was a co-PI, Mathematics in Discourse in Secondary Classrooms.

In aggregate the successes for these projects were: they all showed strong outcomes from the research and fulfilled all grant deliverables. CMP was a program of national scale, and the institution had the infrastructure and partnerships within to manage royalties for the curricular materials. These royalties support summer institutes for teacher professional development at the university and well as its doctoral students. Project LEAP materials were published by happenstance. A publishing company executive read an article about the program's success and contacted the PIs. The last project, Mathematics Discourse in Secondary, produced curricular materials and it took several years to get that to press. After the publisher had trouble understanding the marketplace, it returned the rights back to the PIs.

Dr. Knuth wrapped up the presentation with a list of challenges for partnerships that advance STEM educational innovations: lab to market focuses almost exclusively on innovations in STEM domains other than education; many promising educational innovations with potential for commercial and/or societal benefits do not realize their full potential; there are no formal mechanisms for bringing promising research based educational initiatives to scale when funding for the project ends; and many researchers do not understand how to move beyond the research outcomes to a larger scale.

AC Member Questions for Presenters

One AC member asked about examples related to science projects since science educators think about scale in different ways since science is not part of required courses and standardized tests. have a different way about thinking. This would also be true for engineering, computer science, and data science. Though Dr. Steele nor Dr. Knuth could think of anything specific. He does know of many projects in DRK-12 that cross disciplines and have iterative design and development cycles. There is a constant push to think about dissemination and scale.

Another AC member wondered if the problem is economic. He gave the example of medicine, engineering or computer science that produce patentable products and those with high returns on investments. Perhaps there needs to be needs to be a national curriculum for mathematics education which would cause a need for high quality, well-validated curricular materials for large audiences. These comments prompted Dr. Steele to pose the question, how would midscale infrastructure in education look?

AC Member Discussion

How might EHR and TIP collaborate in support of EHR's mission.

1. What signs would you expect to see demonstrating a strong, productive relationship between EHR and TIP?
2. Given the completion of the charge for the AC Subcommittee on Partnerships, what direction, if any, should the AC take to contribute to the news infrastructure for partnerships within the agency.

The following comments and questions were raised by AC members:

- Could there be a faculty development program focused on entrepreneurship that have partnerships with venture capitalists and others with whom academics do not have much contact?
- What types of programs could help professors cultivate innovative and entrepreneurial programs for undergraduate students?
- Could TIP assist with funding mechanisms where faculty can propose educational commercialization of their research?
- How could EHR think about infusing TIP into programs such as TCUP, HBCU-UP and ADVANCE?
- Concerns were raised about how engaging in entrepreneurial activities could negatively affect junior faculty?
- How could universities be encouraged to create release time for Black and Brown faculty who have high demands placed on them by the university and their communities.
- Many young scholars of color about thinking about having their own companies yet they are unsure how. Perhaps this could be an area of cultivation that aligns with EHRs mission and is relevant to TIP.
- What role could intermediaries play such as student success centers which develop and adopt new approaches for improving student outcomes at community colleges?

- Consider a tiered approach for funding so that smaller grants are available for newer ideas that are less tested and bigger grants are available for ideas with lots of rigorous testing as an incentive to get states or institutions to pick up those strategies with the strongest evidence which gives more confidence about what would lead to positive change.
- What is the role of AI that are designed and commercialized by minoritized scholars who want to go into business?
- What is the definition of innovation considering that not all new things are valuable and perhaps some things that are valuable are not new?
- What can EHR glean from conversations between other directorates such as CISE and SBE and their connection to TIP? A clearinghouse of information could remove the need for another subcommittee.

DAY 1 END

Day 2 – November 4, 2021
12:00 PM – 5:00 PM

11:00 PM – 12:30 PM	**SESSION 4: UTILIZING A COMPREHENSIVE APPROACH TO BROADENING PARTICIPATION OF GROUPS UNDERREPRESENTED IN STEM**
	Moderator: Diana Elder, HRD Division Director, EHR **Introduction:** Diana Elder, Division Director, Division of Human Resource Development, EHR **Presentation:** **DEI Language has Implications for STEM Education Research, Practice, and Policy** Jesse DeAro, HRD Program Officer **Session 4 Discussion**

Dr. Marilyn Strutchens introduced the EHR AC meeting theme for Day 2: Innovation Through Broadening Participation in STEM.

