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GENERIC CLEARANCE FOR THE NASA OFFICE OF EDUCATION/ PERFORMANCE MEASUREMENT AND EVALUATION (TESTING) SUPPORTING STATEMENT

A. JUSTIFICATION

1. NECESSITY FOR INFORMATION COLLECTION:

Explain the circumstances that make the collection of information necessary. Identify any legal or administrative requirements that necessitate the collection. Attach a copy of the appropriate section of each statute and regulation mandating or authorizing the collection of information.

The National Aeronautics and Space Administration inspires the world with our exploration of new frontiers, our discovery of new knowledge, and our development of new technology in support of the vision to discover and expand knowledge for the benefit of humanity.

The NASA Office of Education (NASA Education) supports that mission by deploying programs to advance the next generation's educational endeavors and expand partnerships with academic communities (see Appendix A).

NASA has a long history of engaging the public and students in its mission through educational and outreach activities and programs. NASA's endeavors in education and public outreach began early on, driven by the language in Section 203 (a) (3) of the Space Act, "to provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof, and to enhance public understanding of, and participation in, the Nation's space program in accordance with the NASA Strategic Plan." NASA's education and outreach functions aim to inspire and engage the public and students, each playing a critical role in increasing public knowledge of NASA's work and fostering an understanding and appreciation of the value of STEM, and enhancing opportunities to teach and learn. By augmenting NASA's public engagement and communicating NASA's work and value, the Agency contributes to our Nation's science literacy. NASA is committed to inspiring an informed society; enabling the public to embrace and understand NASA's work and value, today and tomorrow; engaging the public in science, technology, discovery, and exploration; equipping our employees to serve as ambassadors to the public, and providing unique STEM opportunities for diverse stakeholders.

The Office of Education Performance Assessment and Evaluation Information Management (PAEIM) Team supports performance assessment and evaluation of NASA's education investments executed through headquarters and across the ten Center Education Offices (see Appendix B). The PAEIM Team became lead for performance measurement and program evaluation activities within the Office of Education in October 1, 2017. Responsibilities include recommending and implementing agency-wide strategy for performance measurement and evaluation; ensuring the collection of high-quality data; process documentation of NASA Education projects; formative and outcome evaluations; training and technical assistance on performance measurement and evaluation. The PAEIM Team's goal is to provide support that improves education policy and decision-making, provides better education services, increase evaluation rigor and accountability, and ensures more effective administration of investments. The Office of Education IT (OEIT) Systems Team supports the NASA Education community in

the areas of information technology, dissemination and Web services, and communications and operations support. These two teams in collaboration support the overall performance assessment of NASA education investments across the agency.

The purpose of this request is to renew the clearance for methodological testing in order to continue to enhance the quality of the Office Education's data collection instruments and overall data management through interdisciplinary scientific research, utilizing best practices in educational, psychological, and statistical measurement. NASA Education is committed to producing the most accurate and complete data within the highest quality assurance guidelines for reporting purposes by NASA Education leadership and by authority of the Government Performance and Results Modernization Act (GPRMA) of 2010 that requires quarterly performance assessment of Government programs for purposes of assessing agency performance and improvement. It is with this mission in mind, then, that this clearance package is submitted.[1]

Under the current clearance (2700-0159 OMB Control Number) for the NASA Office of Education Performance Measurement and Evaluation (Methodological Testing) the following information collections were approved for pilot testing.

- Office of Education Performance Assessment, Evaluation, and Information Management Data Collection Screens: One Stop Shopping Initiative (OSSI) Student-level Data
- Office of Education Performance Measurement (OEPM) Program-level Data Collection
- NASA Office of Education Undergraduate Internship Impact Surveys - Retrospective and Traditional Development Surveys, Student Baseline Instruments No. 1 and Follow-up Instruments #1
- NASA Education STEM Challenges Impact Surveys: Student Baseline Instruments, Student Follow-up Instruments; and Educator Retrospective Instruments
- NASA Education Internship Data Collection Screens: NASA Internship Application Management System (NIAMS) Student-level Data

The PAEIM Team conducted an internal assessment of the NASA Education information collections above to determine the outcome and results of the methodological testing. Available documentation and testing technical reports provided the example summary of results for the NASA Education STEM Challenges Impact Surveys (Student Baseline and Follow-Up Instruments, and Educator Retrospective) beginning on the next page.

[1] The entire GPRMA of 2010 can be accessed at http://www.gpo.gov/fdsys/pkg/BILLS-111hr2142enr/pdf/BILLS- 111hr2142enr.pdf.

NASA Education STEM Challenges Impact Surveys Methodological Testing

Methodological testing was conducted with educator and student respondents in the 21st Century Learning Community Centers (21stCCLC)/NASA Phase 3 Collaboration. In conducting the methodological testing analysis of our instruments, we included several survey items to address: the amount of time to complete the surveys, if survey questions were understandable, clarity of the survey instructions and if respondents had any survey feedback.

Type of Validity and Reliability Assessment

We measured validity and reliability of the instruments. Instrument validity occurs when the answers correspond to what they are intended to measure. There are four types of validity:

1. *Content – domain covered in its entirety;*
2. *Face – general appearance, design or layout;*
3. *Criterion – how effective are the questions in measuring what is purports to measure;*
4. *Construct – how the questions are structured to form a relationship or association (Bell, 2007).*

Reliable instruments are assessments that produce consistent results in comparable settings. For example, reliability is increased when there are consistent scores across more than one organization that serves populations in a rural setting (Bell, 2007)

We examined the instrument items and its subscales. As such, we calculated conventional measures of reliability for each scale. Cronbach's α, which can be interpreted as the average correlation (or loading usually denoted by λ) between the latent dimension and the items measuring the latent dimension. The squared multiple correlation (SMC), sometimes referred to as Guttman's λ_6, represents the proportion of the variance in the true score explained by the items. For each item, we also calculated the SMC and an examination of each item's contribution to α by examining α if we deleted the item.

Construct validity was used to identify questions that assessed students' skills, attitudes and behaviors toward STEM. The multi-scale measures described below are from the PEAR Institute Common Instrument Suite Survey 3.0 (PEAR Institute, 2016). The common instrument suite survey has been administered over 30,000 times to students enrolled in informal science programs across the U.S., and it has shown strong reliability in previous work (α> 0.85) (https://www.thepearinstitute.org/common-instrument-suite, Allen et al, 2016).

Respondent Characteristics

Our sample consisted of 70 EDC sites chosen at random and all 12 GLOBE SRC pilot sites. Together these 82 evaluation sites provided all the data (e.g., implementation information collected from participation logs, educator feedback forms, and in-depth interviews) for this evaluation.

From these sites we collected a total of 992 surveys from EDC students and 151 surveys

from GLOBE SRC students at pre-test. During the post-test, 671 EDC students and 81 GLOBE SRC students provided responses. This represents a retention rate of 68 percent for EDC and 54 percent for GLOBE SRC. High attrition rates are common in OST programs; previous research has found that between 31 and 41 percent who start such programs go on to finish them (Apsler, 2009; Weisman and Gootfredson 2001).

All 992 EDC participants contributed to our analysis, but we retained only 151 of the 159 participants from GLOBE SRC due to one school dropping out of the study prior to post-test. Of the 992 EDC pre-test participants, 671 (or 68%) participated at post-test, where 321 were lost to attrition. An additional 183 participants provided data only at post-test; however, these participants likely only had partial exposure to the EDC program. As a result, we excluded this from our analysis. Considering comparable numbers for GLOBE SRC, of the 151 pre-test participants, 81 (or 54%) participated at post-test and 70 were lost to attrition.

Findings

Key findings from the performance assessment of the student and educator surveys and analysis are as follows:

1. *EDC and GLOBE SRC students required more than the projected average 10 minutes to complete the pre- or post-test surveys;*
2. *EDC and GLOBE SRC educators required more than the projected average 15 minutes to complete the post-test (retrospective) surveys;*
3. *Students responded that the pre- and post-test survey items were understandable and that the instructions were clear;*
4. *Of those students who provided suggestions for improvement of the EDC and GLOBE SRC pre- and post-test surveys, the most common suggestion was to add more response options, followed by provide additional/more interesting questions;*
5. *Among educators, four responses/suggestions for improving the EDC and GLOBE SRC educator surveys were to provide greater clarity to the questions, reduce the use of reverse coding, that the retrospective reporting may have proved challenging for some respondents, and more time was spent on open-ended responses;*
6. *Survey items and scales for each of the EDC and GLOBE SRC (pre- and post-test) surveys, as well as the EDC and GLOBE SRC educator surveys (retrospective) performed as expected and yielded acceptable reliability readings.*

Recommendations

Based on the findings from the survey item and subscale analysis, and the methodological testing survey item analysis, the contract evaluator made the following recommendations:

1. ***Create a shorter (fewer questions) and simpler (language) version of the student surveys** to achieve a 10-minute survey experience for students, especially if the plan in the future is to survey younger elementary school aged children (e.g., 4th grade);*
2. ***Create a shorter (fewer questions) version of the educator surveys** to achieve a 15-minute survey experience for educators;*

3. ***Consider modifying the student and educator instruments to be applicable for older student populations*** *(e.g., 9th and 10th grades) and include 9th and 10th grade students in future evaluations to examine effects of 21st CCLC on older students;*
4. ***Maintain separate EDC and GLOBE SRC student instrume****nts (do not combine the two instruments);*
5. ***Conduct a comparative analysis with other available data on STEM attitudes and beliefs****;*
6. ***Continue scaling the EDC and GLOBE SRC programs and use revised survey instruments*** *to collect student pre- and post-test data and educator post-test data;*
7. ***Continue to collect and analyze student and educator data and contribute to the research literature*** *regarding successes and challenges of 21st CCLC programs teaching engineering and science skills.*

Another example summary of results for the NASA Office of Education Undergraduate Internship Impact Surveys (Retrospective and Traditional Development Surveys, Student Baseline Instruments No. 1 and Follow-up Instruments #1) is as follows.

