

International Faculty Professional Development: Utilizing Hybrid Environments to Deepen Learning and Grow Community

**Mary Slowinski
Bellevue College**

**Gabrielle Temple
College of the Canyons**

**Ken Walz
Madison Area Technical College**

Providing robust professional development opportunities for educators can present unique challenges, especially when activities occur abroad. In 2019, the NSF-ATE CREATE Energy Education Center took a group of renewable energy educators to Germany to study innovations in renewable energy and energy storage and to learn how these emerging technologies are incorporated into educational programming and workforce preparation. Learning activities conducted before, during and after travel ensured participant preparedness, academic rigor, constructive reflection and collaborative knowledge-building. This paper presents an analysis of accumulated participant data and presents recommendations for enhancing faculty learning when conducting international educator professional development programs.

Keywords:

INTRODUCTION

In 2018, the Center for Renewable Energy Advanced Technological Education (CREATE) received funding from the National Science Foundation to administer an Energy Storage Project with the overarching goal of advancing the renewable energy sector by facilitating integration of energy storage technology into existing two-year college programs. The goals for this project included gathering expertise, conducting job task and curriculum gap analyses, producing instructional materials, implementing pilot energy storage courses, and providing professional development for college instructors.

The project's initial task was to work with educators to gather knowledge and expertise around energy storage technologies and energy education. Widespread adoption of energy storage is only beginning in the U.S. and, subsequently, energy storage-related educational programs are few; conversely, energy storage education efforts have already been pioneered and established in Europe, most notably in Germany. As a result, CREATE leveraged its history of improving energy education through international cooperation and organized a study tour to Germany for nine renewable energy educators to examine innovations in

renewable energy and energy storage and to research how these technologies are incorporated into German workforce preparation.

In the planning and conducting international professional development opportunities for educators, two distinct challenges arise: that of ensuring academic rigor and of anchoring and capturing learning, especially given the additional cognitive load presented by being abroad. CREATE employs an evidence-based, international collaboration model - developed and improved over the course of two previous study tours - to meet these challenges. The learning plan consists of pre-travel online activities, knowledge capture and collaborative sharing during travel, and post-travel reflection. These activities combine to support educators in gathering and preserving knowledge gains and to facilitate collaborative knowledge-building that leverages the expertise and skills of the participant cohort.

While this paper presents the results of the CREATE professional development model, however the findings are not limited to energy storage or to the energy sector. Indeed, this analysis and the resulting set of recommended practices should be of interest to anyone interested in creating a meaningful educator professional development opportunity, especially if international travel is incorporated.

CONTEXT

Participants

Nine participants were selected using an application process developed during two previous CREATE international projects. An initial pool of potential participants were nominated by CREATE's industry and educational partners as having demonstrated discipline-centric expertise and educational excellence. This group was invited to complete a comprehensive application that captured their history, credentials and motivation for participation. From these nominees' application materials, the CREATE leadership team assembled an accomplished group representing a range of disciplines, regions and educational institutions.

Demographically, the final cohort provided national representation with participants hailing from Florida, Illinois, Indiana, New York, North Carolina, Oregon, Washington State and Wisconsin. The group consisted of four females and five males with expertise in a range of areas including building efficiency and automation, energy management technology, sustainable building practices, photovoltaic and solar thermal systems, industrial engineering, bio-fuels, and hydropower.

In terms of institutional representation, the group consisted of six community college or technical college faculty members, one high school instructor, and one university assistant professor; the remaining participant has community college teaching experience but currently directs a national non-profit renewable energy training organization. The educator-participants represented institutions ranging in size from 5,000 to 40,000+ student full-time equivalents (FTEs) and administer programs that collectively offer a range of academic credentials including technical diplomas and certificates, associate, bachelor, and master degrees, and various types of industry certifications.

Itinerary

The Energy Storage Project study tour itinerary consisted of on-site visits with experts and practitioners in the areas of energy storage technology research and development, renewable energy education, and energy policy. The group initially convened at the Washington D.C. offices of the Heinrich Boell Foundation, a German non-profit public policy think tank affiliated with the German Green Party, for presentations on the German school system, the German political structure and the *Energiewende* - or "energy transition" - that Germany is in the midst of as it shifts from coal and nuclear energy to renewables and energy storage.