She then introduced the moderator for Session 4, Diana Elder, and the topic: Utilizing a Comprehensive Approach to Broadening Participation of Groups Underrepresented in STEM.

Dr. Elder, Division Director for HRD, set the context about broadening participation (BP) at NSF at the directorate level, across divisions, and then narrowing to focus on HRD. EHR as a directorate is a hub of NSF's BP efforts. At the division level, BP efforts can range from individual rapid grants with a single Program Investigator to a single institution and have a limited temporal range to a more comprehensive national initiative such as NSF INCLUDES to the 30-year-old Louis Stokes Alliance for Minority Participation. She then spoke about the directorate's newest efforts in BP, the Race and Equity Program, (PD 21-191Y) which is a collaborative effort across all four EHR divisions and has catalyzed strong and positive collaboration and discussion. Diana then shared HRDs vision which is on the division's website: HRD envisions a well prepared and competitive US workforce of scientists and technologists, engineers, mathematicians, and educators that reflects the diversity of the US population. The companion HRD mission statement explicitly identifies a mission to support the broader participation and success of individuals currently underrepresented in STEM and the institutions that serve them. HRD hosts or co-hosts a set of programs that seeks to broad participation via various approaches, including building capacity, institutional transformation. There is a comprehensive approach. HRD is also mindful of the culture and climate that we create as a division and how we interact with each other. And we're also part of a broader discussion of the implications of the language used in our work.

Dr. Elder then introduced the presenter for this session, Jessie DeAro, an expert in diversity, equity and inclusion in STEM as well as and minority serving institutions. Dr. DeAro has 20 years of experience designing, implementing and leading federal grant programs at NSF and the US Department of Education. Dr. DeAro was also on detail in EHR as Deputy Division Director and to the White House Office of Science and Technology policy. She is currently lead program director for ADVANCE and EHR Core Research (ECR). She is also the EHR program officer that works with the cross-directorate NSF Science and Technology Centers (STCs): Integrative Partnerships programs.

Dr. DeAro stated that it is important for EHR to use respectful, accurate and useful language to solicit STEM education, research, and proposals to implement programs with intellectual merit and the broader impacts. She gave an example of statements from different reports that start off with, "women remain underrepresented in engineering", rather than saying "engineering has not been able to recruit and retain women." The order of the wording conveys different messages. Jessie then gave a couple of examples that shows how has EHR is making progress in changing language to better reflect the work that we want to do. The first was from the ECR core research program. In the previous solicitation, the phrase "groups, underrepresented in STEM" was used with traditional categories of women and girls, individuals with disabilities, underrepresented racial and ethnic minorities. In the must current solicitation, the language has been updated to avoid othering and to include intersectionality. The revision is people of various races and ethnicities, genders. sexual orientations and ability rather than groups. Putting the people states that research is not in service for a group or some other monolithic entity, but it's actual individuals who have various identities. Though intersectionality appears in the solicitation as a reminder that the intersection of more than one social identity might be critically important to the framing of their research questions and their methods for collecting data and analyzing that data,

as well as importantly, in terms of drawing conclusions from the research. Including Intersectionality is not a requirement for proposals.

The second example Dr. DeAro gave of revising language in solicitations to become more inclusive is from the NSF wide Science and Technology Centers program. This are large investments ranging from 25 million to 50 million. Research projects are long term in specific topic areas. The proposal process is complex and does not occur yearly. With such a significant budget, those components could be an important addition to the overall work that NSF does to broaden participation in STEM. The language in the previous STC solicitation referred to groups traditionally underrepresented in STEM without definition. In new the solicitation, we've defined it, and we've also changed the language so that we're talking about the individuals who may be underrepresented in STEM and and the types of social identities that they may have that describe them as individuals. And then we also hear added language about the intersection of one or more of these social identities as something that the senator proposers may need to think about strategically when they're thinking about their broadening participation plans for their center.