NASA Internship Expectations Post-Survey and Development Retrospective Methodological Testing NASA International Internships (I^2)

- *Deployed Spring 2016*
- *N=20*
- *STEM-related Outcomes Constructs of interest:*
  - *Internship Expectations*
  - *Development Outcomes: a dependent variable for student learning as well as an additional construct to understand students' intention to complete their degrees and satisfaction with their programs. (Retrospective)*

Success Story

NASA International Internships Post-Experience Survey

Summary (N=16) Response rate: 76%

Inspire Engage, Educate, Employ.

✓ **Who are I^2 Students?**

When asked whether the amount of work in this internship was more than expected they offered the following:

Aerospace Engineering

Mechanical Engineering

Engineering Physics

Biomedical Engineering

Biotechnology

Software Engineering

Biological Sciences

Physiology

"Although the amount of work in this internship was more than I expected, I did enjoy the challenge and opportunity to further develop my skills."

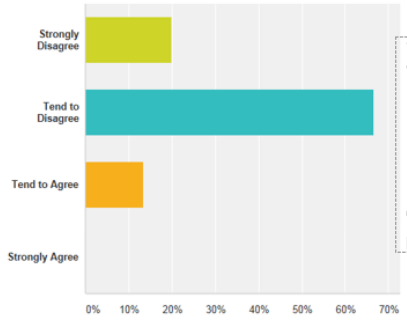
"Compared to other internships I've had, I did a lot more at NASA and really enjoyed it."

"Working with NASA as a research associate is incredible; this is not "work"."

"I came to NASA expecting to work. That's exactly what I did. In the case that I felt I wasn't given enough work I went out and found more as to not put the opportunity to waste."

25% of I^2 students are repeat participants!

✓ **I^2 students are industrious, hardworking, and eager to learn... And when asked if the internship experience was *easier* than expected:**



"I expected it to be tough and it was, but in a good way."

"It was challenging but in a positive way."

"I was challenged day in and day out with my projects."

The take away? Every student had a positive experience in I^2!

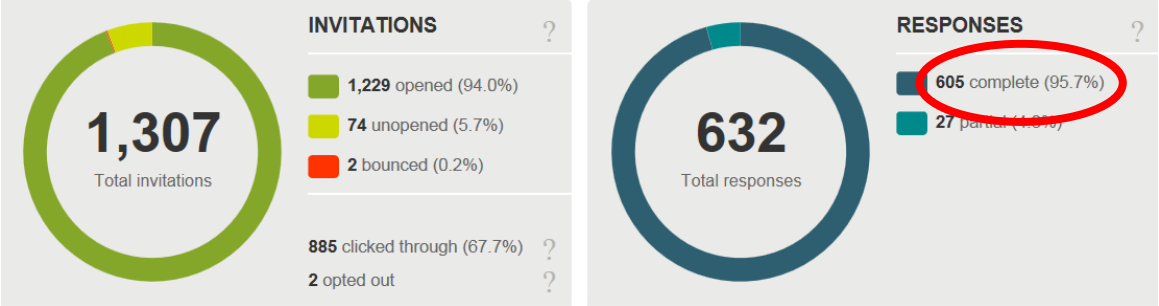
- I walked away from this internship with multidisciplinary knowledge and the insight of what it is like to conduct research.
- Learned a lot while being able to contribute to research was very satisfying.
- I have loved NASA and space since childhood. Being a NASA research associate is satisfying beyond words.
- It was a great opportunity! I am thrilled to have opportunity to contribute to an amazing project.
- The Aeromechanics department at Ames provides the best internship experience for anyone looking to network, learn and overall grow as a person.
- Working at NASA was a childhood dream, and now I know that the people and the facilities are exactly as amazing as I imagined.
- The opportunity was great. I feel that it is one of the best overall internship experiences I have ever heard of. (In regards to the particular branch I was in, Rotorcraft Aeromechanics)

Comprehensibility & Response Rate Results:

Table 1. Calculation chart to determine statistically relevant number of respondents

Data Collection Source	(N) Population Estimate for FY 2015 Q4	(A) Sampling Error +/- 5% (.05)	(Z) Confidence level 95%/ Alpha 0.05	(P) *Variability (based on consistency of intervention administration) 50%	Base sample size	Response Rate	(n) Number of Respondents
OSSI Internship Placements	1,379.00	0.0025	3.84	0.50	300	0.60	500

Table 2. Response rates for the NASA Internship Expectations Pre-Survey Summer 2016



Grit Results: Principal Component Analysis & Deployment June 2017
Rotation of the factor structure has realized three factors and variables loading highly on two factors primarily, with two variables distinct and apart in the rotated solution and presenting as a third factor.
What we learned and how it can be used:

- *Statistical means to ensure population representation in testing and routine administration*
- *Certain of the auto-reminder/auto-send frequency pattern to ensure high, representative response rates*
- *Retrospective survey format for attitude & behavior scales yields statistically relevant STEM-related outcomes data*
- *Comprehensibility questions (2) will aid in OMB clearance reporting*

Towards monitoring performance of its education activities, NASA Education will use rigorously developed and tested instruments administered and accessed through the Office of Education Performance Measurement system.[2] Each data collection form type possesses unique challenges which can be related to respondent characteristics, survey content, or form of administration. In the absence of meticulous methods, such issues impede the effectiveness of instruments and would decrease the value of the data gathered through these instruments for both NASA Education and the Agency.

The central purpose of measurement is to provide a rational and consistent way to summarize the responses people make to express achievement, attitudes, or opinions through instruments such as achievement tests or questionnaires (Wilson, 2005, p. 5). In this particular instance, our interest lies in attitude and behavior scales, surveys, and psychological scales related to the goals of NASA STEM education activities. Yet, since NASA Education captures participant administrative data from activity application forms and program managers submit administrative data, PAEIM Team extends the definition of instruments to include electronic data collection screens, project activity survey instruments, and program application forms, as well.[3] Research-based, quality control methods and techniques are integral to obtaining accurate and robust data, data of high quality to assist leaders in policy decisions.

The following research techniques and methods may be used in these studies:

- Usability testing: Pertinent are the aspects of the web user interface (UI) that impact the User's experience and the accuracy and reliability of the information Users submit (Kota, n.d.; Jääskeläinen, 2010).

[2] The Office of Education Performance Measurement System (OEPM) is the project level data component of NASA Education's data collection suite. It is an automated system for collecting, managing, and securing data, and uses web interfaced on-line data collection screens with a back-end database. As an automated, information technology system that is the centralized collection point for NASA Education performance measurement data, OEPM reduces respondent burden by: 1.) bringing clarity to the exact nature of data required of program managers; 2.) consolidating disparate NASA Education systems in use throughout the NASA Centers of Education; 3.) providing a means to monitor project performance data for the purposes of determining education-related outputs and outcomes; 4.) improving the quality of performance measurement data (i.e., monitoring mechanism for missing data points); and 5.) refining reporting consistency through automated reminder functionality.

[3] If constituted as a form and once approved by OMB, forms will be submitted to NASA Forms Management according to NASA Policy Directive (NPD) 1420. Thus, forms used under this clearance, will have both an OMB control number and an NPD 1420 control number that also restricts access to NASA internal users only. Instruments not constituted as forms will display an OMB control number only.

Think-aloud protocols: This data elicitation method is also called ‘concurrent verbalization’, meaning subjects are asked to perform a task and to verbalize whatever comes to mind during task performance. The written transcripts of the verbalizations are referred to as think-aloud protocols (TAPs) (Jääskeläinen, 2010, p 371) and constitute the data on the cognitive processes involved in a task (Ericsson & Simon, 1984/1993).

Focus group discussion: With groups of nine or less per instrument, this qualitative approach to data collection comprises the basis for brainstorming to creatively solve remaining problems identified after early usability testing of data collection screen and program application form instruments (Colton & Covert (2007), p. 37).

- Comprehensibility testing: Comprehensibility testing of program activity survey instrumentation will determine if items and instructions make sense, are ambiguous, and are understandable by those who will complete them (Colton & Covert, 2007, p. 129).

- Pilot testing: Testing with a random sample of at least 200 respondents to yield preliminary validity and reliability data (Haladyna, 2004; Komrey and Bacon, 1992; Reckase, 2000; Wilson, 2005).