Once in Germany, the group visited energy storage technology and utility providers and met with city officials of two municipalities: The Green City of Freiburg and the energy independent city of Wildpoldsried which produces 7.5 times the amount of energy that it consumes. In addition, the participants visited cultural sites, educational institutions and co-operative Green communities. The trip concluded with two days at the SmarterE Conference, one of the largest solar conferences in the world.

Professional Development Learning Activities

A proven curriculum, developed over the course of CREATE's prior international study tours, was employed to ensure academic rigor and to deepen participant learning. The learning plan consisted of 1) pre-travel online activities and webinars, 2) daily knowledge capture, individuated research and collaborative sharing during travel, and 3) post-travel reflection and summation. These mandatory activities supported the capture and preservation of acquired knowledge and facilitated participant sharing, which deepened and extended learning for the group and leveraged the expertise of cohort.

Activities prior to travel were designed to capture existing knowledge, provide context and baseline knowledge in support of in-country learning, foster community and group collaboration, and to establish academic rigor. See Table 1 for a full description of pre-travel learning activities.

TABLE 1
PRE-TRAVEL LEARNING ACTIVITIES AND INTENDED PURPOSE

Pre-Travel Learning Activity	Purpose
Pre-Survey	Inform selection of pre-travel learning materials; provide baseline data
Weekly readings & guided online discussions	Provide information on German education system, culture, energy policy, and storage technologies; foster community of learners; establish rigor
Monthly webinars	Increase connections via peer presentations and synchronous discussions
Pre-visit Site Reports (peer presentations via webinar)	Increase group awareness of sites, peers; reinforce rigor.
Individual Inquiry selected	Select research area tied to specific professional interest; reinforce rigor

Activities during travel ensured that participants captured acquired knowledge and reflected on their experiences daily, and actively participated with providing context and technical knowledge to the group. Please see Table 2 for details regarding learning activities conducted during travel.

TABLE 2
LEARNING ACTIVITIES DURING TRAVEL AND INTENDED PURPOSE

During Travel Learning Activity	Purpose
Pre-Visit Site Reports (peer presentation en route to sites)	Reinforce site knowledge just before visit; deepen peer connection
Site Reports (one report per site, due daily)	Record of acquired knowledge, experiences, reflection; sustain rigor.
Individual Inquiry research	Anchor experience; capture individually relevant information

Post-travel activities supported participant reporting out of summative knowledge gains, measurement of pre/post project knowledge, and dissemination of key findings. Please see Table 3 for more details on post-travel activities.

TABLE 3
POST-TRAVEL LEARNING ACTIVITIES AND INTENDED PURPOSE

Post-Travel Learning Activity	Purpose
Individual Inquiry Reports	Anchored learning experience; individualized outcome
Post-Survey (conducted upon return)	Collect data to compare against pre-travel survey results; solicit feedback on trip logistics and planning
Follow-up Survey (conducted 8 months post-travel)	Deepen awareness of project impact; solicit reflective feedback on learning experience; gain insights into practical applications
Conference presentations, journal publications	Dissemination of technical knowledge, project results; synthesize acquired knowledge

Theoretical Basis

The theoretical constructs that shaped the curricular model derive from a range of literature and methodologies, including those of learning science, distance education, and curricular design. Principles, theories and approaches from these disciplines and others were incorporated into the learning plan to increase its effectiveness. Below are three illustrative examples.

The first is the incorporation of social learning theory. Social learning theory posits that learning is fundamentally social, a “situated” activity rather than an isolated individuated process. Social learning theory is at the basis for many pedagogical practices today and was advanced in the foundational work of Jerome Bruner (1996) who proposed that to really “stick”, learning needs to involve both acquiring knowledge about a topic or discipline but also understanding how this knowledge fits into the greater structure of the discipline’s practice and culture. Jean Lave and Etienne Wenger, proponents of learning communities and the first to use the term “communities of practice,” also embraced socially situated learning and found in their research that social learning is beneficial for growing group knowledge, noting that “where the circulation of knowledge among peers and near-peers is possible, it spreads exceedingly rapidly and effectively” (Wenger, 1998). Learning activities that utilized social learning theory and its promise of enriching and extending participant learning included online discussions and peer presentations of pre-travel site reports.