AC Questions for the Presenter:

Dr. DeAro clarified that the ECR language change was in the 2021 version of the solicitation about a year ago, and the STC changes was published recently in October. Dr. DeAro explained that

These changes to the language are not perfect and the goal is doing better. There will be opportunities for future improvement. One AC member asked provisions continuous updating of these definitions (AC member used that specific word) and Dr. DeAro answered that there is not a set plan for revisions to solicitations. This will probably be determined by program and leadership, year by year. Dr. DeAro states that this question alludes to the need to review of language on a regular basis since language is dynamic. This is not a task solely within EHR and needs to happen in the other directorates.

The next topic for the Q&A was about NSFs' role since researchers and other agencies look to NSF for guidance about BP and inclusive language. Dr. DeAro responded that NSF needs to set the tone for those who work with NSF and apply for grant money. It is the agency's responsibility is to communicate accurately and respectfully which will impact research and long-term outcomes that lead to broadening participation. Dr. DeAro stated that NSF is part of the ecosystem, but not the only player in setting the tone and the language.

AC Discussion led by Dr. Ada Monzon

1. *Language is dynamic and critical in broadening participation. What considerations should EHR keep in mind with regard to language designed to be inclusive in solicitation writing, reviewer training, or principal investigator outreach?*
2. *What other trends or practices should EHR explore for broadening participation?*
3. *What are effective strategies EHR might utilize for broadening participation with regard to reviewers, PIs and employee recruitment and retention?*

Dr. Monzon started the discussion by stating that there is consensus that STEM education needs to include and engage a diverse public audience in their multiple ways of knowing, and that there is a need to broaden these definitions and make it a dynamic infrastructure.

For the responses to the guiding questions, one AC member advised to be very careful, especially about the tone and how we stereotype people because we want to empower more and not to limit. We want better outcomes. As for training, one AC member replied that the crosswalk that Dr. DeAro provided that shows the evolution of terms should become a part of every panel reviewer training. That person also suggested a repository with a reading list that also keep topics current. Another suggestion was that the slides should be a regular part of every program officer's outreach which would continue to educate others about the ways in words are changing.

Another AC member expressed that the changes over time to terms reflect philosophy, our underlying thinking which becomes much more fundamental than the terms alone. This member offered further guidance in that for the terms to be meaningful, there needs to be synergy of policy, like NSF funding policy that pushes the field but also the field informs NSF. The more the funding agency pushes, the field will respond, then the practice will change.

Another AC member suggested that part of that training might focus on intersectionality and how it matters. This person recognized that there was a lot of struggle with making terminology inclusive because it's very important and encouraged continuing to struggle with it. This person also referenced the comment he made in the chat: this is going to be political, given our current climate and this is an assumption EHR is prepared for. Another AC member added that there's an emotional aspect in the way that we write and how we say things this is a concern. To continue the conversation an AC member suggested that there may be some similar [BP] programs at other foundations. NSF could compare the language that is used. If this becomes political, it's not just an assessment, it could be something that's consistent. An AC member revisited an earlier comment that though NSF can't always be on the necessary the leading edge the agency can play a major role. NSF can play a major role.

Additional advice was given about review panels. This AC member advised that language is changeable and part of a developmental process. If language appears in proposals that is not inclusive, reviewers should take into account the intention behind the research which may headed in the right direction for broadening participation. The goal is to grow the community by nurturing people rather than making criteria that may potentially exclude others. An AC member suggested using the Gendered Innovations work from Stanford University as a model (https://www.genderedinnovations.standford.edu). This person stated that we cannot allow folks to continue to get money if they're not coming at their research from an intersectional perspective on the design aspect, and not just broadening participation. There is a difference than looking at sheer numbers of people that are engaged whereas an intersectional approach brings together the whole person or thinking holistically. EHR needs to continue advocacy around intersectional work, both from a funding perspective, from the perspective of conducting, as well as a broadening participation perspective, because they all go together.

