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Promising Practices and Design Principles in Career and Technical Education Delivered via Distance Learning Technology

APEC HUman Resources Development Working Group

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Table of Contents

Introduction

The Asia-Pacific Economic Cooperation (APEC) Digital Workforce Development Project aims to provide promising practices and design principles to assist APEC economies in leveraging digital and distance learning technologies in order to build a strong 21st-century workforce through innovative career and technical education (CTE). The project builds off US and APEC Leaders' priorities, including promoting sustainable and inclusive growth by leveraging digital technology and expanding access to quality education and employment for women, girls and underrepresented populations. The Digital Workforce Development Project was approved in December 2017; the project convened three webinars and an in-person workshop on improving digital and distance CTE. The lessons learned and promising practices shared during these events inform the chapters and case studies of this report.

CTE delivered via distance learning technology, what is referred to in this report as digital or distance CTE, exemplifies the opportunities for expanding access to quality education, training and employment that strategically harness digital technologies. Examples of distance CTE have shown promise in removing barriers to access for women, girls and underrepresented populations while offering innovative, flexible and personalized educational experiences that are responsive to industry demands.

Nevertheless, distance CTE, like traditional CTE, cannot be effective without careful attention to content, delivery and quality. The first three chapters, which were written by industry, association and academic experts, discuss those three themes, reflecting the authors' expertise in the field as well as the input from the webinars and workshop. Promising examples have been appended to the first three short chapters to offer concrete ways in which those concepts have been implemented throughout the APEC region.

The fourth chapter focuses on increasing the participation and success of women, girls and underrepresented populations in distance CTE. There are clear steps, at all stages of the design and implementation levels, that can be taken so that programs are designed inclusively and effectively to maximize participation. This chapter was built on reflections of our experts and was an explicit focus of the workshop.

The fifth chapter highlights work led by the US Department of Labor's APEC Project DARE (Data Analytics Raising Employment), focusing on distance delivery of data analytics competencies. Project DARE was a result of a public-private partnership driven by industry demand for more workers with data analytics skills. The spotlight chapter focuses on the overlap and cross-sectoral nature of the APEC Human Resources Development Working Group's effort to promote and develop in-demand 21st-century competencies.

The Project Process

Developing the interactive webinars and workshop provided many opportunities for collaboration with subject matter experts and practitioners in the field of virtual CTE from the United States and partnering member economies. Following planning activities during early 2018, a series of three webinars were held to share promising practices from across the Asia-Pacific region. More than 80 participants and presenters from 12 APEC members joined the three webinars.

- Webinar 1: Promising Practices and Design Principles in Content for Distance CTE, held 15 August 2018 with Dr Habibah Abdul Rahim and Dr Shukry Hassan (Malaysia) and Michael Connet, Mark Wagner, Tom Ogletree, and Maria Weaver (the United States)
- Webinar 2: Promising Practices and Design Principles in Program Delivery for Distance CTE, held 12 September with Maria Susan P. Dela Rama (the Philippines) and Katie Hall, Sue Schmidt, and Patricia A. Shea (the United States)
- Webinar 3: Promising Practices and Design Principles on Quality for Distance CTE, held 17 October with Dr Karen Treloar (Australia) and Dr Tanya Joosten and Amy Lorenzo (the United States)

Building on the lessons learned during the three webinars, the US Department of Education hosted the APEC Workshop on Digital Workforce Development on 3-4 December 2018. The workshop included panels featuring subject matter experts in digital and distance education, breakout sessions to discuss briefing papers drafted by webinar presenters, and cultural events and networking opportunities for participants to connect with one another. The workshop drew 41 attendees from eight economies and received positive feedback from participants submitted through in-person and online evaluation forms.

To provide continued access to the valuable information gathered through the project, resource and webinar recordings are available on the APEC Digital Workforce Development Project website, at https://tech.ed.gov/apec-digital-workforce-development-project.

Policy Recommendations for Consideration

The considerable collaboration between experts and practitioners across the field elicited substantial promising practices and recommendations to consider for those who seek to develop or enhance digital CTE programs. The following list of recommendations to consider in the five areas: on content, deliver, and quality in digital and distance CTE, as well as inclusion of women, girls and underrepresented students, and the field of data analytics in digital workforce development.

Policy Recommendations for Consideration
Content in Digital CTE
• Blend academic and technical skills with the ability to practice these skills in authentic workplace environments - consider to what extent skills can be delivered digitally versus requiring hands-on training.
• Incorporate career exploration and career development content for students in a variety of grade levels and types of institutions.
• Create innovative opportunities for synchronous distance instruction to be adaptive, thereby imparting skills and providing feedback in real time to personalize the learning experience.
Delivery of Digital CTE
• Consider the technical infrastructure that is available to providers and students and consider what improvements or additional equipment are needed - try to include a sustained budget for technical support throughout the life of the project.

• Evaluate the regional, economy-level, and local needs for industry areas and occupations where distance and digital CTE can have the biggest impact.
• Prepare to invest in technical updates, curriculum upgrades, and professional development for teachers and providers.
Quality of Digital CTE
• Incorporate quality assurance protocols into all stages of system and course design, including during the planning stage, and try to match quality assurance indicators so that they correspond to district, state, and/or provincial level standards whenever possible.
• Use appropriate quality indicators and rubrics at the system and course levels - see chapter 3 and Appendix F for specific examples of indicators and rubrics, and key design concepts in creating them.
• Build quality protocols that ensure faculty and staff are effectively incentivized and trained to teach students online.
Inclusion of Women, Girls and Underrepresented Students in Digital CTE
• Develop course content and outreach materials that explicitly utilize inclusive imagery, examples, and language choice.
• Show potential new students the benefits of workforce training and digital skills on career opportunities and earning potential.
• Consider physical, financial, technical, and other barriers that prevent access for student populations at all levels and incorporate human-centered design into systems and course design.
Data Analysis in Digital CTE
• Leverage digital technology to provide numerous synchronous learning opportunities into the structure of online courses and programs to engage learners directly in the online classroom.
• Tailor online courses for working adults looking to expand their technical skills, as they account for many students in digital CTE for data skills and analysis.
• Develop a sustained effort at the regional and economy levels to close the digital skills gap and meet the needs of the digital workforce.