A second key element of the learning plan is reflected in the written Site Reports, submitted daily, that documented participant observations for each site visited. The act of writing has long been accepted as a means to solidify thought and observation; in this case, daily writing was employed to reinforce participant knowledge acquisition in the short term and to improve recall of the learning experience. This learning activity relates to the qualitative research methodology of autoethnography during which the researcher examines their own experience (auto) within the larger context or situation (ethnography). Examples of application would be the inclusion of reflective question prompts on the Site Reports template which cued participants to consider their knowledge gains and experiences against the backdrop of German technology, practice and culture.

The incorporation of anchored instruction also shaped the learning plan for this project. Anchored learning was first described by John Bransford and his team at the Cognition & Technology Group at Vanderbilt University (CTGV) in 1990. Closely related to the theory of situated learning mentioned above, anchored instruction is based on the theory that learning is improved when knowledge is embedded and contextualized and applied in an environment rather than in the absence of context. The Individual Inquiry activity is a variation on anchored instruction; proposed participant questions were vetted closely to ensure that inquiries aligned with trip resources. Allowing the participants to single out something they wanted to investigate stimulated curiosity, increased involvement, and made the results more personally meaningful.

METHODOLOGY

Approach & Subjects

The primary source of data used to analyze the effectiveness of the various learning activities on participant knowledge acquisition and collaborative knowledge-building was a web-based survey conducted eight months after travel. This survey captured participant perceived value of the various learning activities and persistent changes in technical knowledge, teaching practice and curricular activity. Two surveys had been administered previously, one when the project began and one immediately following travel. These captured participant responses to similar survey items but as this data is not included in this analysis, these will not be mentioned further. The study subjects - participants in the CREATE Germany Energy International Faculty Consortium - are described in section 2.1 above.

Survey Administration

The survey was administered via SurveyMonkey from January 2 to January 12, 2020. An initial email invitation was sent to all participants with reminders to non-responders on days 5 and 7. The final response rate was 100% with all surveys completed in full.

Instrument Design

An interactive initial page ensured informed consent. Four items on the first page collected data regarding impact on teaching and curriculum. The second page of five items focused on the impact on professional development, perceived knowledge gains, and community involvement. The following three pages recorded perceived value of each learning activity grouped as pre-travel (4 items), during travel (4 items) and post-travel which included dissemination (5 items). The final page used two open text items to request the most valuable aspect of the project and for any additional feedback. An exit page provided choices to opt in or out of being quoted in publication and to be consulted before being quoted. Throughout the survey, Likert-like scales were utilized to collect interval and ratio-scaled data along with open-ended text items.

Responses were automatically aggregated prior to analysis to identify trends and frequency of response. For questions employing Likert scales, both the percentage of respondents selecting a given response and weighted averages were calculated to rank importance and facilitate interpretation of the results. Open text responses were analyzed independently by two reviewers, with conclusions then compared to discern emergent patterns and themes.

RESULTS

Perceived Value of Pre-Travel Learning Activities

Learning activities that occurred prior to travel included reviewing provided learning materials, posting to moderated discussion boards, attending monthly webinars, preparing and presenting pre-visit site reports to peers, and selecting and finalizing an Individual Inquiry question. The majority of participants ranked each of the pre-travel activities as either "very useful" or "somewhat useful" with no activities perceived as "not useful at all". (see Table 4).