12:30 PM –12:45 PM BREAK

12:45 PM – 2:00 PM	SESSION 5: CONTEMPLATING THE ROLE OF TRANSLATIONAL SCIENCE FOR THE PURPOSE OF BROADENING PARTICIPATION THROUGH K-12 STEM EDUCATION
	Moderator: Monya Ruffin, Acting Deputy Division Director, Division of Research on Learning in Formal and Informal Settings, EHR **Presentations:** **Targeting Children's Beliefs and Misconceptions Concerning COVID-19,** Susan Gelman, University of Michigan **Teacher Professional Learning to Support Student Motivation and Engagement During Science Instruction: A Translational Approach** Dr. Lisa Linnenbrink-Garcia, Michigan State University **Session 5 Discussion**

Dr. Monya Ruffin opened floor for discussion.

Session 5 Discussion:

> *1. In thinking about Translational Science as a potential tool for advancing innovation in interventions designed to improve STEM K-12 education, what advice do you have for future directions in EHR?*
> *2. What other approaches, beyond translational science, might EHR consider to facilitate innovation in K-12 STEM education?*

Dr. Monya Ruffin thanked the EHR office of AD and Advisory council and introduced the second session for the broadening participation thematic series. Dr. Ruffin described EHR's investment in K-12 STEM education and broadening participation. Dr. Ruffin then introduced the session's speakers, Dr. Susan Gelman who is a Developmental Psychologist at the University of Michigan. Dr. Gelman's work focuses on how children organize experiences into categories and how children discover language. The second presenter, Dr. Lisa Linnenbrink-Garcia, is a Professor of Educational Psychology at Michigan State University and her work focuses on development of achievement and education in elementary through post-secondary education.

Dr. Susan Gelman presented research about how children think about COVID-19. Dr. Gelman's key findings are that even the youngest children know about behaviors that transmit or block germs, and know germs are too small to be seen and can make us sick. However, children found it difficult to grasp what is taking place inside the body and what viruses can and cannot do, which makes kids hesitant about vaccines.

Dr. Lisa Linnenbrink-Garcia presented on motivation as essential for broadening participation and cultivating short- and long-term engagement of student in STEM fields. Dr. Linnenbrink-Garcia's work focuses on middle school, which is a crucial development time and when research shows declines in motivation. She presented Motivation Design Principles (MDPs) to support students' adaptive motivation and engagement.

AC Questions for Presenters

On AC member asked about knowledge of authority and pointed out that even adults do not have a complete understanding of virus science. Normally adults rely on professional expertise, but that system has broken down. He asked, what is the analogous situation for children? Since parents are the authority, do their opinions propagate? Is that issue accounted for in your [Dr. Gelman's] work? He also pointed out a moral issue regarding individual vs. group interest: what extent does individual prerogatives override collective interest? Are there different kinds of interventions for children?

Dr. Gelman responded that they have thought about knowledge of authority and assessed it in different ways in children and parents. They asked both groups how much they believe they know about viruses. More knowledgeable parents were aware of gaps in their knowledge. In children it was the opposite; they showed classic positivity bias. The researchers asked groups about how much they know at beginning and end of the study. Children were more confident at the end and felt good about what they answered, regardless of truth. Researchers also asked parents about their confidence in medical science to act on best behalf of society. Their answers were predictive of their interest in getting vaccines and self-reported behaviors outside of the interview context. There was a cluster of attitudes, behaviors, and trust in authority that was difficult to tease apart. Dr. Gelman agreed with the AC member about the moral conundrum and appreciates that we have to consider greater good and not just our individual selves.

One AC member asked Dr. Linnenbrink-Garcia if she observed in her research a statistical significance by race for motivation. She suggested unpacking the host of additional factors that lead to differentials in participation which may not necessarily be motivation. She pointed out that motivation comes with such a personal impact of understanding, and wondered what Dr. Linnenbrink-Garcia attributed to motivation? Dr. Linnenbrink-Garcia responded that the sample size is quite small, and thus it is hard to break down those differences with underrepresented minority students. At this point, they cannot tease these factors apart. Dr. Linnenbrink-Garcia is studying whether motivational processes are similar across races, and if there are systematic barriers to motivation.

AC Member Discussion

Question 1: In thinking about Translational Science as a potential tool for advancing innovation in interventions designed to improve STEM K-12 education, what advice do you have for future directions in EHR?