Moving forward, this report will be circulated through the APEC Human Resources Development Working Group and Education Network, and member economies are encouraged to disseminate it through their respective ministries and agencies. The project team looks forward to further work in this field, including the APEC Forum on Closing the Digital Skills Gap, scheduled for 2019, for stakeholders to discuss how to encourage collaboration across academia, government and industry to close the digital skills gap and reduce youth unemployment by 2025.

Chapter 1: CTE Delivered via Distance Education in the United States: Content Considerations

By Michael Connet, Associate Deputy Executive Director - Outreach and Partner Development, Association for Career and Technical Education (ACTE)

ACTE is the United States' largest not-for-profit association committed to the advancement of education that prepares youth and adults for successful careers. ACTE represents the community of more than 200,000 CTE professionals, including educators, administrators, researchers, guidance and career development professionals, and others at all levels of education. ACTE is committed to excellence in providing advocacy, public awareness, and access to resources, professional development and leadership opportunities.

Introduction

Career and technical education (CTE) has been experiencing a renaissance across the United States over the past decade, fueled in part by a surging economy that demands a skilled workforce with the academic, technical and employability skills required for success. The changing nature of work has created an environment demanding high-quality CTE programs and courses. The CTE field is responding to this resurging interest in CTE and is working to address students' increasing need for more flexible delivery systems through distance learning. While growing, CTE instruction via distance learning has lagged (Evergreen Education Group, 2015) behind other subjects due to the unique nature of instruction in CTE.

CTE has evolved from focusing narrowly on the development of technical skills offered as 'vocational training' into an integrated learning approach. Simply put, CTE is an educational experience and not just training on a specific task, skill or job. High-quality CTE programs provide a thoughtful balance of three basic components (Association for Career and Technical Education, 2010):

- Technical Skills: The skill sets required across the 16 Career Clusters identified by the US Department of Education
- Academic Skills: Academic concepts that provide a foundational understanding of language, mathematics and science
- Employability Skills: The set of skills and behaviors that are necessary for every job and that employers demand to be exhibited in their workforces

In defining 'high-quality CTE,' ACTE has created an evidence-based quality CTE program of study framework (Imperatore & Hyslop, 2018), including 12 elements that are present in high-quality, high-performing CTE programs. When present, these elements increase the potential to move learners along a career pathway that maximizes their options for obtaining further education and for pursuing a family-sustaining, fulfilling career.

Responding to the Need

Given the growth of interest in offering high-quality CTE programs to address the skills gaps faced by employers, educational institutions in the United States have turned to alternate methods to deliver CTE courses and learning experiences (Garza Mitchell, 2017). While a basic goal of distance-delivered CTE programs is to enlarge the workforce pipeline of skilled learners, specific issues that have prevented participation are being addressed.

Overcoming the barriers of access to high-quality CTE programs, particularly by those in rural or resource-strapped locations where programs in their interest area may not exist, is an important consideration for the development of distance-delivered high-quality CTE programs (Staker, 2011). A distance-delivered approach not only serves to close the gap between communities in terms of resources but it also opens up new opportunities for women and girls and for the inclusion of other audiences that have historically been underrepresented among CTE students.

Simultaneously, distance-delivered courses are taking advantage of the concept of the 'flipped-classroom' (Zainuddin, 2016). This allows for out-of-classroom learning to occur via technology to increase learners' ability to develop foundational knowledge and is coupled with other opportunities to experience 'hands-on' instruction in focused sessions.

This trend toward the adoption of distance-delivered CTE also addresses the challenge of responding to the rapidly evolving skill needs required for jobs and careers that are emerging (and yet to exist). Successful CTE programs often work closely with technical and industry-led associations to communicate needs and address specific gaps in resources or skills. Given the changing nature of required skills and emerging and evolving fields of employment, distance learning technologies provide responsiveness in developing new technical skills in learners (Vector Consulting, 2017).

This growth in interest in distance-delivered CTE takes advantage of new instructional innovations through new delivery models that effectively engage students in real-world/experiential learning opportunities.

Content Considerations

Recognizing that high-quality CTE programs feature a mix of instructional approaches for skill development, the question of what content is most suitable for delivery via distance learning techniques, and through what methods, deserves careful consideration.

Because CTE programs focus on career readiness and preparation for further education, their instructional approach requires a rigorous blend of academic, technical, and employability skills and the ability to apply

these skills in authentic environments. The move to provide programs through distance delivery continues to be driven by this consideration (Association for Career and Technical Education, 2010, November). Content drives the determination of how learning is to be delivered, whether a hands-on experience can be extended or replicated through technological means or whether the online instruction needs to be supplemented with in-person activities.

Also driving the consideration of what CTE content can be effectively delivered over distance is the growth of interest in the United States in promoting STEM (science, technology, engineering and mathematics) skill sets as well as in building pathways that lead to advanced technical skills. In response to the increasingly globalized economy, providers are incorporating such skills as foreign languages to attract both international students and domestic students seeking to enter the global workforce.

Finally, there is a growing recognition that career awareness needs to integrate with, or even preface, the offering of specific CTE programs. Consequently, it is especially important for career exploration and career development content to be broadly distributed among learning communities. Many private businesses are leading the way in field-specific CTE and offer valuable job training as recruitment or retention incentives, which can serve to benefit both the company and employees.

Design Principles in US Distance-delivered CTE programs

The design of effective CTE instruction for delivery via distance begins with the basic structure of high-quality CTE. By ensuring that quality elements are incorporated in the curriculum, students are able to progress toward technical aptitude development integrated with their academic and employability skills. While the majority of CTE being delivered via distance is currently asynchronous (Staker, 2011), new technologies and a rethinking of the use of existing ones (e.g., interactive video) are creating more opportunities for synchronous CTE distance-delivered instruction.