TABLE 4
PERCEIVED USEFULNESS OF PRE-TRAVEL LEARNING ACTIVITIES

How useful were the PRE-TRAVEL learning activities?					
	Very Useful	Somewhat Useful	Not very useful	Not useful	Weighted Average
Preparing Pre-Visit Site Reports for others	8	1	0	0	3.89
Required readings	6	3	0	0	3.67
Crafting a question for my Individual Inquiry	5	4	0	0	3.56
Presenting Pre-Visit Site Reports on webinar	4	4	1	0	3.33
Moderated online discussions of readings	3	5	1	0	3.22
Listening to Pre-Visit Site Reports on webinar	3	4	2	0	3.11
Reviewing posted Pre-Visit Site Reports	3	3	3	0	3.00

A key takeaway is that activities that garnered relatively lower marks were mostly passive; reviewing/reading and listening to the reports of others were not reported to be as impactful as the active tasks of writing, presenting and even reading source materials.

Participants were also queried about the amount of information, facts and knowledge provided prior to travel to determine if the resources were perceived as too little, too much, or appropriate for their needs. Fifteen topical categories were utilized to collect and organize this feedback. The majority of respondents indicated that for twelve of the fifteen topic areas they had received the right amount of information (see Table 5).

Interestingly, the three areas in which more than half the respondents would have preferred more information were all tied to the United States green energy and energy storage industry, technologies and policies. While this may be due to an oversight or to information overcrowding given the short time span to prepare the participants for travel, it may also speak to the emergent nature of this sector and the difficulty for experts and educators alike to keep current. Regardless it is an important reminder that providing relevant domestic information prior to travel increases the ability of the participants to actively compare and contrast that which they are exposed to when abroad.

Comments from participants regarding pre-travel activities – for example, *"I think the pre-travel information was well done, thoughtful, and comprehensive. I feel it did a good job preparing me for the visit to Germany"* - reinforced the survey findings of perceived effectiveness of the activities. One comment that may be of interest to future professional development designers spoke to the inherent friction between thorough preparation and the desire to approach learning experiences without any pre-knowledge by noting *"Sometimes (often) I am at my best when I learn something that I've hardly been introduced to. Other times its the opposite."* While the two approaches are essentially mutually exclusive, it would be worthwhile to keep both positions in mind while creating professional development programs and activities.

TABLE 5
PARTICIPANT FEEDBACK ON INFORMATION PROVIDED PRIOR TO TRAVEL

Was the provided amount of PRE-TRAVEL information too little, too much, or an appropriate amount?				
	Appropriate amount	Too little	Too much	Weighted Average
Info about sites to be visited	9	0	0	3.00
Info on German energy policy	8	0	1	2.89
Info on societal factors influencing German energy usage	8	1	0	2.78
Info about participant expectations/ deliverables	7	2	0	2.56
Info on the German education system	7	2	0	2.56
Info on German energy storage technologies	7	2	0	2.56
Info on German culture in general	7	2	0	2.56
Pre-travel presentations by international peers	6	1	2	2.56
Pre-travel relationship-building with international peers	6	1	2	2.56
Info about peers with whom I'd be traveling	6	2	1	2.44
Info on German energy industry	6	3	0	2.33
Info on environmental influences on German energy use	6	3	0	2.33
Info on U.S. energy storage/renewable energy industry	4	5	0	1.89
Info on U.S. energy storage/renewable energy policy	4	5	0	1.89
Info on U.S. energy storage technologies	3	6	0	1.67

Perceived Value of Learning Activities During Travel

During travel, learning activities consisted of written Site Report submissions for each site visited to capture participant knowledge gains, and the continuance of collaborative knowledge-building through peer presentations of Pre-Visit Site Reports while traveling to a given site. As with the pre-travel learning activities, none were rated as "not at all useful" and participants again showed a preference for actively constructing knowledge rather than passively absorbing information however this preference was less pronounced than with pre-travel activities (see Table 6).

The slight increase in perceived value of passive activities during travel is likely due in part to the top ranking of the all-day in-person orientation session at the Boell Foundation that preceded the group's international departure. While this particular activity was essentially passive, the presenters were extremely knowledgeable and generous with their time, and also provided the participants with their first opportunity to interact face-to-face with German colleagues. The peer presentations of the Pre-Visit Site Reports, which were among the lowest ranked pre-travel activities, moved into the second ranking during travel; this was likely due to proximity to the site and the immediacy of the need to know where one was going.