One AC member stated that she enjoyed hearing about research and stated that it is important to inform schools and students about translational science. She emphasized that it is important to

support teachers through mentorship and ensuring funds are available to schools. Collaboration with teachers is important such as in Dr. Linnenbrink-Garcia's study. She also advocated for K-12 teachers to get support for learning about the process for conducting research studies and know they can make a difference.

An AC member asked a question of clarification. Before this AC meeting, he searched the internet about translational science and saw that every example was in biology. He asked what does that mean, and if there are interesting examples in other STEM fields?

Another AC member expressed how partnerships that exist between research institutions and industry feed into each other and translates science. NSF is supporting these efforts through the iCORE program, which funds multi-year long commercialization activities, and the upcoming TIP directorate.

Dr. Bonnie Green, executive secretary, shed light on the previous question regarding translational science's predominance in biology. Dr. Green explained that translational science began in medicine since the knowledge gained in the lab translates into practice faster than in other scientific disciplines.

Another AC member emphasized how important it is to collaborate with teachers, virologists, and pediatricians. The perspectives of developmental psychologists should be part of messaging about COVID. She encouraged EHR to consider who should be involved and brought into conversations about partnerships.

The topic about climate change surfaced, particularly how educators should lead students to think about problems and solutions to make changes in their communities. She would like to see EHR think about teachers, but also empower students to make a difference with their knowledge and be involved in community-change.

Dr. Ruffin reads Question 2: *What other approaches, beyond translational science, might EHR consider facilitating innovation in K-12 STEM education?* Dr. Sylvia Butterfield clarified that K-12 includes both formal and informal settings. She listed DRL programs that involve informal learnings. What can we do better? Where are the gaps?

One AC member responded that when Covid-19 first hit, math educators and teachers started thinking of ways to simulate the virus and connect science to mathematics. How can EHR cultivate these kinds of relationships? Most disciplines are not as connected as we would like to work together to create great curriculum. Especially in communities where people needed to have vans for hot spots so students could continue learning despite Covid.

An AC member advised that it is important that funded portfolios should reflect the diversity of students in elementary classrooms who are in a variety of situations. Studies should not focus on privileged students. Dr. Ruffin gave the reminder that most of programs in DRL are Broadening Participation focused.

Dr. Laurel Vermillion spoke from her vantage point as an AC member who is president Sitting Bull College which is in a rural area. She suggested that college students become mentors for high school students. Since her school community is rural, there is no availability of clubs such

as Boy Scouts and Girl Scouts and young people miss out on those types of activities. Dr. Vermillion stated that mentoring by college students would have several benefits such as earning money, becoming a leader, and potentially becoming a teacher. There are opportunities for them at Standing Rock.

Mellissa Collins suggested that EHR work with programs that connect with classrooms virtually for inquiry-based learning.

2:30 PM – 3:30 PM	**SESSION 6: ENCOURAGING AUTHENTIC AND USEABLE ASSESSMENT FOR BROADENING PARTICIPATION**
	Moderator: Susan Richardson, Acting Deputy Division Director, Division of Undergraduate Education, EHR **Presentation:** **Georgetown University Center on Education and the Workforce** Dr. Nicole Smith **Session 6 Discussion**

Session 6 Discussion:

1. *In thinking about the presentation by Dr. Smith and EHR's mission, what information could be used to help prepare EHR for "what's next?"*
2. *What trends are you seeing or do you predict will be occurring in STEM education assessment and evaluation? (e.g., AI, technology, measurement, etc.)*

Moderator: Susan Richardson, Acting Deputy Division Director, Division of Undergraduate Education, EHR

Dr. Richardson introduced Dr. Nicole Smith, an AC member and **e**conomist at the Georgetown University Center for Workforce Development (Center). Dr. Smith explained that the Center focuses on projects that advance economic prosperity for all Americans and education is an important component. It is nonpartisan and will be involved in public discourse relevant to education and workforce issues. The Center cares about implications for educational attainment and obtaining a job that provides sustaining wages for families. It does not advocate for STEM education directly yet does so indirectly in conversations about which programs of study or which courses are the ones that add the most economic value. STEM is at the top.