- Large-scale statistical testing: Instrument testing conducted with a statistically representative sample of responses from a population of interest. In the case of developing scales, large-scale statistical testing provides sufficient data points for exploratory factor analysis, a “large-sample” procedure (Costello & Osborne, 2005, p. 5).

- Item response approach to constructing measures: Foundations for multiple-choice testing that address the importance of item development for validity purposes, address item content to align with cognitive processes of instrument respondents, and that acknowledge guidelines for proper instrument development will be utilized in a systematic and rigorous process (DeMars, 2010).

- Split-half method: This method is an efficient solution to parallel-forms or test/retest methods because it does not require developing alternate forms of a survey and it reduces burden on respondents, requiring only participation via a single test rather than completing two tests to acquire sufficient data for reliability coefficients.

The PAEIM Team’s goal and purpose for data collection through methodological testing is to provide support that improves education policy and decision-making, provides better education services, increases accountability, and ensures more effective administration within the NASA Office of Education. More in depth descriptions of techniques and methods can be found in Appendix D.

2. USES OF INFORMATION

Indicate how, by whom, and for what purpose the information is to be used. Except for a new collection, indicate the actual use the agency has made of the information received from

the current collection.

The purpose of this data collection by the PAEIM Team is to ultimately improve our Federal data collection processes through scientific research. Theories and methods of cognitive science, in combination with qualitative and statistical analyses, provide essential tools for the development of effective, valid, and reliable data collection instrumentation.

The PAEIM Team's methodological testing is expected to 1) improve the data collection instruments employed by NASA Office of Education, 2) increase the accuracy of the data produced by execution of NASA Education project activities upon which policy decisions are based, 3) increase the ease of administering data collection instruments for both respondents and those responsible for administering or providing access to respondents, 4) increase response rates as a result of reduced respondent burden, 5) increase the ease of use of the data collection screens within the Office of Education Performance Management system, and 6) enhance NASA Education's confidence in and respect for the data collection instrumentation utilized by the NASA Education community.

The application of cognitive science, psychological theories, and statistical methods to data collection is widespread and well established. Neglecting accepted research practices and relying on trial and error negatively impact data quality and unfairly burden respondents and administrators of data collection instruments. For example, without knowledge of what respondents can be expected to remember about a past activity and how to ask questions that effectively aid in the retrieval of the appropriate information, researchers cannot ensure that respondents will not take shortcuts to avoid careful thought in answering the questions, or be subject to undue burden. Similarly, without investigating potential respondents' roles and abilities in navigating electronic data collection screens, researchers cannot ensure that respondents will read questions correctly with ease and fluency, navigate electronic data screens properly or efficiently, or record requested information correctly and consistently. Hence, consequences of failing to scientifically investigate the data collection process should and can be avoided.

In light of the Administration's call for increased sharing of federal STEM education resources through interagency collaborations, NASA Education may make available results of methodological testing to other federal STEM agencies in the form of peer-reviewed methods reports or white papers describing best practices and lessons learned. For instance, from inception NASA has supported the Federal Coordination in STEM (FC-STEM) Graduate and Undergraduate STEM Education interagency working groups' efforts determine cross-agency, common metrics and share effective program evaluations. *Coordination Objective 2: Build and use evidence based approaches* calls for agencies to:

> Conduct rigorous STEM education research and evaluation to build evidence about promising practices and program effectiveness, use across agencies, and share with the public to improve the impact of the Federal STEM education investment. (National Science and Technology Council, 2013, p. 45)

The methods to be employed in developing and testing data collection instruments will be methodologically sound, rigorously obtained, and will thus constitute evidence worthy of dissemination through appropriate vehicles. Data collection instruments appropriate for a participant in a postsecondary NASA Education research experience and are specific to the category of participant: undergraduate student, graduate student, mentor participant. One survey instrument explores a participant's preparation for a research experience while its complement explores a participant's attitudes and behaviors pre- and post-experience (undergraduate or graduate student) (Crede & Borrego, 2013.) Two non-cognitive competency scales explore a participant's developmental levels of affect (grit and mathematics self-identity & self-efficacy) as related to participation in a NASA Education research experience (Duckworth, Peterson, Matthews, & Kelly, 2007; National Center for Education Statistics, 2009.) Lastly, the mentor survey explores a mentor's attitudes and behaviors associated with participation as a mentor of a NASA Education research experience (Crede & Borrego, 2013.) Additional information collections will be submitted separately under this clearance with justification information and evidence-based methodology for methodological testing. Appendix G shows the explanatory content that will accompany each information collection for methodological testing purposes.

3. CONSIDERATIONS OF USING IMPROVED TECHNOLOGY

Describe whether, and to what extent, the collection of information involves the use of Automated, electronic, mechanical, or other technological collection techniques or other forms of information technology, e.g., permitting electronic submission of responses, and the basis for the decision for adopting this means of collection. Also describe any consideration of using information technology to reduce burden.

The Performance Assessment and Evaluation Information Management (PAEIM) Team in collaboration with the Office of Education IT (OEIT) System Team and Center Education Offices will plan, conduct, and interpret field and laboratory research that contributes to the design of electronic data collection screens, project activity survey instruments, and program application forms used within the context of the NASA Education community spread across ten Center Education Offices. These efforts are supported in two ways, by use of information technology applications and strategic efforts to improve the overall information technology data collection systems used by NASA Education.

Use of Information Technology (IT) Applications

IT applications will be used to bridge the distance between the PAEIM Team of researchers mostly based at NASA Glenn Research Center in Cleveland, OH, and the OEIT Systems Team at NASA Headquarters in Washington, DC along with the Center Education Offices. Multiple modes of technology may be used to bring the laboratory environment to study participants at various Center locales. In addition, data management and analyses applications have been made available to study leads to optimize data collection and analyses.

Different laboratory methods may be used in different studies depending on the aspects of the

data collection process being studied. Computer technology will be used when appropriate to aid the respondents and interviewers, and to minimize burden. For instance, the PAEIM Team and/or contractor support may use Adobe Connect, VidyoDesktop, or VidyoWeb to conduct focus groups and cognitive interviews if indeed there is inadequate representation of participant populations at area NASA research centers.[4,5] Adobe Connect and VidyoDesktop platforms are used throughout the NASA research centers and have the potential to facilitate instrument development by providing access to appropriate study participants. The PAEIM Team has direct access and is also training in using other IT applications to facilitate this work as described below.

- Adobe Connect: Adobe Systems Incorporated describes Adobe Connect as "a web conferencing platform for web meetings, eLearning, and webinars [that] powers mission critical web conferencing solutions end-to-end, on virtually any device, and enables organizations […] to fundamentally improve productivity."
- VidyoDesktop: Key features include Ultra HD 4k support to display rich content and multiple full HD participants; Multiple user-selectable layouts for continuous presence, active speaker, and shared content; Supported in Windows and Mac environments; In- conference public and private text chat, and ability to switch between multiple streams of shared content; Far-end camera control of Vidyo. Benefits include conferences hosting in your own virtual conference room with simple click-to-connect access for both administered users and guests; and works on existing computers and laptops with no need for an expensive dedicated appliances. The VidyoWeb browser plug-in provides guest participants a comparable in-conference experience to VidyoDesktop, but without user account or special software requirements.
- SurveyMonkey: This application may be used to collect non-sensitive, non-confidential qualitative responses to determine preliminary validity. This online survey software provides an electronic environment for distributing survey questionnaires.[6] For the purpose of NASA Education, SurveyMonkey is a means by which feedback can be collected from a variety of participants such as from subject matter experts when in the early stages of instrument development when operationalizing a construct is vital to the process of instrument development. A

[4] More information on Adobe applications is available at http://www.adobe.com/products/adobeconnect.html
[5] More information on Vidyo applications is available at http://info.vidyo.com/schedule-live-vidyo-demo.html?utm_source=bing&utm_medium=cpc&utm_campaign=Brand+-+Vidyo(US)&utm_adgroup=Brand-Vidyo&utm_term={keyword&_kk=vidyo}
[6] More information on SurveyMonkey can be found at https://www.surveymonkey.com/mp/take-a-tour/?ut_source=header. This application has been approved by the OCIO for uses not requiring a high level of security. In that regard, NASA Office of Education has a license to this application

process referred to as operationalization is another tangible means to measure a construct since a construct cannot be observed directly (Colton & Covert, 2007, p. 66). The qualitative feedback of subject matter experts, in addition to the research literature, provides the factors or variables associated with constructs of interest. SurveyMonkey will facilitate the gathering of such information and interface with NVivo 10 for Windows qualitative software for analyses and consensus towards developing valid items and instruments.