TABLE 6
PERCEIVED USEFULNESS OF LEARNING ACTIVITIES OCCURRING DURING TRAVEL

How useful were the learning activities that occurred DURING TRAVEL?					
	Very Useful	Some-what Useful	Not very useful	Not at all useful	Weighted Average
Pre-seminar at Heinrich Boell Foundation	8	1	0	0	3.89
Listening to en route Pre-Visit Site Reports	7	1	1	0	3.67
Presenting en route Pre-Visit Site Reports	6	2	1	0	3.56
Gathering info for Individual Inquiry report	5	3	1	0	3.44
Writing Site Reports	4	5	0	0	3.44
Reviewing peers' Pre-Visit Site Reports online	4	4	1	0	3.33

Participants were also asked to identify additional activities they felt would have deepened their learning during travel. Two of the six respondents indicated that meeting German educators would have been beneficial, noting that "it would be great to hold a collaboration session between German and American college instructors...to exchange curriculum and teaching ideas." These types of session were incorporated into previous international projects (see Alfano & Slowinski, 2014; Alfano, Slowinski & Walz, 2016) and were found to be quite helpful to participants. For this project, however, the focus was on gathering information on energy storage that will inform curricular development upon return, so visits were more heavily skewed to emergent technological sites. One other comment noted that "facilitated group discussions / de-brief sessions following each site visit (or group of site visits - or even every few days) to help process and share information, insights, and ideas among peers" might enhance learning. This suggestion may well inform future professional development activities however caution should be exercised, given the number of sites visited and the many hours spent together each day, to ensure that such additions do not preclude periods of unstructured time that allow for reflection, completion of required reports, and rest.

Perceived Value of Post-Travel Learning Activities

As with the learning activities that took place prior and during travel, both post-travel activities were reported to be "Very Useful" or "Somewhat Useful" by all participants (see Table 7).

TABLE 7
PERCEIVED USEFULNESS OF POST-TRAVEL LEARNING ACTIVITIES

How useful were the learning activities that occurred AFTER TRAVEL?						
	Very Useful	Somewhat Useful	Not very useful	Not useful	NA	Weighted Average
Participating as a presenter or panelist	7	0	0	0	2	4.00
Completing Individual Inquiry Report	5	4	0	0	0	3.56

Although not all participants had yet been able to participate as a presenter or panelist, those that had done so clearly found this to be very useful to their learning and retention. Overall, the work on the Individual Inquiry Report was reported to be useful as well, with one respondent adding in the provided comment section that "I'll probably rate my report higher in a few years" presumably as the memories of the trip begin to recede. This is an interesting insight as it may speak to the importance of capturing the experience while it is fresh and documenting it in writing.

Impact on Professional Development

Nearly all of the participants reported impacts on their teaching practices and on curriculum development activity following this professional development opportunity. Key changes noted by participants as either implemented or in progress at the time of the follow-up survey included increasing or incorporating an international perspective to existing courses (76%), creating new lecture content (78%) and learning materials (56%), integrating new teaching methods learned from peers over the course of travel (33%) and even the creation of entire new courses (33%). While a more detailed analysis of these results is outside the scope of this paper, a full report on the impact of this study trip on content knowledge, teaching and curricular development is provided by our peers in Bosman, Brinker & Walz (2020) and we encourage the interested reader to seek out this publication.

Survey items also sought to measure how this experience was perceived to have impacted the participants' professional development. The first of these questions explicitly asked respondents to rate how impactful the experience was on their development as professionals (see Table 8).