Dr. Smith shared highlights from several reports:

If Not Now, Then When: This report advocated for investing in education and breaking down artificial barriers between primary school, secondary school, postsecondary education which would lead to labor market success.

College Pay Off: The report compared 170+ majors available using American Community Survey and then calculated earnings over a lifetime using synthetic cohorts. Majors in STEM were addressed indirectly since those lead to higher earning potential.

Mission Not Accomplished: The focus was attrition in the engineering workforce and some of the reasons why it is difficult for engineers who are people of color to persist in their careers over significant periods of time.

Selective Bias: This report was about claims of enrollment discrimination by Asian American students. Data from the last two decades about for enrollment completion, persistence, types of majors were analyzed. Findings show that claims were unconvincing

The Cost of Economic and Racial Injustice in Postsecondary Education: Commissioned by the Post-Secondary Value Commission, findings from this report fall in line with the Georgetown Center's thought experiment. If all systematic barriers to access, completion, and participation were removed, what would be implications for GDP, taxation, and overall economic growth. Closing these gaps would start at pre-K The benefits outweigh the costs and over time that could mean a boost in GDP of close to 765 billion annually over an

15 Million Infrastructure Jobs: This report examined the 1.9 trillion-dollar infrastructure bill and the extent to which we would require workforce development and training and for whom. Most of those jobs are STEM jobs. A significant number of STEM jobs are for middle skilled workers which means post-secondary vocational certificates, licenses, and some bachelor's degrees. A significant amount of training is needed. There is not a significant amount of money allotted to job training.

Dollars and Sense of Free College: This report examined the implications of free college defined as tuition free or debt free. In the Build Back Better infrastructure bill the Biden Administration anticipated the cost of free college at close to $190 billion. The long-term benefits of free college outweigh the cost. The report also examined the impact of additional funding for Pell grants, and this would affect one in five students who attend community college and four-year institutions.

AC Discussion about Nicole's Presentation

Dr. Thomas Brock and his colleagues at CCRC (Community College Research Center) often reference the work from Georgetown Center. One challenge CCRC has faced is thinking more broadly about the value of community college courses and degrees aside from monetary value which is easiest to measure. There are many positions such as after school and early childhood program providers that are critical for society yet are notorious for paying terribly. Dr. Smith agreed and said that transparency is needed. Students need to learn what type of salary they will make when they pursue majors in the caring and intellectual careers such as nursing, social work, and teaching. She advocates for addressing the amount of debt students incur for majors that are

needed yet their pay is less than others. That is why loan forgiveness is important for intellectual and caring professions.

An AC member raised the point that many of outcomes are long term in the life of a person. Lots of studies are cross sectional looking at grade level cohorts and boosting test scores, yet this does not always add up to a better longitudinal picture. The discussion caused him to reflect on the AC session about language and the structural barriers that limit the greater diversity of students who pursue STEM careers. How should things change? Dr. Smith responded by speaking about the all-in-one system that the Georgetown Center is advocating recently. CCCR is more advanced in these discussions which advocate for early experiential learning, early involvement, exposure to STEM and making sure that students can see themselves in those careers. The all-in-one system also advocates for removing artificial barriers that exist which create K-12 and workforce development silos in addition direct counseling and early mentoring. Dr. Roschelle made a connection with the all-in-one system to Digital Promise's work with the League of Innovative Schools. Superintendents in many districts are bringing in real world learning so that students can understand early on how what they are learning now connects to their future.

Another AC Committee member asked about the resistance to progress in implementing ideas such as the all-in-one system since it seems to be a win-win for everyone and good for many people. Dr. Smith answered that resistance comes from those who are concerned about tracking. There has been lots of push back from discussion that advocates for career and technical education that does not involve college. Some people are hypersensitized to making sure that groups are not tracked into sub-BA credentials.

Discussion -

Dr. Okhee Lee gave general remarks about the presentation and guided the committee members in answering questions posed to the AC committee. In her general remarks she spoke of the $250 billion dollar proposal for research in STEM sitting in the house. National policy is on STEM with a focus on equity.