- SurveyMonkey: This application may be used to collect non-sensitive, non-confidential qualitative responses to determine preliminary validity. This online survey software provides an electronic environment for distributing survey questionnaires.[6] For the purpose of NASA Education, SurveyMonkey is a means by which feedback can be collected from a variety of participants such as from subject matter experts when in the early stages of instrument development when operationalizing a construct is vital to the process of instrument development. A process referred to as operationalization is another tangible means to measure a construct since a construct cannot be observed directly (Colton & Covert, 2007, p. 66). The qualitative feedback of subject matter experts, in addition to the research literature, provides the factors or variables associated with constructs of interest. SurveyMonkey will facilitate the gathering of such information and interface with NVivo 10 for Windows qualitative software for analyses and consensus towards developing valid items and instruments.
- NASA Google G-Suite (Google Form): This application may be used to collect non-sensitive, non-confidential qualitative responses to determine preliminary validity. This online survey application provides an electronic environment for distributing survey questionnaires. For the purpose of NASA Education, Google Form is a means by which feedback can be collected from a variety of participants such as from subject matter experts when in the early stages of instrument development when operationalizing a construct is vital to the process of instrument development. The NASA Google G-Suite also provides a file storage and synchronization service that allows users to store files on their servers, synchronize files across devices, and share files with NASA/non-NASA credentialed.
- NVivo 10 for Windows: This software is a platform for analyzing multiple forms of unstructured data. The software provides powerful search, query, and visualization tools. A few features pertinent to instrument development include pattern based auto-coding to code large volumes of text quickly, functionality to create and code transcripts from imported audio files, and convenience of importing survey responses directly from SurveyMonkey.[7]

[7] More information is available at http://www.qsrinternational.com/products_nvivo.aspx

- STATA SE v14: This data analysis and statistical software features advanced statistical functionality with programming that accommodates analysis, testing, and modeling from large data sets with the following characteristics: Maximum number of variables-32,767; Maximum number of right-hand variables- 10,998; and unlimited observations. These software technical specifications allow for the statistical calculations to determine and monitor over time item functioning and psychometric properties of NASA Office of Education data collection instrumentation. [8]

Strategic Planning and Designing Improved Information Technology Data Collection Systems

NASA PAEIM Team has invested much time and effort in developing secure information technology applications that will be leveraged on behalf of instrument piloting and for the purposes of routine deployment that will enable large-scale statistical testing of data collection instruments. New information technology applications, the Composite Survey Builder and Survey Launcher, are in development with the NEACC. The Survey Launcher application will allow PAEIM Team to reach several hundred NASA project activity participants via email whereas the Composite Survey Builder will allow PAEIM Team to administer data collection instruments approved by the Office of Management and Budget (OMB) Office of Information and Regulatory Affairs via emailed web survey links. This same technology PAEIM Team will leverage to maximize response rates for piloting and routine data collection instrument deployment.

Most recently, NASA Office of Education has acquired a full-time SME specifically tasked with strategizing approaches to enhance the Office's IT systems and applications to be more responsive to Federal mandates as well as to the needs of the Education community. This person's work is intended to lay the foundation for fiscally responsible IT development now and in the future.

Recall, participants in focus groups and cognitive interviews must mirror in as many characteristics as possible the sample of participants upon which the instrument will eventually be tested and then administered. Using technology to employ qualitative and quantitative methods is a means to establish validity from the onset prior to field testing and quantitative measures to determine instrument reliability and validity while monitoring and minimizing burden on study participants. Having the proper IT foundations in place for this work is a NASA Office of Education priority.

[8] More information is available at http://www.stata.com/products/which-stata-is-right-for-me/#SE

4. EFFORTS TO IDENTIFY DUPLICATION

Describe efforts to identify duplication. Show specifically why any similar information already available cannot be used or modified for use for the purposes described in Item 2 above.

Because developing new valid and reliable data collection instrumentation is still a relatively new procedure for NASA Education, many participants within our community have yet to participate in this kind of procedure. Participation in instrument development or testing is not mandatory.
Further, to reduce burden, any participant within our community recruited to participate in instrument development will only be solicited to contribute effort towards a single instrument, unless he or she volunteers for other opportunities. The PAEIM Team will attempt to reduce some of the testing burden by identifying appropriate valid and reliable instruments/scales through Federal resources or the educational measurement research literature.

5. EFFORTS TO MINIMIZE BURDEN ON SMALL BUSINESS

If the collection of information impacts small businesses or other small entities (Item 5 of OMB Form 83-I), describe any methods used to minimize burden.

Not applicable. NASA Office of Education does not collect information from any small business or other small entities.

6. CONSEQUENCES OF LESS FREQUENT DATA COLLECTION

Describe the consequence to Federal program or policy activities if the collection is not conducted or is conducted less frequently, as well as any technical or legal obstacles to reducing burden.

This planned collection of data will allow PAEIM Team the opportunity to design appropriate valid and reliable data collection instrumentation, and the prerogative to modify and alter instruments in an on-going manner in response to changes in respondent demographics and the NASA Office of Education portfolio of activities. Because this collection is expected to be an on-going effort, it has the potential to have immediate impact on all data collection instrumentation within NASA Education. Any delay would sacrifice potential gains in development of and modification to data collection instrumentation as a whole.

7. SPECIAL CIRCUMSTANCES

Explain any special circumstances that would cause an information collection to be conducted in a manner: requiring respondents to report information to the agency more often than

quarterly; requiring respondents to prepare a written response to a collection of information in fewer than 30 days after receipt of it; requiring respondents to submit more than an original and two copies of any document; requiring respondents to retain records, other than health, medical, government contract, grant-in-aid, or tax records, for more than three years; in connection with a statistical survey, that is not designed to produce valid and reliable results that can be generalized to the universe of study; requiring the use of a statistical data classification that has not been reviewed and approved by OMB; that includes a pledge of confidentiality that is not supported by authority established in statute or regulation, that is not supported by disclosure and data security policies that are consistent with the pledge, or which unnecessarily impedes sharing of data with other agencies for compatible confidential use; or requiring respondents to submit proprietary trade secrets, or other confidential information unless the agency can demonstrate that it has instituted procedures to protect the information's confidentiality to the extent permitted by law.

Not applicable. This data collection does not require any one of the reporting requirements listed.

8. FEDERAL REGISTER ANNOUNCEMENT AND CONSULTATION OUTSIDE THE AGENCY

If applicable, provide a copy and identify the date and page number of publication in the Federal Register of the agency's notice, required by 5 CFR 1320.8(d), soliciting comments on the information collection prior to submission to OMB. Summarize public comments received in response to that notice and describe actions taken by the agency in response to these comments. Specifically address comments received on cost and hour burden.

- The 60-day Federal Register Notice, Volume 83, Number 399 (pages 399-400) was published on 1/3/2018. No comments were received from the public.
- The 30-day Federal Register Notice, Volume 83, Number 9870 (pages 9870-9871) was published on 3/8/2018. No comments were received from the public.

Describe efforts to consult with persons outside the agency to obtain their views on the availability of data, frequency of collection, the clarity of instructions and recordkeeping, disclosure, or reporting format (if any), and on the data elements to be recorded, disclosed, or reported.

The NASA Office of Education (OE) will continue to leverage its civil servant and contractor workforce to develop strategies, design programs, sustain operations, implement new application and capabilities, develop business processes and training guidance, and provided support to stakeholders and end users. Key to an effective portfolio of programs is having a more rigorous approach to planning and implementation of activities through the use of evidence-based effective practices for STEM education and evaluation. An important component of these performance assessment and evaluation activities, is the review and input by a panel of nationally recognized experts in STEM. For this reason, NASA OE will also consult

with relevant expertise from individuals outside of the agency through a Performance Assessment and Evaluation Expert Review Panel (ERP) to obtain views and feedback on performance measurement activities including, but not limited to: internal and external performance measures and recommended data collection sources, process and tools, as well as NASA evidence-based decision making. The ERP will act as a technical review working group providing expertise and feedback in the following areas: program structure and evaluation, K12/higher education and diversity, building technical research capacity at higher education institutions, information technology systems/social media and emerging technologies, science literacy and large scale public engagement campaigns.

9. PAYMENT OR GIFTS TO RESPONDENTS

Explain any decision to provide any payment or gift to respondents, other than remuneration of contractors or grantees.

Not applicable. NASA Office of Education does not offer payment or gifts to respondents.

10. ASSURANCE OF CONFIDENTIALITY

Describe any assurance of confidentiality provided to respondents and the basis for the assurance in statute, regulation, or agency policy.

NASA Education is committed to protecting the confidentiality of all individual respondents that participant in data collection instrumentation testing. Any information collected under the purview of this clearance will be maintained in accordance with the Privacy Act of 1974, the e-Government act of 2002, the Federal Records Act, and as applicable, the Freedom of Information Act in order to protect respondents' privacy and the confidentiality of the data collected (See Appendix E.)

The data collected from respondents will be tabulated and analyzed only for the purpose of evaluating the research in question. Laboratory respondents will be asked to read and sign a Consent form, a personal copy of which they are provided to retain. The Consent form explains the voluntary nature of the studies and the use of the information, describes the parameters of the interview (taped or observed), and provides assurance of confidentiality as described in NASA Procedural Requirements (NPR) 7100.1.[9]

The consent form administered will be edited as appropriate to reflect the specific testing situation for which the participant is being recruited (See Appendix C). The confidentiality statement, edited per data collection source, will be posted on all data collection screens and instruments, and will be provided to participants in methodological testing activities per NPR 7100.1 (See Appendix E.)