Of particular importance in the design of this instruction is that programs allow learners the ability to develop and demonstrate their content knowledge through the delivery system. This is being done in several ways:

- Blended Design (Layton, 2017) - Electronic delivery of core content through digital technology (web, interactive, etc.) coupled with in-person interaction in a lab or other physical environment
- Simulated and Virtual/Augmented Reality (McMahon, 2018) - Taking the place of the physical environment, these advanced technologies allow students to experience hands-on learning and can be used to demonstrate proficiency
- Rich and Interactive Media (Metz, 2011) - Video and interactive graphics that allow learners to apply their understanding of technical concepts in visually engaging ways

Promising Practices in Distance-delivered CTE Instruction in the United States

Driven by the demand described above, there are a growing number of both secondary and postsecondary institutions that offer distance-delivered CTE courses and entire programs. The vast majority of their CTE offerings are asynchronous online courses and learning modules. Private accredited providers like Penn Foster focus on the delivery of CTE and online career courses, and a number of leading educational solution publishers like Today's Class specialize in the development and distribution of CTE instructional offerings that are licensed for use in US classrooms.

Groups like the United States Distance Learning Association (United States Distance Learning Association, 2018), the Virtual Learning Leadership Alliance (Virtual Learning Leadership Alliance, 2018) and the North American Council of Online Learning (North American Council for Online Learning, 2018) provide information to member organizations and distance learning professionals. They include CTE instruction via distance and virtual delivery in their service area.

Among several innovative synchronous and hybrid programs are the following:

Veterinary Technology Program - The US Department of Labor, Bureau of Labor Statistics reports that employment of veterinary technologists and technicians (US Department of Labor, Bureau of Labor Statistics, 2018) is projected to grow 20 percent from 2016 to 2026, much faster than the average for all occupations. Employment is expected to increase as veterinarians continue to utilize technicians and technologists to do general care and lab work on household pets.

At Jefferson State Community College located in Alabama, the Veterinary Technology Program (Jefferson State Community College, 2018) is a distance education program. Students access their instruction via the web and work or volunteer for a veterinarian in their local area (within the state) for a minimum of 20 hours per week. The Theory classes are conducted through the internet and required clinical tasks are performed at the clinical site at which students work. Students may be asked to travel to the Jefferson State campus or go to another clinic once/twice each semester to fulfill clinical requirements that may not be available at the clinic where they are working. Midterm and final exams are given at various testing sites across the state at the student's convenience.

Emergency Medical Services - The US Department of Labor, Bureau of Labor Statistics reports that employment of emergency medical technicians (EMTs) and paramedics (US Department of Labor, Bureau of Labor Statistics, n.d.) is projected to grow 15 percent from 2016 to 2026, much faster than the average for all occupations. Emergencies, such as car crashes, natural disasters and acts of violence, will continue to require the skills of EMTs and paramedics.

At the Kiamichi Career and Technical Education Center (Kiamichi Tech Centers, 2018) in Wilburton, Oklahoma, the Paramedic program is a 15-month (1,210 hours) certification program that features 860 hours of fieldwork. Participants must be age 18 and up, and they must be eligible for employment. Classes are held online two nights each week, and students participate in clinical activities in their home community or nearby communities. The program also features a remote lab; a mobile truck travels around the state to deliver specialized instruction in person and for skill demonstrations and assessments. Because of the regulated nature of health care instruction, the program has produced a comprehensive clinical competency guidebook for use with participating field organizations.

Welding Program - In North Dakota, the workforce development agency reports that employment of welders, cutters, solderers and brazers (JobService North Dakota, 2018) is projected to grow 16 percent from 2018 to 2025, faster than the US average for the occupation. Employment growth reflects the need for welders in the state for the energy industry that has seen rapid and continued expansion.

The North Dakota Department of Career and Technical Education (North Dakota Workforce Development, 2018) received its first CTE Access Grant for a synchronous distance-delivered welding program in 2013 and has successfully been expanding the program to additional locations. The program uses a statewide fiber network that provides dedicated bandwidth to connect all schools across North Dakota. The system is fully interactive for two-way communication, in real time.

While the program was designed to compensate for teacher shortages in welding, another benefit has been realized: smaller schools are now able to retain their full-time teachers by sharing their instruction with other schools statewide. North Dakota provides incentives for the distance delivery of high-demand instruction. There is 4 percent additional funding provided to schools when they participate in a CTE program via the interactive video network.

Unique features of the program include the use of high-definition cameras and monitors to demonstrate and supervise the students. This equipment has special filters to address the extreme light conditions created by the welding. Students in the remote locations use a package of mobile welding equipment that is rotated among participating schools. A security system of cameras is installed in each location for an overall view of classroom activity to ensure the safety of the students. Once every nine weeks, the teacher visits the satellite schools to test the students' knowledge face-to-face.

Conclusion

While the footprint of distance-delivered instruction in the United States has grown significantly, CTE programs offered through this approach are a relatively new phenomena. However, that is changing due to increased demand for a skilled workforce. The need to address existing and projected skills gaps and the

changing nature of work is creating new opportunities for distance access to CTE program delivery. The goal for our distance-delivered CTE programs is to continue to develop strong skills in our citizens and prepare them to be lifelong learners who will successfully contribute to our economy and society.

Further Reading on Content in Digital CTE

For more information about a program that trains students in high-demand skills through innovative digital courses, please see the case study *Implementing Innovative Curriculum Using the Interactive Video Network to Take a Welding Course*, submitted by North Dakota Career and Technical Education in **Appendix A.**

For more guidance and best practices in planning a digital CTE program that successfully provide content for both students and employers, please see the whitepaper, *Scoping Your Digital Training Program,* submitted by General Assembly in **Appendix B.**

For more information on how a particular APEC member government agency delivers online language skills training to tens of thousands of teachers across their economy, please see the presentation, *English Language Teaching Centre*, submitted by the Ministry of Education of Malaysia in **Appendix C.**

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Chapter 2: Best Practices and Design Principles in Delivery of Career and Technical Education Programs via Distance Learning Technology

By Katherine Hall, Director, The Competency Project

The rapid emergence of new technologies is continually changing global economies, disrupting traditional industries and shifting demands for the current and future workforce. It is critical for stakeholders in governments, industry and education to work together to equip the global workforce with the new and emerging skills they need to remain competitive in the 21st-century economy.