Ques 1 – how do we situate EHR in the STEM education national policy space. Dr. Lee added, how does EHR situate the scope of boundaries so that the work does not only address cross-sectional studies which relates to an AC member's ques about long term impact. How does EHR prepare students? She stated that the short-term goal is getting high school students interested in STEM careers and the long-term goal is exposing students as early as prek- and kindergarten. ITEST can be used to figure out what does it mean to prepare students for careers.

The second question: How can we assess an evaluation. How do we assess and evaluate?

Okhee shared her concern about scale and that any innovation could widen gaps. Equity and justice must be at the center. Nicole's response: the Georgetown Center tries to forecast the demand for education which leads to a discission about the occupations of the future, the types of skills needed talk about types of skills needed for occupations and extent to which skills are transferrable.

This discussion reminded one AC member about debates in mathematics education about whether data science or other alternative tracks can be used as a parallel to algebra. There are also challenges to adding computer science to the curriculum. If it is only a high school elective, then that limits the diversity of students who can take it. This elective is offered at later grade levels for students in high school. He asked when should students take courses such as computer science and data science? How do we create equity in opportunities to learn those topics and how soon can we start? These thoughts are resonating, yet he's not sure what to do about them.

This session ended with an AC member who called attention to community college students who are careers changers, first time goers, or stop outs. There are millions of adults who have some credits or no credentials who are thinking about continuing, starting back, or changing and they need support. She appreciates that Nicole brought attention to middle skills which helps think about a broader cross section of learners which include children in K-12 and include many folks trying to enter the technical workforce through various entry points.

2:50 PM –3:05 PM BREAK

3:05 PM – 3:50 PM	**PREPARE TO MEET NSF DIRECTOR SETHURAMAN "PANCH" PANCHANATHAN AND CHIEF OPERATING OFFICER KAREN MARRONGELLE** **Moderator: Marilyn Strutchens**, Chair, EHR Advisory Committee

Marilyn called the session back to order.

AC members suggested questions and topics for which the AC would like insight into from NSF Director, Sethuraman "Panch" Panchanathan, and Chief Operating Officer (COO), Karen Marrongelle. Topics included: opportunities and partnership between EHR and the new TIP directorate; challenges facing DEIA and broadening participation nomenclature; strengths and opportunities that the Director sees for NSF; partnerships with MSIs; perspective about the traditional lab-to-market tech transfer model; the EHR AD search; and the continued assault on Scientific Inquiry and NSF's role in that space.

3:50 PM –4:00 PM BREAK

4:00 PM – 4:30 PM	**DISCUSSION WITH NSF DIRECTOR SETHURAMAN "PANCH" PANCHANATHAN AND CHIEF OPERATING OFFICER KAREN MARONGELLE** **Moderator: Sylvia Butterfield**, Acting Assistant Director, EHR

Dr. Butterfield opened the session and asked AC members to introduced themselves.

After brief introductions, Dr. Panchanathan shared that NSF is a pathway to reaching talent and the only federal agency that has the broad mission that touches talent in every part of the nation's infrastructure. NSF is an Agency that can make an impact. He believes that NSF should not be viewed as only a research agency and wishes to get the word out that NSF is an Agency for all. Currently, the K12 STEM talent, the missing millions, and workforce development are at the top of the outreach efforts. Dr. Panchanathan thanked the committee for its time and guidance provided to EHR.

Dr. Karen Marrongelle acknowledged EHR staff and their hard work generating and supporting K12 STEM talent, reaching the missing millions, and supporting the needs of the Nation's workforce.

Dr. Butterfield opened the floor for discussion, questions, and comments. AC members thanked Dr. Panchanathan for sharing his perspective in advance and explored topics related to the rationale for the new TIP directorate, the metaphor for TIP being "lab-to-market" and starting at scale rather than starting small, as well as the timeline and search for the next EHR Assistant Director.