[9] The entire NPR 7100.1 Protection of Human Research Subjects (Revalidated 6/26/14) may be found at: http://nodis3.gsfc.nasa.gov/displayDir.cfm?Internal_ID=N_PR_7100_0001_&page_name=main

11. JUSTIFICATION FOR SENSITIVE QUESTIONS

Provide additional justification for any questions of a sensitive nature, such as sexual behavior and attitudes, religious beliefs, and other matters that are commonly considered private. This justification should include the reasons why the agency considers the questions necessary, the specific uses to be made of the information, the explanation to be given to persons from whom the information is requested, and any steps to be taken to obtain their consent.

Assuring that students participating in NASA education projects are representative of the diversity of the Nation requires NASA Education to capture the race, ethnicity, and disability statuses of its participants. Therefore, to assure the reliability and validity of its data collection instruments, PAEIM Team in collaboration with the OEIT Systems Team and Center Education Offices, will need to ascertain that study participants are representative of students participating in NASA education projects. Race and ethnicity information is collected according to Office of Management and Budget (1997) guidelines in "Revisions to the Standards for the Classification of Federal Data on Race and Ethnicity."[10] Although disclosure of race and ethnicity are not required to be considered for opportunities at NASA, respondents are strongly encouraged to submit this information. The explanation given to respondents for acquiring this information is as follows:

> In order to determine the degree to which members of each ethnic and racial group are reached by this internship/fellowship program, NASA requests that the student select the appropriate responses below. While providing this information is optional, you must select decline to answer if you do not want to provide it. Mentors will not be able to view this information when considering students for opportunities. For more information, please visit http://www.nasa.gov/about/highlights/HP_Privacy.html.

Information regarding disabilities is collected according to guidelines reflected in the "Self-Identification of Disability" form SF-256 published by the Office of Personnel Management (Revised July 2010) and is preceded by the following statement:

> An individual with a disability: A person who (1) has a physical impairment or mental impairment (psychiatric disability) that substantially limits one or more of such person's major life activities;
> (2) has a record of such impairment; or (3) is regarded as having such an impairment. This definition is provided by the Rehabilitation Act of 1973, as amended (29 U.S.C 701 et. seq.)[11]

Regulations safeguarding this information is provided to study participants on the informed consent form as governed by NPR 7100.1.

[10] http://www.whitehouse.gov/omb/fedreg_1997standards
[11] http://www.opm.gov/forms/pdf_fill/sf256.pdf

12. ESTIMATE OF RESPONDENT BURDEN

Provide estimates of the hour burden of the collection of information. The statement should: Indicate the number of respondents, frequency of response, annual hour burden, and an explanation of how the burden was estimated. Unless directed to do so, agencies should not conduct special surveys to obtain information on which to base hour burden estimates.

Consultation with a sample (fewer than 10) of potential respondents is desirable. If the hour burden on respondents is expected to vary widely because of differences in activity, size, or complexity, show the range of estimated hour burden, and explain the reasons for the variance.

The estimate of respondent burden for methodological testing is as follows (See Table 1):

Table 1: Estimate of Respondent Burden for Methodological Testing

Data Collection Sources	Respondent Category	Statistically Adjusted Number of Respondents	Frequency of Response	Total minutes per Response	Total Response Burden in Hours
Office of Education Performance Measurement System	Undergraduate and graduate student profiles	629	2	20	420
	Educator participant surveys	639	2	15	319
	External program manager- Data collection screens	264	2	60	528
One Stop Shopping Initiative					
	Pre-College surveys	517	2	10	172
	Undergraduate surveys	618	2	20	412
	Graduate surveys	444	2	20	296
	Post-Graduate surveys	247	2	20	165
	Total Burden for Methodological Testing	**3,358**			**2,312**

Generally, estimates should not include burden hours for customary and usual business practices. If this request for approval covers more than one form, provide separate hour

burden estimates for each form and aggregate the hour burdens in Item 13 of OMB Form 83-I.

Not applicable.

Provide estimates of annualized cost to respondents for the hour burdens for collections of information, identifying and using appropriate wage rate categories. The cost of contracting out or paying outside parties for information collection activities should not be included here. Instead, this cost should be included in Item 13.

The estimate of annualized cost to respondents for methodological testing is as follows (See Table 2). Annualized Cost to Respondents is calculated by multiplying Total Response Burden in Hours by Wage specific to Respondent Category (Bureau of Labor Statistics, 2014).

Table 2: Estimate of Annualized Cost to Statistically Adjusted Number of Respondents Required for Methodological Testing

Data Collection Sources	Respondent Category	Total Response Burden in Hours	Wage	Annualized Cost to Respondents
Office of Education Performance Measurement System	Undergraduate and graduate student profile	420	7.25	$3,042.52
	Educator participant surveys	319	25.09	$8,015.32
	External program manager- Data collection screens	528	25.09	$13,243.60
One Stop Shopping Initiative				
	Pre-College surveys	172	7.25	$1,249.98
	Undergraduate surveys	412	7.25	$2,985.26
	Graduate surveys	296	7.25	$2,146.71
	Post-Graduate surveys	165	7.25	$1,192.98
	Total Burden for Methodological Testing	**2,312**		**$31,876.37**

13. COST BURDEN TO RESPONDENTS

Provide an estimate for the total annual cost burden to respondents or record keepers resulting from the collection of information. (Do not include the cost of any hour burden shown in Items 12 and 14). The cost estimate should be split into two components: (a) a total capital and start-up cost component (annualized over its expected useful life) and (b) a total operation and

maintenance and purchase of services component. The estimates should take into account costs associated with generating, maintaining, and disclosing or providing the information. Include descriptions of methods used to estimate major cost factors including system and technology acquisition, expected useful life of capital equipment, the discount rate(s), and the time period over which costs will be incurred. Capital and start-up costs include, among other items, preparations for collecting information such as purchasing computers and software; monitoring, sampling, drilling and testing equipment; and record storage facilities. If cost estimates are expected to vary widely, agencies should present ranges of cost burdens and explain the reasons for the variance. The cost of purchasing or contracting out information collections services should be a part of this cost burden estimate. In developing cost burden estimates, agencies may consult with a sample of respondents (fewer than 10), utilize the 60-day pre-OMB submission public comment process and use associated with the rulemaking containing the information collection, as appropriate. Generally, estimates should not include purchases of equipment or services, or portions thereof, made: (1) prior to October 1, 1995, (2) to achieve regulatory compliance with requirements not associated with the information collection, (3) for reasons other than to provide information or keep records for the government, or (4) as part of customary and usual business or private practices.

Not applicable. Participation in testing does not require respondents to purchase equipment, software, or contract out services. The instruments used will be available in electronic format only. NASA Office of Education's expectation is all targeted respondents can access the NASA OEPM System/forms/instruments electronically for the purposes of testing as they have in the past when applying to NASA opportunities.

14. COST BURDEN TO FEDERAL GOVERNMENT

Provide estimates of annualized costs to the Federal government. Also, provide a description of the method used to estimate cost, which should include quantification of hours, operational expenses (such as equipment, overhead, printing, and support staff), and any other expense that would not have been incurred without this collection of information. Agencies may also aggregate cost estimates from Items 12, 13, and 14 in a single table.

The total annualized cost estimate for this information collection is $0.7 million based on existing contract expenses that include contract staffing, staff training for data collection, data cleaning, validation, and management, and reporting relating to contract staffing for online systems including but not limited to OEPM and OSSI that compose the OEIT Systems Team data collection suite. Note, the two online systems will be assessed for continuous improvement opportunities in alignment with the performance assessment and evaluation strategic framework.

15. REASON FOR CHANGE IN BURDEN

Explain the reasons for any program changes or adjustments reported in Items 13 or 14 of the OMB Form 83-I.

Not applicable. This is a renewal application for methodological testing of data

collection instrumentation within the NASA Office of Education by the PAEIM Team.

16. SCHEDULE FOR INFORMATION COLLECTION AND PUBLICATION

For collections of information whose results will be published, outline plans for tabulation and publication. Address any complex analytical techniques that will be used. Provide the time schedule for the entire project, including beginning and ending dates of the collection of information, completion of report, publication dates, and other actions.

NASA Education may make available results of methodological testing to other federal STEM agencies in the form of peer-reviewed methods reports or white papers describing best practices and lessons learned on an as-appropriate basis determined by NASA Education leadership. Although there is no intent to publish in academic journals, standards for drafting will reflect peer-reviewed, publication-level standards of quality.

17. DISPLAY OF OMB EXPIRATION DATE

If seeking approval to not display the expiration date for OMB approval of the information collection, explain the reasons that display would be inappropriate.

The OMB Expiration Date will be displayed on every data collection instrument, once approval is obtained.

18. EXCEPTION TO THE CERTIFICATE STATEMENT

Explain each exception to the certification statement identified in Item 19, "Certification for Paperwork Reduction Act Submissions," of OMB Form 83-I.