Distance learning technology has become a key tool that has allowed education providers to deliver education and training to larger numbers of learners, located across vast geographical areas. At the same time, these technologies have provided a broader diversity of students the opportunity to obtain skills in a variety of disciplines and industry areas at a lower cost and often with flexibility to accommodate their varying schedules.

This document outlines best practices, future trends and the economic context relevant to some of these opportunities. In addition, the document focuses specifically on delivery of career and technical education (CTE) and discusses success factors and innovations that can increase effectiveness and efficiency in distance delivery of education and training and enable better outcomes for learners.

This analysis is a result of extensive research conducted with the support of community and technical colleges in the United States and Europe by the Corporation for a Skilled Workforce (CSW), and in consultation with representatives from practitioners and policymakers across Asia-Pacific Economic Cooperation (APEC) member economies.

I. The Promise of Digital Learning Technology

CTE is typically offered in person and includes a strong emphasis on tactile or practice experiences. When translated to a digital or mixed-mode experience, a digital CTE course can both mimic the in-classroom/lab experience and take advantage of increased feedback and more personalized customization that technology tools can offer.

The most successful CTE courses are not single-mode, slow-paced delivery of information, which will often overload students while not improving their learning. Blended learning, or a 'multimodal' model, offers learners a variety of different experiences and tools to enable them to learn in the way that is most comfortable and familiar, and incorporates significant tactile components with online information delivery.

This includes a mix of different program windows, colors, videos, chat boxes and other engagement mechanisms. Programs and individual students can be anywhere along the blended continuum, from all face-to-face to all virtual.

Technology also allows courses and modules to include more frequent feedback loops for both learners and instructors. Learners who receive feedback from instructors, peers and frequent digital reminders are more engaged, and this collaborative highly interactive component mimics the 'buzz of a classroom,' lab or real-world workplace. Technology-enabled tools can also facilitate student observations during lectures, team activities or web interactions, which build a strong and engaged learning community and empower instructors to adapt more quickly to student needs.

In addition, digital courses allow instructors and learning providers to mark incremental student progress at more frequent intervals than a single, final assessment and provide feedback to students on their progress. Such markers may be analog or digital, but small artifacts built into the program or software are part of the feedback loop on success or challenges, drive engagement and are an opportunity to use the technology to facilitate customized student success for a process that would be a much heavier lift in a traditional classroom. In many digital courses, artifacts can be an alert at the completion of a module, a notification of exactly what course material remains, an avatar celebrating an achievement, a badge or an award of points to be used on a subsequent task.

II. Technology Infrastructure

In order to successfully implement a distance learning workforce development program, governments, institutions and other education providers need to consider the technical infrastructure that is currently available to themselves and to learners. Because the specifications for the technology change quickly, this section provides a few principle considerations that can inform education providers and policymakers as they build their distance learning programs.

Obviously, policymakers and providers should evaluate the training needs, including specific skills, industry areas and occupations where certification or training can provide the most opportunity. They should also consider broadband infrastructure and learning devices currently accessible to learners as well as the infrastructure and learning devices that are likely to be available as the technology infrastructure continues to evolve.

<u>Broadband infrastructure</u>

Internet connectivity remains a challenge globally, especially in rural and economically depressed communities. While much progress has been made through various government programs and public-

private partnerships to close the connectivity gap, most learners in these communities are able to access broadband with only a fraction of the 10MBPS connection speed that is required to run many vendor-developed distance training programs or currently available online learning courses.

Devices for digital learning

In addition to connectivity, another challenge is learner access to learning devices. Across APEC economies, home computers are often shared by many members of one household - both younger students completing schoolwork and adults pursuing workforce training. In addition, these devices may not have the most current processing speed or updated software. For example, suppliers of online learning in the United States and Europe often assume that learners and instructors have devices with at least i5 processors, 500GB hard drive, 8GB RAM and Windows 7.

Creating an online learning community

An important component of the digital learning experience is the online learning community that can be facilitated through technology. Often, training programs that incorporate applications such as Slack, VoiceThread or Voxer have resulted in improved outcomes for learners and increased instructor effectiveness, at low cost to education providers and very little technological strain.

Though data collection in the United States is still in the early stages, examples of learning providers include the Distance Education and Learning Technology Applications (DELTA) program at North Carolina State University, online laboratory content through LearningStudio at Arizona State University, the EagleVision web conferencing platform at Embry-Riddle Aeronautical University, the Center for Online Innovation in Learning (COIL) at Penn State World Campus, competency-based online learning for technical fields at such online institutions as Capella University or Western Governors University, and similar programs at Ball State University in Indiana and the Virginia Polytechnic Institute and State University (Virginia Tech).

Considerations

When investing in education and training programs, whether through development or procurement, policymakers and education providers should consider several items:

- How to provide an immersive learning experience using lower bandwidth and fewer technical requirements.
- Ways to leverage shared resources (such as libraries, schools), if learners typically share devices within households and whether there are ways to ensure that these devices have a high level of processing and the most current software.

- Options to produce learning resources that can be principally accessed through mobile devices.
- Partnerships or other programs to provide robust internet connections in rural and economically depressed regions.

III. Organizational Infrastructure

A robust strategy for building technology infrastructure is just one of the elements necessary for effectively using technology to deliver education and training. Since technology is rapidly evolving, education providers and policymakers interested in implementing distance CTE programs should be prepared to invest in technical updates, curriculum refreshing and teacher professional learning, among other things. Frameworks such as the ISTE Essential Conditions can provide guidance for evaluating a broad set of 14 elements to aid an organization's transition to digital learning.

In the context of digital CTE programs, the APEC working group identified two areas of particular concern.

Financial sustainability

It is important that policymakers and education providers build a budget that will continue beyond the initial investment of infrastructure and content and that will ensure any future technology maintenance or content improvements can be sustained. It is often best to consider these improvements or upgrades in conjunction with other technology improvements. For example, content for distance CTE programs can at first be developed for offline or mobile use and then adapted over time to include more media-rich content as the availability of broadband and bandwidth increases.