TABLE 8
PERCEIVED IMPACT OF PARTICIPATION ON PROFESSIONAL DEVELOPMENT

How has the international project impacted your PROFESSIONAL DEVELOPMENT?						
	Very Much	Some what	A little	Did Not Occur	N/A	Weighted Average
Gained knowledge about new or unique technologies	8	1	0	0	0	3.89
Developed professional relationships with other participants	8	1	0	0	0	3.89
Developed an understanding of renewable energy policy outside of U.S.	6	3	0	0	0	3.67
Fulfilled professional development institution requirement	5	0	1	1	1	2.88
Developed professional relationships w/ international peers	2	2	3	1	0	2.63
Influenced me to join related professional organizations	1	2	2	4	0	2.00

Two items tied for the top rating, those being "*gained knowledge about new or unique technologies*," and "*developed professional relationships with fellow participants*." These were followed closely by "*developed an understanding of renewable energy policy outside the United States*." In evaluating this feedback, it is worth noting that the learning activities developed for this professional development project were intended to support, encourage and facilitate educator knowledge-building and collaborative learning in an international setting. The impacts reported by the participants aligns well with the project objectives.

The next survey item that prompted participant response around professional development gains was an open text item; the resulting comments repeated very similar impacts. Of the seven comments, four noted professional knowledge advancement in the area of energy storage; two spoke to the connections formed with colleagues including the comment: "*Many of the instructors on this trip shared teaching strategies*,

and I have adopted some of their ideas and continue to stay in touch with them as we strengthen our classes and programs based on our collective experience." This reinforces the findings from the previous survey item indicating that project objectives were met.

Finally, when respondents were asked about perceived persistence of the professional gains they had experienced as a result of this professional development opportunity, they again responded that the significant lasting impacts obtained from the experience centered around technological knowledge advancement, the benefits of an expanded professional peer network, and the first-hand observation of their area of pedagogical expertise in a foreign setting (see Table 9).

TABLE 9
PERCEIVED LASTING IMPACT OF LEARNING ACTIVITIES

How much LASTING IMPACT did the following experiences have on your professional practice?					
	Significant	Some	Little	None	Weighted Average
Exposure to new technologies	8	0	1	0	3.78
Working, traveling, learning with educator/peers	7	2	0	0	3.78
Visiting industry sites	7	2	0	0	3.78
Exposure to non-U.S. energy storage deployment	7	2	0	0	3.78
Visiting cultural sites	4	3	1	1	3.11
Visiting German energy policy makers	3	4	2	0	3.11
Interacting with educator/peers from outside the U.S	4	2	1	2	2.89

This data, along with the results from the two survey items discussed above, appears to substantiate the finding that the project goals - in terms of participant learning and collaborative knowledge-building - were realized.

DISCUSSION

Designing and implementing professional development opportunities for educators, as with all curricular development, is made easier when goals are explicit and distinct. For this segment of CREATE's Energy Storage Project, the goals were to ensure academic rigor, to anchor and capture participant learning by supporting participants in recording and preserving knowledge acquisition and to facilitate collaborative knowledge-building. The data analysis of reported impacts of these learning activities and the overall professional development experience, while limited by the small number of subjects, does indicate that the goals of the project were met.

This analysis also allowed the authors to identify the learning plan elements most effective in deepening learning, aiding professional development, and building community, along with those elements that were less successful or that could be improved. These findings have been summarized as suggestions for developing impactful international professional development projects and are presented below.

Effective Learning Plan Elements

Academic Rigor

The expectation for academic rigor began with the first round of participant submissions and continued throughout the project; all submissions were reviewed with feedback promptly provided by the Learning Coordinator to guide participants in engaging with the learning activities at an appropriate level of critical thinking and review.

Knowledge Acquisition

In terms of deepening learning and ensuring knowledge acquisition, the inclusion of both pre- and post-travel activities stands out as key. Clearly the study results point to the effectiveness of the orientation provided by the Boell Foundation immediately prior to travel; such an orientation is strongly recommended as a result. Providing study materials and requiring their review and discussion grounded participants in the educational, economic, cultural and political landscape of the country to be visited as well as the technologies to be encountered prior to travel; this too appears crucial as it provides context before the inevitable cognitive load presented by international travel. Setting a distinct personal learning goal prior to travel, as facilitated by the Individual Inquiry activity, anchored and guided learning for participants so that a meaningful personal outcome was obtained. Daily report writing provided for structured reflection, self-observation and critical thinking about knowledge acquisition as it occurred and deepened the professional development of the participants. Additionally, post-travel summaries and dissemination efforts served to cement the learning that had occurred, and expedited the discussion and sharing of individual findings.