NASA does not take exception to the certification statements below:

> The proposed collection of information –
>
> (a) is necessary for the proper performance of the functions of NASA, including that the information to be collected will have practical utility;
>
> (b) is not unnecessarily duplicative of information that is reasonably accessible to the agency;
>
> *(c)* reduces to the extent practicable and appropriate the burden on persons who shall provide information to or for the agency, including with respect to small entities, as defined in the Regulatory Flexibility Act *(5 U.S.C. 601*(6)), the use of such techniques as:
>
> > (1) establishing differing compliance or reporting requirements or timelines that take into account the resources available to those who are to respond;
> >
> > (2) the clarification, consolidation, or simplification of compliance and reporting requirements; or
> >
> > (3) an exemption from coverage of the collection of information, or any part thereof;
>
> (d) is written using plain, coherent, and unambiguous terminology and is understandable to those who are targeted to respond;

(e) indicates for each recordkeeping requirement the length of time persons are required to maintain the records specified;

(f) has been developed by an office that has planned and allocated resources for the efficient and effective management and use of the information to be collected, including the processing of the information in a manner which shall enhance, where appropriate, the utility of the information to agencies and the public;

(g) when applicable, uses effective and efficient statistical survey methodology appropriate to the purpose for which the information is to be collected; and

(h) to the maximum extent practicable, uses appropriate information technology to reduce burden and improve data quality, agency efficiency and responsiveness to the public; and

(i) will display the required PRA statement with the active OMB control number, as validated on www.reginfo.gov

Name, title, and organization of NASA Information Collection Sponsor certifying statements above:

NAME: Richard L. Gilmore Jr., M.Ed.

TITLE: Educational Programs Specialist/Evaluation Manager

ORG: Office of Education Performance Assessment and Evaluation Information Management (PAEIM) Team

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APPENDIX A: NASA Education Goals

Education is a fundamental part of NASA's work to execute its vision to discover and expand knowledge for the benefit of humanity. NASA will continue to pursue three major education goals:

- Strengthening NASA and the Nation's future workforce
- Attracting and retaining students in science, technology, engineering and mathematics, or STEM, disciplines
- Engaging Americans in NASA's mission

NASA's education program strives to "inspire and motivate students to pursue careers in science, technology, engineering, and mathematics" by supporting education in the Nation's schools and to "engage the public in shaping and sharing the experience of exploration and discovery" by supporting informal education and public outreach efforts. NASA's commitment to education places special emphasis on these goals by increasing elementary and secondary education participation in NASA projects; enhancing higher education capability in STEM disciplines; increasing participation by underrepresented and underserved communities; expanding e-Education; and expanding NASA's participation with the informal education community.

The Office of Education will continue to support NASA's strong historical role in education at all levels, with linkages to NASA research as a central part of our focus. The majority of NASA support to higher education is delivered through the NASA Mission Directorates.

The Office of Education supports the work of the Mission Directorates by coordinating projects for students, faculty, and institutions that broaden the base of those who compete for NASA research awards. These efforts will help create and sustain the scientific and engineering workforce of the future. In addition, the Office of Education will continue to emphasize sharing the results of NASA missions and research programs with wider audiences by using science discoveries and research applications as vehicles to improve teaching and learning at all levels.

APPENDIX B: NASA Center Education Offices

Strategic management of the NASA education portfolio requires the participation of the Office of Education (headquarters), the four Mission Directorates and all ten NASA Centers. This extensive participation provides broad education engagement with NASA content, people and facilities. Close and effective consultation, coordination and cognizance among all entities are critical to the optimal fulfillment of NASA's objectives relative to its education investment.

The Office of Education provides integration and evaluation support to the Education Coordinating Committee (ECC). As such, the Office of Education IT (OEIT) Systems Team maintains a centralized database of all NASA education activities and investments, and supports coordination of evaluation and assessment of the Agency education portfolio. The Performance Assessment and Evaluation Information Management (PAEIM) Team works closely with the Office of the Chief Information Officer (OCIO) to develop Paperwork Reduction Act (PRA) guidance and training resources for Center Education Office. Upon improved compliance of the Center Education Offices, all Centers will submit data collection instruments for development and clearance through the PAEIM Team first and then approval by the NASA OMB liaison prior to submission to OMB. This process will reduce burden on the Education community while optimizing data collection.

Center Education Offices are responsible for implementing NASA education programs, projects and activities for the Mission Directorates and the Office of Education, as well as planning and implementing education projects that are unique to and funded by their Centers. Centers are responsible for execution of programs and projects and for institutional assets. The Center Education Offices provide expertise in state standards and requirements in their area of geographic responsibility for K-12 education, and provide valuable field-based input into education program planning.

Locations of NASA Center Education Offices

Ames Research Center

Ames specializes in research geared towards creating new knowledge and new technologies that span the spectrum of NASA interests.

Armstrong Flight Research Center

As the lead for flight research, Armstrong continues to innovate in aeronautics and space technology. The newest, fastest, the highest -- all have made their debut in the vast, clear desert skies over Armstrong.

Glenn Research Center

Glenn Research Center develops and transfers critical technologies that address national priorities through research, technology development, and systems development for safe and reliable aeronautics, aerospace, and space applications.

Goddard Space Flight Center

The mission of the Goddard Space Flight Center is to expand knowledge on the Earth and its environment, the solar system, and the universe through observations from space.

Jet Propulsion Laboratory

The Jet Propulsion Laboratory, managed by the California Institute of Technology is NASA's lead center for robotic exploration of the Solar System.

Johnson Space Center

From the early Gemini, Apollo, and Sky Lab projects to today's Space Shuttle and International Space Station programs, Johnson Space Center continues to lead NASA's effort in Human Space Exploration.

Kennedy Space Center

Kennedy Space Center is America's Gateway to the Universe -- leading the world in preparing and launching missions around the Earth and beyond.

Langley Research Center

Langley continues to forge new frontiers in aviation and space research for aerospace, atmospheric sciences, and technology commercialization to improve the way the world lives.

Marshall Space Flight Center

Bringing people to space; bringing space to people. Marshall Space Flight Center is world leader in the access to space and use of space for research and development to benefit humanity.

Stennis Space Center

Stennis is responsible for NASA's rocket propulsion testing and for partnering with industry to develop and implement remote sensing technology.

APPENDIX C: Data Instrument Collection Testing Participation Generic Consent Form[12]

In accordance with the Privacy Act of 1974, as amended (5 U.S.C. 552a), you are hereby notified that this study is sponsored by the National Aeronautics and Space Administration (NASA) Office of Education Performance Assessment and Evaluation Information Management (PAEIM) Team, under authority of the Government Performance and Results Modernization Act (GPRMA) of 2010 that requires quarterly performance assessment of Government programs for purposes of assessing agency performance and improvement. Your participation is important to the success of this study. The information we collect will help us improve the nature of NASA education project activities and the accuracy with which NASA Office of Education can report to the stakeholders about the project activities offered. The NASA PAEIM Team will use the information provided for statistical purposes related to data collection instrument development only and will hold the information in confidence to the full extent permitted by law. Information will be secured and removed from this server and location upon guidelines set out by the NASA Records Retention Schedule 1392, 68-69. Although the following efforts will be taken to ensure confidentiality, there remains a remote risk of personal data becoming identifiable. A non-identifying code number will be assigned to participants' data records, which will be stored in accordance with federal regulatory procedures and accessible only to the investigator. Any use of individual data to illustrate specific assessment results will be labeled in a manner to preserve the participants' anonymity. In no way does refusing participation in this instrument development study preclude you from eligibility for NASA education project activities now or in the future.

Introduction

This research seeks to support the mission of the NASA Office of Education by asking you to take part in a (focus group/cognitive interview/ instrument development testing) pertaining to our interest in the ways in which NASA project activities impact outcomes for participants.[13] The information we collect will help us to improve the nature of the project activity and the accuracy with which NASA Office of Education can report to the community about the project activities it offers.

Purpose of the Study

Determine the degree to which this instrument accurately captures the ways participant outcomes are measured by this data collection instrument.

Description of Study Procedures

Participants will be asked to complete XXX.
There are no foreseeable risks to participants electing to participate in this study.

Estimation of Time Required

We estimate it will take you an average of [enter #] minutes to participate in this research (ranging from [enter #] minutes to [enter #] minutes).

Securing Your Responses

Under no circumstances will the results of your surveys be shared with anyone without your explicit permission. The results of this research may be presented at meetings or in publications,

[12] Once approved by OMB, this form will be submitted to NASA Forms Management according to NASA Policy Directive (NPD) 1420. Thus, this form, and all others used under this clearance, will have both an OMB control number and an NPD 1420 control number that also restricts access to NASA internal users only.

[13] This clearance package is to obtain permission to develop instruments to be used in testing that will be approved by OMB first for inclusion under this clearance prior to testing.

however your identity will not be disclosed. Presentations and manuscripts typically contain participants' quotes, but participants are never identified by name. Your involvement in the development of this instrument is entirely voluntary and you have the right to discontinue participation at any time.