Professional development

Critical to the successful use of distance CTE programs is the capacity of instructors. When implementing new programs, policymakers and education and training providers should consider professional development of administrators, faculty, information technology (IT) service providers and students so that they can correctly and effectively use the technology for learning. In some cases, it may be important to provide digital literacy training for these stakeholders. The professional and economic returns on providing greater technological literacy tie directly in with the concern that opens this report. Namely, that new technologies are shifting demands on the workforce, and meeting these demands will require greater mastery over those technologies, if we wish to avoid displacements in the labor market.

IV. Future Trends

Mixed and augmented reality, simulations

Many technical programs like nursing, welding, robotics and agriculture are using simulation technology as a key feature in replicating the 'hands-on' component of the learning, and the debate over what can be acquired online versus in person continues. Community and technical college faculty, students and industry are split on which experience has the most benefits and is ultimately more effective. In the United States, students tend to be the most willing to do as much as possible online - they trust technology, it is more convenient when balancing other life demands and comfort with industry technologies is increasingly an essential competency for jobs in CTE fields. Employers are reticent about the effectiveness of blended or fully online CTE programs, but this does not necessarily translate into a decrease in demand for these graduates; rather, the competencies they acquire override *how* they were acquired in these rapidly growing industries. Given this, it seems highly important to continually reemphasize this link: digital learning and the acquisition of tech-related competencies (in addition to soft skills). Educators are somewhere in the middle and are considering how to best address the current belief that knowledge can be acquired online, but skills are learned in person.

Artificial intelligence

In the near future, advances in technology may provide some answers. One of the most exciting features that artificial intelligence (AI) can bring to online CTE is adaptive learning or 'extreme personalization.' Current applications of AI in the consumer realm are to assist with specific tasks or increase efficiency (Siri, Alexa, Google Assistant), but applying the power of machine learning to customize a student's experience in real time could have tremendous impact. It is expected that AI in US education will grow by 47.5 percent from 2017 to 2021,[1] and while AI is already 'good enough' to disrupt education, the democratization and affordability shift is still forthcoming. Pilots are underway in Silicon Valley and MIT Media Lab, and select institutions in the United States can provide a glimpse into the possibilities.

Georgia Tech's virtual teaching assistant (TA), Jill, was built using the IBM Watson platform (Bluemix) and was initially designed to handle the massive amount of questions coming in from the fully online technical programs. Jill handled the routine questions about class times, submission formats, office hours and assignments, and the human TAs handled the more complex inquiries.[2] While AI won't be teaching class,

[1] Marr, B. (25 July 2018). "How Is AI Used In Education -- Real World Examples of Today and a Peek into the Future." *Forbes*. Retrieved from https://www.forbes.com/sites/bernardmarr/2018/07/25/how-is-ai-used-in-education-real-world-examples-of-today-and-a-peek-into-the-future/#3956809e586e

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painting and composing or solving complex programs for a while, what it can do masterfully is process, synthesize and use data to increase efficiency and make decisions that improve learning.
Examples include:

- Select (and deselect) videos that result in better screen attentiveness and speed in subsequent modules.
- Adapt the interface based on individual student progress (i.e., blue screens increase attentiveness and absorption more than yellow or red or Susan completes modules faster with minimal windows open and Ryan seems to do better with rich media and multiple windows).
- Curate articles, chats and faculty comments based on previous response.
- Provide clues, workarounds or additional materials for concepts or classes students appear to be 'stuck' on.
- As AI gets more sophisticated, it will read the expression on students' faces that indicates they are struggling to grasp a subject and will modify a lesson to respond to that.
- Use existing advertising and suggestion algorithms (Facebook) to curate online learning experiences and increase attentiveness.
- Holographic telepresence, mixed reality and gaming will also be introduced as mechanisms for making CTE more accessible and real.

Conclusion

Continuing to analyze and push the frontier of distance learning opportunities in CTE is a priority for all APEC economies, and partnering and sharing to improve educational access and outcomes will drive economic growth and serve as a global example in the years to come.

Further Reading on Delivery of Digital CTE

To learn more on how a consortium of education providers developed an online network to deliver real-world laboratory experience remotely, please see the case study, *North American Network of Science Labs Online* (NANSLO), submitted by the Western Interstate Commission on Higher Education in **Appendix D.**

For more information on an economy's initiative to deliver needed skills development trainings to its citizens through an open digital CTE program, please see the *Selections from TESDA Online Program Presentation submitted by the Technical Education* and *Skills Development Authority of the Philippines* in **Appendix E.**

Chapter 3: Improving Quality in CTE in the Asia-Pacific Region | Sharing of International Practices

By Tanya Joosten, PhD, and Rachel Cusatis, PhD

Executive Summary

Quality is of utmost importance when launching, designing and developing distance career and technical education (CTE) programs. With the number of online CTE programs increasing, there is the need to ensure that distance education for career development meets high instructional and pedagogical criteria. Defining what constitutes such a broad term as 'quality' for a range of CTE programs may seem challenging. Nevertheless, many research-based learning criteria applicable to in-person career education are also central to the online domain.

This chapter will provide a brief overview of some of the challenges and contexts that give rise to online tools to assist in expanding access to distance learning for career development. It will then discuss how such challenges have given rise to this increased demand for online instruction. In seeking to provide a resource for this growing demand, this chapter will discuss how researchers assimilated research on curriculum and instructional design quality. Emerging from that research are the eight quality indicators, each of which will be described briefly. These eight indicators will be defined alongside a toolkit providing nine quality domains, or benchmarks, of online education programs. The concluding section will discuss key practices and lessons learned, based on input from leading online learning researchers, developers and practitioners, together with a brief note regarding methodologies used.