Dr. Panchanathan emphasized the cross-cutting nature of the TIP Directorate, and the purpose of TIP is to increase talent that will generate additional opportunities. The intersection with other directorates will advance the TIP objective allowing the forward progress of other Agency directorates at speed while engaging industry, the economy, and entrepreneurialism. Dr. Panchanathan asked "How might industries of the future advance?". He shared that NSF wants to create an ecosystem of lab-to-market through TIP that allows various ideas to mature at scale. EHR's partnership with TIP will focus on broadening the talent-base. Dr. Panchanathan asked the AC: *How do we adapt things that work and scale them fast? How do we get K12 sector and industry sectors to co-create and co-adoption to scale fast?* Dr. Panchanathan shared that there are hundreds of companies in the interactive technology space. There is a clear need to establish goals and learning outcomes and co-create a shared objective. The Committee shared in the enthusiasm for the development of TIP and inquired on if NSF would be using the new directorate as an opportunity to review its own processes stating that if the goal was to be broader and more inclusive that it may be a good idea to change some of the Agency's processes. Dr. Panchanathan posited that NSF is attempting to do two things with TIP. First, NSF may create new granting mechanisms as the Agency learns from other established agile mechanisms. Increasing partnership with entities successful in this space so we can do things faster within NSF as an establishment. Secondly, NSF's goal is to increase capacity. To write new ideas into

competitive proposals that allow new institutions to execute their projects across the nation may require virtual SROs. To increase capacity, Dr. Panchanathan would like to see EHR get more community colleges, minority serving institutions, and tribal colleges to be successful during the merit review process.

Dr. Panchanathan believes NSF has a big role to play in discussions around broadening participation language and common nomenclature however, NSF should not determine the terminology but rather listen to the community through listening sessions. NSF acknowledges the impact of language and while continuing to ensure that the future STEM workforce reflects the diversity of our nation, NSF supports achieving the outcome most desired by the community and should co-create in the space.

Dr. Panchanathan disclosed that the search for the next EHR Assistant Director has begun and that there were members on the search committee who were very passionate about K12 and the need for transformation. He stated that the search committee is not about processing CVs and the members were charged with finding the best candidate. As such, the timeline will be established as soon as possible but there is a stronger desire to engage with the best talent across the Nation.

4:30 PM – 4:45 PM	**CLOSING REMARKS**
	Sylvia Butterfield, Acting Assistant Director, HER **Marilyn Strutchens**, Chair, EHR Advisory Committee, & Emily R. & Gerald S. Leischuck Endowed Professor, Mildred Cheshire Fraley Distinguished Professor, Department of Curriculum and Teaching, Auburn University

Dr. Sylvia Butterfield and Dr. Marilyn Strutchens thanked all AC members for their valuable input and time. Dr. Butterfield made several announcements and emphasized the shared goal of the meeting was to engage and inspire opportunities and to provide guidance to EHR on a wide range of topics. Dr. Strutchens extended appreciation to Hyman Bass for his contributions to the AC and to the field of mathematics. Marilyn then asked the AC what they would like to charge EHR with, or if they would like to share parting remarks:

The Committee was struck by the scale of workforce and TIP. The AC provided feedback on how EHR might engage in TIP, use leadership roles to address issue of language, and give insight to address challenges in STEM education, intersectionality, broadening participation, and economy. While the Committee found discussions on equity and inclusion to be rich, the AC recognized there were challenges that EHR should engage in around the narrow notion of who EHR is partnering with. As the Agency transitions from a knowledge-producing agency to a value-producing agency, the Committee urged EHR to think strategically and get the metaphor just right. The AC charges EHR to keep thinking on how to form communities of likeminded individuals to share information and resources thinking collectively on how to create larger

learnings from current awards and funding. The Committee recognized the critical need to do more for community college initiatives and inquired about what EHR plans to do regarding the decline in enrollments as community colleges are an important part of the higher education framework and are related to STEM adjacent workforce. The Committee recognized that science used to be esoteric to public discourse as it relates to policy. The role of NSF to society matters because of accountability. The Committee further recommends that EHR keep making teachers' voices matter. The Committee found discussions on nomenclature were helpful as they kept intersectionality in mind.

Dr. Butterfield thanked all EHR staff who helped the meeting come to fruition. Dr. Marylin Strutchens thanked all members for their contributions to a productive discussion and adjourned the meeting at 4:58p.m.