Contact Persons

If you have any additional questions concerning the research, this informed consent, or confidentiality of responses, please contact Richard L. Gilmore Jr., Evaluation Manager, at richard.l.gilmore@nasa.gov or call (216)433-5493.

~~~~~~

I have read and understand the contents of this study information and informed consent form and have been encouraged to ask questions. I have received answers to the questions I have asked. I give my consent to participate freely in this research. I have signed and retained a copy of the information and consent form for my records and future reference. **I have signed and submitted this information and consent form for the researcher's records.**

_____ _____

Participant's signature Date

_____

Participant's printed name

_____

Researcher's signature

OMB Control Number: XXXX-XXXX

Expiration Date: [enter expiration date]

HQ-Form-XXXX MM/YYYY PREVIOUS EDITIONS ARE OBSOLETE
~~~~~~

APPENDIX D: Descriptions of Methodological Testing Techniques

- Usability testing: Pertinent are the aspects of the web user interface (UI) that impact the User's experience and the accuracy and reliability of the information Users submit. The ease with which Users navigate the data collection screens and the ease at which the User accesses the actions and functionality available during the data input process are equally important. User experience is also impacted by the look and feel of the web UI and the consistency of aesthetics from page to page, including font type, size, color scheme utilized and the ways in which screen real estate is used (Kota, n.d.). The foundation for Usability testing will be a think-aloud protocol analysis as described by Jääskeläinen (2010) that exposes distractions to accurate input of data whereas a short Likert Scale survey with qualitative questions will determine the extent of distraction and nature of the distractions that impede accurate data input.
- Think-aloud protocols (commonly referred to as cognitive interviewing): This data elicitation method is also called 'concurrent verbalization', meaning subjects are asked to perform a task and to verbalize whatever comes to mind during task performance. The written transcripts of the verbalizations are referred to as think-aloud protocols (TAPs) (Jääskeläinen, 2010, p 371) and constitute the data on the cognitive processes involved in a task (Ericsson & Simon, 1984/1993). When elicited with proper care and instruction, think-aloud does not alter the course or structure of thought processes, except with a slight slowing down of the process. Although high cognitive load can hinder verbalization by occupying all available cognitive resources, that property is of no concern regarding the tasks under analysis that are restricted to information actively processed in working memory (Jääskeläinen, 2010, p. 371). For the purposes of NASA Education, think-aloud protocols will be especially useful towards the improvement of existing and developing of new data collection screens, which are different in purpose from online applications. Whereas an online application is an electronic collection of fields that one either scrolls through or submits, completed page by completed page, data collection screens represent hierarchical layers of interconnected information for which user training is required. Since user training is required for proper navigation, think-aloud protocols capture the user experience to incorporate it into a more user-friendly design and implementation of this kind of technology. Lastly, data from think-aloud protocols is used to ensure that user experiences are reliable and consistent towards collecting robust data.
- Focus group interviews: With groups of nine or less per instrument, this qualitative approach to data collection is a matter of brainstorming to creatively solve remaining problems identified after early usability testing of data collection screen and program application form instruments (Colton & Covert, 2007, p. 37). Data from this type of research will include audiotapes obtained with participant consent, meeting minutes taken

by a subject matter expert in administration assistance, and reflective comments submitted by participants after conclusion of the focus group. Focus group interviews may be used to refine items that failed initial reliability testing for the purposes of retesting. Lastly, focus group interviews may be used with participants as a basis for a grounded theory approach to instrument development or for refining an already existing instrument to be appropriate to a specific audience.

- Comprehensibility testing: Comprehensibility testing of program activity survey instrumentation will determine if items and instructions make sense, are ambiguous, and are understandable by those who will complete them. For example, comprehensibility testing will determine if items are complex, wordy, or incorporate discipline- or culturally-inappropriate language (Colton & Covert, 2007, p. 129).
- Pilot testing: After program activity survey instruments have performed satisfactorily in readability and comprehensibility testing, the next phase is pilot testing with a sample of the target population that will yield statistically significant data, a random sample of at least 200 respondents (Komrey and Bacon, 1992; Reckase, 2000). The goal of pilot testing is to yield preliminary validity and reliability data to determine if items and the instrument are functioning properly (Haladyna, 2004; Wilson, 2005). Data gleaned from pilot testing will be used to fine-tune items and the instrument in preparation for more complex statistical analysis upon large-scale statistical testing.
- Large-scale statistical testing: Instrument testing conducted with a statistically representative sample of responses from a population of interest. In the case of developing scales, large-scale statistical testing provides sufficient data points for exploratory factor analysis (EFA), a multivariate statistical method used to uncover the underlying structure of a relatively large set of variables and is commonly used when developing a scale, a collection of questions used to measure a particular research topic (Fabrigar & Wegener, 2011). EFA is a "large-sample" procedure where generalizable and/or replicable results is a desired outcome (Costello & Osborne, 2005, p.5). This technique is particularly relevant to examining relationships between participant traits and the desired outcomes of NASA Education project activities.
- Item response approach to constructing measures: Foundations for testing that address the importance of item development for validity purposes, address item content to align with cognitive processes of instrument respondents, and that acknowledge guidelines for proper instrument development will be utilized in a systematic and rigorous process. Validity will be determined as arising from item development, from statistical study of item responses, and from exploring item response patterns via methods prescribed by Haladyna (2004) and Wilson (2005.)
- Split-half method: This method for determining test reliability is an efficient solution to parallel-forms or test/retest methods. Split-half method does not require developing alternate forms of a survey and it places a reduced burden on respondents in comparison to other methods, requiring participation in a single test scenario rather than requiring retesting at a later date. This method involves administering a test to a group of

individuals, dividing the test in half along odd and even item numbers, and then correlating scores on one half of the test with scores on the other half of the test (Davidshofer & Murphy, 2005).

APPENDIX E: Privacy Policies and Procedures

- Information collected under the purview of this clearance will be maintained in accordance with the Privacy Act of 1974, the e-Government act of 2002, the Federal Records Act, NPR 7100.1, and as applicable, the Freedom of Information Act in order to protect respondents' privacy and the confidentiality of the data collected.[14]
- Data is maintained on secure NASA servers and protected in accordance with NASA regulations at 14 CFR 1212.605.
- Approved security plans are in place for the Office of Education Performance Measurement (OEPM) system in accordance with the Federal Information Security Management Act of 2002 and Office of Management and Budget, Circular A-130, *Management of Federal Information Resources*.
- Only authorized personnel requiring information in the official discharge of their duties are authorized access to records from workstations within the NASA Intranet or via a secure Virtual Private Network (VPN) connection that requires two-factor hardware token authentication.
- OEPM resides in a certified NASA data center and has met strict requirements relating to application security, network security, and backup/recovery of the NASA Office of the Chief Information Officer's security plan.
- Data will be secured and removed from this server and location upon guidelines set out by the NRRS/1392, 68-69. Specific guidelines relevant to the OPEM system include the following:
    - Project management records documenting basic information about projects and/or opportunities, including basic project descriptions, funding amounts and sources, project managers, and NASA Centers, will be destroyed when 10 years old or when no longer needed, whichever is longer.
    - Records of participants (in any format), maintained either as individual files identified by individual name or number, or in aggregated files of multiple participants identified by name or number, including but not limited to application forms, personal information supplied by the individuals, will be destroyed 5 years after the last activity with the file.
    - Survey responses and other feedback (in any format) from project participants and the general public concerning NASA educational programs, including interest area preferences, participant feedback, and reports of experiences in projects, will be destroyed when 10 years old or when no longer needed, whichever is longer.

[14] http://www.nasa.gov/privacy/nasa_sorn_10EDUA.html

The following Confidentiality Statement and Paperwork Reduction Act (PRA) statement, edited per data collection source, will be posted on all data collection screens and instruments, and will be provided to participants in methodological testing activities per NPR 7100.1:

> Privacy Act Statement: In accordance with the Privacy Act of 1974, as amended (5 U.S.C. 552a), you are hereby notified that this study is sponsored by the National Aeronautics and Space Administration (NASA) Office of Education, under authority of the Government Performance and Results Modernization Act (GPRMA) of 2010 that requires quarterly performance assessment of Government programs for purposes of assessing agency performance and improvement. Your participation is important to the success of this study. The information we collect will help us improve the nature of NASA education project activities and the accuracy with which NASA Office of Education can report to the stakeholders about the project activities offered.
>
> Paperwork Reduction Act Statement: This information collection meets the requirements of 44 U.S.C. §3507, as amended by section 2 of the Paperwork Reduction Act of 1995. You do not need to answer these questions unless we display a valid Office of Management and Budget (OMB) control number. The OMB control number for this collection is 2700-0159 and expires 04/30/2018. Send comments to: richard.l.gilmore@nasa.gov.