Factors Giving Rise to Online Education

CTE in an online environment continues to grow. Correspondingly, institutions and instructors have shown increased interest in ensuring quality in online courses. Not only does some research suggest that online courses can be as effective as onsite courses (see Allen, Bourhis, Burrell, & Mabry, 2002; Allen, Mabry, Mattrey, Bourhis, Titsworth, & Burrell, 2004), the demand for online course offerings continues to grow as students require more flexibility in where and when they are able to learn. This flexibility stems from a variety of factors, among them work, family, financial limitations and other obligations. Allen and Seaman (2016) reported that "enrollments continue to grow at a healthy rate, showing a 7% increase overall between fall 2012 and fall 2014" (p. 13). With increasing demand for online courses and the evidence that online and face-to-face courses are comparative in quality, research efforts refocus on understanding how to best design online courses and deliver instruction online to positively influence student outcomes. In particular, this means incorporating greater indicators of student learning.

For decades, instructors, researchers and instructional support staff have worked to identify factors in curriculum design that lead to successful course experiences and improve the quality of programs provided to their students. Several tools have been developed (e.g., Quality Matters Rubric, Rubric for Online Instruction) to assist in the development and evaluation of online practices (Sener, 2006). Institutions diffuse these effective practices in course design through faculty development and instructional support services and can use these tools to improve the quality of courses. Institutions are under pressure to ensure that the quality of courses offered to students at a distance or online is equal to the traditional, on-campus courses. Moreover, these efforts have become a lucrative business opportunity for third-party vendors in their claims to provide services to ensure quality, whereas a higher education institution may not have that capacity to do so. Yet, many of these tools lacked predictive value in that there was no empirical research indicating a significant relationship between these tools and student outcomes.

Eight Indicators for Quality Online Courses

To fill this gap, a series of cross-institutional studies was conducted at the National Research Center for Distance Education and Technological Advancements to examine course quality and the relationship to student outcomes in online courses. Highlighted below are the eight online course quality indicators that emerged from these mixed-methods studies.

1. Design - The course is designed with clearly defined, specific and measurable learning objectives aligned to assessment and learning activities (including interactions with content, peers and instructors) taking into account authentic, real-world experiences.
2. Organization - The course is well organized and easy to navigate with a logical and consistent format, an alignment between topics and subtopics, and manageable sections.
3. Support - The course and instructor help manage student expectations by providing an orientation to the course (purpose, format and getting started); illustration of the alignment of objectives, assessments and activities; clear instructions and directions; and a description of the grading and assessment plan.
4. Clarity - The course supports ease of student learning by clarifying the expectations for students' activities in the course, such as their participation and performance, by providing explanations, descriptions, standards, requirements, guidelines and context.
5. Instructor Interaction - Instructors interact with students by expressing interest in their learning and actively participating in online discussions, including facilitating learning and peer interaction, expanding students' thoughts and knowledge, and providing new prompts and additional content. Moreover, instructors provide timely and detailed feedback on assessments and student inquiries.
6. Peer Interaction - The course design and technologies facilitate active learning through frequent and ongoing student-to-student involvement and meaningful collaborative work. Peer-to-peer

interaction is facilitated by the instructor, yet there are opportunities and technologies available for students to learn from one another, as well.

7. Content Interaction - The instructor strategically enhances the student interaction with accessible and interactive content (preferably open educational resources [OER]) that supports dialogue, critical reflection and analysis, and real-world applications by providing materials that are current, rich, and sufficient in breadth and depth. Moreover, instructors identify important topics and provide context.
8. Richness - The course provides richness in learning materials and activities, support and instructions, instructor interactions, and tools and media.

Quality Assurance Online Learning Toolkit

Alongside these course quality indicators developed in the United States, another research-based set of benchmarks for quality, called the Quality Assurance Online Learning Toolkit (2017), was devised by Australian education researchers. Input for its development came from a diverse group of representatives from government, quality assurance agencies and higher education institutions from 13 Asia-Pacific region economies. The toolkit was in response to the growth of distance education, including online and blended, in higher education. The toolkit includes the following nine domains to guide quality in online programming: leadership and management, staff and professional development, review and improvement, resources and information, student support, student experience, curriculum design, assessment and integrity, and learning outcomes. The following table provides a brief definition of each of the nine quality domains in online learning programs.

Quality Domain	**Definition**
Leadership and management	Leadership and management actively support the realization of quality online and blended education by developing strategic plans, by creating performance indicators and by influencing the culture of quality within an institution.
Staffing and professional development	Staff involved in the teaching, management and support of online and blended education have the appropriate qualifications, knowledge and skills required to support the achievement of student learning outcomes.
Review and improvement	Performance data and a broad range of feedback from stakeholders, including students, are fed into planned cyclical reviews.
Resources and information	The necessary technical and digital infrastructure, including clear information about online study, is reliable, accessible and

	regularly updated.
Student support	Mechanisms to identify students who require additional technical, educational and personal support are implemented and monitored; each student is aware of all support systems in place.
Student experience	Each student has the opportunity to interact socially and academically with staff and other students, and feedback of student experience is acted on through monitoring.
Curriculum design	Curriculum design is based on sound educational principles and provides a coherent and interactive series of learning experiences that develop knowledge and skills aligned to learning outcomes appropriate to the qualification level.
Assessment and integrity	A range of policies and mechanisms ensures that assessment tasks for students studying online are clearly communicated, effectively moderated and allow opportunities for students to demonstrate the program learning outcomes.
Learning outcomes	Learning outcomes for students studying online are equivalent to those for face-to-face cohorts for the same qualification level and are assessed with rigor.

Lessons Learned and Best Practices

Moving from the conceptualization to the implementation of online CTE programs, practitioners have shared insights and lessons learned. A guiding question for these practitioners is how one maintains the integrity or quality of a CTE experience in a virtual or hybrid environment. Taken together, these lessons help illuminate the dynamic nature of quality when designing online learning programs.

- Quality is integral to a CTE program, from the planning stage to the evaluation stage.

Quality needs to be a consideration from the start of an initiative and not an afterthought. In the case of a rural US state like Idaho, for example, educators there realized that they would need to prepare more students for CTE fields, based on labor and employment shortages. Therefore, they had to integrate new subject matter into their training programs, providing greater access to rural students who otherwise may not have had the opportunities to meet these demands. At the same time, not all students are necessarily interested in or prepared to enter directly into a specific, narrowly defined professional career. Developing programs therefore needs to distinguish between adolescent and adult learners.