Collaborative Knowledge-Building

The facilitation of collaborative knowledge-building was somewhat accomplished through required pre-travel online discussions and, more effectively, during travel when pre-visit site report presentations occurred on the way to a given site. Outside of the learning activities themselves, participants informally shared expertise, insights and acquired knowledge spontaneously during long hours of travel and rare moments of unstructured time. This type of exchange is a natural outgrowth of professional development-based travel and is enhanced when the cohort is mindfully selected with intentional balances struck in terms of areas of expertise, years of experience, teaching environment and general demographics. Although participant selection is not a formal learning activity and falls outside the scope of this paper, it is an important element when constructing a collaborative learning environment.

Learning Plan Elements to Be Improved

The learning activities were reported as effective by most project participants and supported the project goals. However, several elements were identified that could be improved.

One potential improvement would be to provide more information about U.S. technologies, policies and practices that mirror those studied abroad. The study results clearly indicate that this type of information was missed by participants and, given the speed at which such technologies and policies evolve, would provide a valuable service to all involved. Other improvements would be to increase the effectiveness of pre-travel webinar presentations of Pre-Visit Site Reports, and to improve instructions for the Individual Inquiries to support selection of meaningful topics to investigate. Adding summative group discussions periodically while traveling, without overfilling the schedule, may also be useful. Lastly, it may be worthwhile to reincorporate a post-travel activity - such as a collaborative essay comparing and contrasting U.S. and German technologies and educational practices - that was part of previous CREATE study tours. This activity helped participants to summarize their learning and synthesize their findings into documents that can be shared with a wider audience.

Recommended Practices for International Professional Development Programs

When reviewing the analysis presented here, and considering the evaluation and analysis of CREATE's two prior international study tours, certain best practices emerge. Below is a summary that distills the learning activities and related components that the study authors have found to be effective. Please note

that these recommendations are not limited to professional development efforts with energy educators alone but should prove useful for anyone charged with creating a professional development experience abroad. Here are the recommendations:

- Create and use a competitive nomination, application and participant selection process to assemble a strong community of practice that embodies professional diversity and excellence and ensures a personal commitment by those selected to participate.
- Utilize pre-travel activities to present learning materials, webinars, and required assignments that establish baseline knowledge, foster peer relationships, and build the context for the international experience. This front-end work also helps ensure the best use of valuable time abroad.
- Ensure knowledge capture and retention by requiring daily writing exercises while traveling.
- Utilize post-travel assignments to support integration of acquired knowledge into participants' professional and instructional practices. Setting personal learning goals prior to travel and then reporting out post-travel can be helpful in accomplishing this.
- Plan and budget for dissemination opportunities for participants. Conference presentations, panel discussions and article submissions cement lessons learned and provide opportunities for participants to share experiences with others, thereby magnifying the impact of the project.
- Plan to measure both immediate outcomes and longer-term impacts to assess the success of the project. The impacts of such professional development experiences often take 1-2 years to manifest and it is important that project organizers plan and budget accordingly to capture such impacts.
- Do not underestimate the amount of work such a study trip involves! At a minimum, create a leadership team that includes the project lead, a program coordinator to handle logistics, and a learning specialist to develop, implement and manage the learning activities. Each performs distinct and necessary duties to ensure the study tour meets its goals. Ideally, this team would be expanded to make the workload manageable for all.
- If traveling to a region that speaks a language other than English, retain the services of translators with both foreign language and technical expertise.

CONCLUSION

When international professional development opportunities are deliberately and thoughtfully designed, are informed by learning theory, and are implemented with structured participant activities and feedback, project goals can be met and participants can experience meaningful gains. The results of this study demonstrate that international study tours can be extremely effective in deepening the technical knowledge of educators, in facilitating the incorporation of international trends and technological advances into curricula and instruction, and in fostering on-going community between education professionals to further advance teaching practice and improve the quality of related programs of study. Those interested in developing international programs in any discipline are encouraged to adopt and adapt the recommendations provided here to create successful projects of their own.

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