APPENDIX F: Overview: NASA Education Data Collection Instrument Development Process

FROM OUTPUTS TO SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS (STEM) EDUCATION OUTCOMES MEASUREMENT: DATA COLLECTION INSTRUMENT DEVELOPMENT PROCESS

WORKING WITH THE PROJECT MANAGERS AND PROGRAM DIRECTORS

I. Develop a logic model

a. Information & training sessions to provide guidance
b. Facilitation of logic modeling upon request
c. Review and recommendations to ensure incorporation of evidence-based practice

II. Identify outputs and short-term outcomes from logic models for performance indicators

a. Identify outputs and outcomes across lines of business and projects aligned with CAP goals and FC-STEM investment priority areas
b. Convert outputs and outcomes into performance indicators and outcome measures, identifying required data elements and data collection methods

UNDERSTANDING THE IMPACT OF STEM EDUCATION PROJECT ACTIVITIES ON PARTICIPANTS

III. Develop survey instruments based on NASA Education project performance indicators and outcome measures

a. Conduct a scholarly STEM education and measurement literature review (assures that the evidence base is rigorous and current)
b. Connect outcomes from literature review with identified outcome measures, given constraints of inputs and within the context of activities
c. Search the STEM education research and measurement literature for instrument candidates for adaptation (previous literature review augments this step)[15]
d. Create a draft instrument targeting a specific project activity to explore specific outcomes impacted by the quality of outputs (e.g., non-cognitive competencies associated with STEM degree attainment in the NASA Internships and Fellowships)[16]

[15] Provides opportunity to add to the research literature while using an instrument already determined to be reliable and valid for a particular respondent population.
[16] For example, reporting on STEM undergraduate attainment is much less meaningful without understanding what kinds of experiences contributed to degree attainment and the quality of their NASA experience.

i. Draft should be lengthy and exhaustive to allow editing down in the testing process
ii. Draft should reflect many questions that ask the same question to allow editing down
iii. Draft should demonstrate multiple items per construct as convergence is important

e. Obtain stakeholder feedback & edit instrument draft
   i. Editing question type
   ii. Adding new constructs and items
f. Conduct cognitive interviews with a small number (less than 10) of appropriate respondents & edit accordingly[17]
   i. Editing question language
   ii. Editing question type

DEVELOPING VALID AND RELIABLE DATA COLLECTION INSTRUMENTS

IV. Conduct field test of an instrument draft

a. Provide draft to OMB to approve for testing under the NASA OE methodological testing generic clearance (no official timeline associated with this informal process)
b. Small scale field testing[18]
   i. Statistical analysis of responses
   ii. Remove items with low p-values
c. Large scale field testing
   i. Determine population/universe size for respondent audience
   ii. Implement steps to enhance response rate
   iii. Remove items with low p-values

OBTAINING AND MAINTAINING OMB-APPROVED DATA COLLECTION INSTRUMENTS

V. Obtain clearance from OMB for tested data collection instruments

a. Update OMB-approved drafts according to results obtained from large scale field testing
b. Submit tested data collection instrument for review by OMB, in accordance with the terms of clearance set upon approval of the plan as stipulated in the generic clearance.[19]

[17] Involves qualitative research skills and analysis using software NASA Ed has provided for this purpose.
[18] Involves statistical analysis skills and analysis using software NASA Ed has procured.
[19] PRA_Gen_ICRs_5-28-2010.pdf.
Accessed at https://www.whitehouse.gov/sites/default/files/omb/assets/inforeg/PRA_Gen_ICRs_5-28-2010.pdf

VI. Reevaluate instrument function

a. Maintain first universe of collected responses as baseline data
b. On an annual basis, pool recently collected instrument responses with current data set and rerun statistical analyses
c. Take barely passing items back through process starting at III.f.
d. Integrate refreshed items into instrument and forward draft to OMB for approval under the NASA OE methodological testing generic clearance

VII. Reevaluate alignment of data collection instruments

a. Maintain alignment with portfolio as updated
b. Maintain alignment with line of business logic model as updated

APPENDIX G: Explanatory Content for Information Collections for Testing Purposes

Every information collection for the purposes of methodological testing will be prefaced by a version of the information categories, ***edited to be appropriate for that particular instrument and audience***. Below is a sample that demonstrates the type of information and content that reflects the following: 1.) Source of adaptation (if applicable); 2) Constructs of interest; 3) Bibliographic sources that support the particular adaption or instrument draft; 4) Privacy statement; 5) Instrument introduction; 6) Purpose of the study; 7) Description of study procedures; 8) Estimate of time to complete the instrument; 9) Assurance of confidentiality; 10) Contact person's information; 11) Office of Management and Budget control information; and 12) NASA headquarters form information.

Tester Copy of Graduate Research Impact Pre-experience Survey Draft

Instrument Information and Bibliography

NASA Office of Education's purpose for this survey is to explore graduate students' preparation for and expectations of a NASA opportunity. In comparison with post-experience survey results, the results of this survey will be used to improve the NASA research experience for future participants.

Adapted from:
Crede, E., & Borrego, M. (2013). From ethnography to items: A mixed methods approach to developing a survey to examine graduate engineering student retention. *Journal of Mixed Methods Research, 7* (1), 62-80.

Constructs of interest: International diversity, expectations, lab climate, organizational mechanisms for success, individual preferences, perception of value, socialization to research (leadership skills, teamwork skills), research match, networking structures

Bibliography
Boden, D., Borrego, M., & Newswander, L. K. (2011). Student socialization in interdisciplinary doctoral education. *Higher Education, 62*(6), 741-755.

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Executive Office of the President NSTC. (2013). Federal science, technology, engineering, and mathematics (STEM) education 5-Year strategic plan: A report from the committee on STEM Education National Science and Technology Council.

Feldon, D. F., Maher, M. A., & Timmerman, B. E. (2010). Performance-based data in the study of STEM PhD education. *Science, 329*(5989), 282-283.

Nassar-McMillan, S. C., Wyer, M., Oliver-Hoyo, M., & Schneider, J. (2011). New tools for examining undergraduate students' STEM stereotypes: Implications for women and other underrepresented groups. *New Directions for Institutional Research, 152* , 87-98.

Rates, C., & Feldon, D. M. (2014, April). Threshold concepts within doctoral biology programs. Paper presented at the American Education Research Association annual conference, Philadelphia, PA.

Swigonski, M. E. (1999). Ways of knowing/oprression and privilege. In M. S. Kiselica (Ed.), *Confronting prejudice and racism during multicultural training* (pp. 123-154). Annapolis Junction, MD: American Counseling Association.

Next

Tester Copy of Graduate Research Impact Pre-experience Survey Draft

Study Consent

Study Consent Form

In accordance with the Privacy Act of 1974, as amended (5 U.S.C. 552a), you are hereby notified that this study is sponsored by the National Aeronautics and Space Administration (NASA) Office of Education Infrastructure Division (OEID), under authority of the Government Performance and Results Modernization Act (GPRMA) of 2010 that requires quarterly performance assessment of Government programs for purposes of assessing agency performance and improvement. Your participation is important to the success of this study. The information we collect will help us improve the nature of NASA education project activities and the accuracy with which NASA Office of Education can report to the stakeholders about the project activities offered. The NASA OEID will use the information provided for statistical purposes related to data collection instrument development only and will hold the information in confidence to the full extent permitted by law. Information will be secured and removed from this server and location upon guidelines set out by the NASA Records Retention Schedule 1392, 68-69. Although the following efforts will be taken to ensure confidentiality, there remains a remote risk of personal data becoming identifiable. A non-identifying code number will be assigned to participants' data records, which will be stored in accordance with federal regulatory procedures and accessible only to the investigator. Any use of individual data to illustrate specific assessment results will be labeled in a manner to preserve the participants' anonymity. In no way does refusing participation in this instrument development study preclude you from eligibility for NASA education project activities now or in the future.

Introduction: This research seeks to support the mission of the NASA Office of Education by asking you to take part in a (focus group/cognitive interview/ instrument development testing) pertaining to our interest in the ways in which NASA project activities impact outcomes for participants.[2] The information we collect will help us to improve the nature of the project activity and the accuracy with which NASA Office of Education can report to the community about the project activities it offers.

Purpose of the Study: Determine the degree to which this instrument accurately captures the ways participant outcomes are measured by this data collection instrument.

Description of Study Procedures: Participants will be asked to complete XXX. There are no foreseeable risks to participants electing to participate in this study.

Estimation of Time Required: To be determined through the testing procedure. Please note your start time. At the end of this survey, you will be asked to approximate the time required to complete this survey.

Securing Your Responses: Under no circumstances will the results of your surveys be shared with anyone without your explicit permission. The results of this research may be presented at meetings or in publications, however your identity will not be disclosed. Presentations and manuscripts typically contain participants' quotes, but participants are never identified by name. Your involvement in the development of this instrument is entirely voluntary and you have the right to discontinue participation at any time.

Contact Persons:

If you have any additional questions concerning the research, this informed consent, or confidentiality of responses, please contact Dr. Lisa E. Wills, Education Research Manager, at lisa.e.wills@nasa.gov or call (202)258-6021.

Paperwork Reduction Act Statement: This information collection meets the requirements of 44 U.S.C. § 3507, as amended by section 2 of the Paperwork Reduction Act of 1995. You do not need to answer these questions unless we display a valid Office of Management and Budget (OMB) control number. The OMB control number for this collection is XXXX-XXXX and expires on XX/XX/XXXX. We estimate that it will take XX minutes to read the instructions and answer the questions. Send only comments relating to our time estimate to: lisa.e.wills@nasa.gov

OMB Control Number: XXXX-XXXX
Expiration Date: [enter expiration date]
HQ-Form-XXXX MM/YYYY **PREVIOUS EDITIONS ARE OBSOLETE**

List of Tables