- Ensure program quality standards, leadership from researchers, sufficient training and instructional certifications.

Launching a distance education program is not purely about acquiring technology and putting learning online. Rather, practitioners emphasize proper leadership and support, ensuring that faculty and staff are incentivized and receive the appropriate technical and pedagogical training through professional development to teach students effectively online. Such training should include instructor endorsements, while students are greatly helped when engaging with actual workforce experts in the field they are studying. Program standards and performance measures should be developed on a statewide basis, taking into account the different domains and indicators of quality. Applying these indicators should inform both the design of curricula and the multiple forms of instructional online support students can receive.

- Meeting the criteria for institutional readiness is integral to ensuring quality.

Finally, success in distance education was defined by institutional readiness on the part of the education provider. Tools developed to assist programs or institutions in determining such readiness include ACE indicators of CTE program quality, Online Learning Consortium (OLC) program indicators, and the Courseware in Context (CWiC) Guide to Coursework Adoption. However, more can be done to build this institutional capacity, as quality is ensured when looking beyond the individual course level. This is especially the case when an institution demonstrates a record in supporting innovation, increasing access and providing learning effectiveness to all students, regardless of income levels.

That said, evaluating course quality should not be overlooked. There is an array of course-level rubrics and processes to evaluation quality, including Quality Matters, California State University (CSU) Chico Rubric of Online Instruction (ROI), California Quality in Online Learning and Teaching (QOLT), Open SUNY Course Quality Review (OSCQR), and the OLC Course and Program Scorecard.

Background on Research

These mixed-methods studies incorporated (1) a survey instrument, which included demographic questions, Likert items asking students about the experiences in online courses and open-ended questions, and (2) institutionally warehoused data. The surveys were made using previously developed tools (i.e., California State QOLT, CSU Chico ROI, Quality Matters Rubric). Participants were students enrolled in a course section that was delivered online at 2-year and 4-year higher education institutions, including a technical college, in the United States. Statistical analyses included hierarchical linear regression analyses to control for known covariates of student learning, satisfaction and course grade. Qualitative thematic analysis was conducted through a grounded theory approach, which included a thematic analysis to identify common themes and

trends regarding students' perception of their success in the online course. Results from both quantitative and qualitative analyses were collated to create the top eight indicators for quality online courses.

Further Reading on Quality in Digital CTE

For a resource to help developers of digital CTE programs consider how best to ensure high quality content and delivery for their students, please see the selections from the *Quality Assurance of Online Learning Toolkit*, submitted by the Tertiary Education Quality and Standards Administration, Australia Department of Education and Training in **Appendix F.**

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About the Authors

Tanya Joosten, PhD, is a senior scientist, Director of Digital Learning Research and Development and Co-Director of the National Research Center for Distance Education and Technological Advancements (DETA) at the University of Wisconsin - Milwaukee. Currently, Dr Joosten leads a research initiative across the United States, supported by the US Department of Education, working to provide access to research models and methods, facilitating innovative processes of data collection, and encouraging the replication of research across institutions through the DETA Research Toolkit to identify key instructional and institutional factors that influence student success. She previously worked as the Director of the Learning Technology Center,

leading faculty development and engagement initiatives, pedagogical and technological innovation projects, core learning technology oversight, and blended and online program development.

Rachel Cusatis, PhD, is a social scientist serving as an instrumentation innovator in research at DETA at the University of Wisconsin - Milwaukee. Dr Cusatis serves as the key grant activities coordinator and liaison to the institutional partners supporting research efforts across those institutions, working directly with the PIs, institutional researchers and data analysts. This included the collection of data from each educational institution, merging of data sets and cross-institutional data analysis. In these efforts, she has developed, reviewed and edited student and instructor survey instrumentation and codebooks, including shared measures, definitions and coding. Furthermore, Dr Cusatis performs quantitative analysis on student and instructor surveys merged with student grade and retention data across institutions to identify key instructional and institutional factors that influence student academic outcomes. She has contributed to key outcomes of the grant, including development of the DETA Research Toolkits and DETA research briefs.

Chapter 4: Inclusion of Women, Girls and Underrepresented Populations in Distance CTE

By Aaron Neumann and Sarah Whitehead, Leed Management Consulting, Inc.

While there has been an increase in women's and girls' participation in online education, there is still work to do to ensure equality in access. Women are still sorely underrepresented in career and technical education (CTE) programs that are considered 'nontraditional,' such as (but not limited to) architecture and construction, logistics and transportation, STEM (science, technology, engineering and mathematics) fields and manufacturing.[3] This can directly impact their earning potential as they often are enrolled in postsecondary programs that lead to lower-paying jobs[4]; their participation in CTE programs would prepare them for high-skill, high-wage jobs that would help close the gender wage gap.[5] One of the Asia-Pacific Economic Cooperation's (APEC's) most significant goals is to empower women in local and regional economies through innovative programs that enhance their opportunities in education and employment.

The annual APEC Women and the Economy Forum in 2018, with the theme of "Seizing Opportunities for Women and Girls to Advance in the Digital Age," promoted women's participation in the digital economy, starting with proper training for industries of the future. In recognition of this need, organizers of the APEC Workshop on Digital Workforce Development, hosted by the US Department of Education, asked participating experts and practitioners for their recommendations on women's and girls' inclusion in digital and distance CTE. Workshop participants weighed in on how distance CTE learning programs can help ensure effective content design, delivery and quality. The workshop also spotlighted how data analytics is an emerging 21st-century competency that can embody the benefits of distance CTE. Some of their considerations are outlined below.

To capture a more complete picture in digital and distance CTE, who the stakeholders are and who are impacted, it is useful to understand current trends in access and opportunities.[6] For example, both the Babson and Sewell survey and the *Handbook of Distance Education* show that women are already enrolled in online education at higher levels than men in the United States. In fact, men and women are similar when it comes to interests and goals in enrolling in online learning and programs focused on high-quality content for

[3] National Coalition for Women & Girls in Education and National Coalition on Women, Jobs and Job Training. *Education Data Show Gender Gap in Career Preparation*. Retrieved from https://www.ncwge.org/PDF/GenderGapinCareerPrep.pdf
[4] National Coalition for Women & Girls in Education and National Coalition on Women, Jobs and Job Training. *Education Data Show Gender Gap in Career Preparation*. Retrieved from https://www.ncwge.org/PDF/GenderGapinCareerPrep.pdf
[5] Boushey, H., O'Leary, A., & Glynn, S. J. (2013). *Our Working Nation in 2013: An Updated National Agenda for Work and Family Policies*. Washington DC: Center for American Progress.
[6] Lufkin, M. E., Wiberg, M. M., Reed Jenkins, C., Lee Berardi, S. L., Boyer, T., Eardley, E., & Huss, J. "Gender Equity in Career and Technical Education." Retrieved from https://www.napequity.org/nape-content/uploads/CH-20-GE-in-Career-Tech-Ed.pdf

all potential students. Instead, there is a variety of other factors that impact enrollment and mobility for underrepresented groups,[7] including access, lack of inclusive practices, lack of mentorship, and cultural and technical barriers. It has been suggested that there is a history of inequity in CTE that has impacted underrepresented populations' ability to trust in the value of CTE.[8] As seen in STEM, student interest and confidence play a role in student enrollment for underrepresented populations, which may be in part due to that lack of trust. Additionally, CTE programs and apprenticeships will face stereotypes that make general recruitment challenging.[9] In other parts of the world, such as Southeast Asia[10] and China,[11] issues of accessibility to and the cost of the technology needs, particularly for women and girls, are a significant factor.

When it comes to developing course content, delivery and marketing materials, it is important that content is inclusive in image and language choices. Messaging in these materials should avoid language that drives certain populations into certain fields. Program descriptions and marketing can reflect contexts specific to underrepresented students. Some US school districts, such as the Alamance-Burlington School System in North Carolina (https://www.abss.k12.nc.us/Page/39062), have taken steps to incorporate inclusive language and images in their marketing materials, which may serve as a model for other programs. Additionally, there might be natural synergies with existing initiatives aimed at encouraging participation of underrepresented populations, including women and girls, in STEM programs to connect those new students with digital and distance CTE programs.

There is a variety of ways to be innovative when reaching out to underrepresented groups. This includes showing potential students how they are in fact already using data but might not realize it and how data, coding and other digital skills benefit career opportunities and future earning potential, thus making a connection between the classroom and the real world. Other innovative approaches to CTE include the increase in gamification in course design, use of compelling design aesthetics and creativity in enhancing interactive learning. For example, Arizona State University created data science massive open online courses (MOOCs), recording all of them on a green screen, and tested how different backgrounds for content impacted the learning experience. Those specifically looking for hands-on resources regarding equity and

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[7] Leonhardt, L. (3 December 2017). Lost Einsteins: The Innovations We're Missing." *The New York Times*. Retrieved from https://www.nytimes.com/2017/12/03/opinion/lost-einsteins-innovation-inequality.html; and Bell, A., Chetty, R., Jaravel, X., Petkova, N., & Van Reenen, J. *Who Becomes an Inventor in America? The Importance of Exposure to Innovation*. Retrieved from http://www.equality-of-opportunity.org/assets/documents/inventors_summary.pdf

[8] Advance CTE. *Making Good on the Promise: Building Trust to Promote Equity in CTE*. Retrieved from http://coloradostateplan.com/wp-content/uploads/2019/01/Building_Trust_Promote_Equity_CTE_Jan_2019.pdf

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[10] Mohiuddin, M. (28 June 2016). "What stops girls in South Asia getting online?" *Voices Magazine*. Retrieved from https://www.britishcouncil.org/voices-magazine/what-stops-girls-south-asia-getting-online

[11] Elizabeth, K. (19 January 2019). "Can AI Powered Education Close the Global Gender Gap?" *Forbes*. Retrieved from https://www.forbes.com/sites/katieelizabeth1/2019/01/19/can-ai-powered-education-close-the-global-gender-gap/#1af140763a22

CTE can look for resources such as the *Making Good on the Promise* series. The series aims to put tools and resources into the hands of US state leaders and anyone else interested in negating misconceptions about CTE by providing necessary supports, guidance and solutions in helping identify and close equity gaps and better serve underrepresented populations.[12] Squirrel artificial intelligence is another innovative example of a collaborative effort between labs in China and the United States with the goal of providing effective, accessible education.[13]

Existing programs may have models that can be replicated, expanded on or modified to fit a program's needs or provide answers on boosting women's and girls' participation. One suggestion is to look at successful programs and training courses specific to women and girls across APEC communities and to replicate those strategies that are appropriate. Programs can collect data analyzed by gender, for instance from exit interview responses or dropout reports, to identify what does or does not keep students engaged in digital and distance CTE; note that current research suggests that age and life events impact dropout rates. Programs that utilize innovative programs that encourage women's and girls' participation should be recognized by officials and promoted to policymakers throughout the APEC region. Programs may also want to research what happened to graduates after degree/certificate completion, as research suggests that even when girls enroll in CTE programs at the high school level in the United States, they are still less likely to obtain a higher-paying job.[14]

[12] Advance CTE. (2019). *Making Good on the Promise*. Retrieved from https://careertech.org/resource/series/making-good-promise

[13] Elizabeth, K. (19 January 2019). "Can AI Powered Education Close the Global Gender Gap?" *Forbes*. Retrieved from https://www.forbes.com/sites/katieelizabeth1/2019/01/19/can-ai-powered-education-close-the-global-gender-gap/#1af140763a22

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Chapter 5: Distance Delivery of Data Analytics Competencies – Spotlight on Project DARE

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Project DARE Overview: Addressing urgent global workforce and employment needs and driving sustainable economic growth and prosperity

> *"We are currently preparing students for jobs that don't yet exist … using technologies that haven't yet been invented … in order to solve problems we don't even know are problems yet."*
> *– Richard Riley, former US Secretary of Education (1993-2001)*
>
> *"We recognize the vital importance of continuing work towards an inclusive education agenda that will enable people of all ages to meet the challenges of a globalized world. Furthermore, realizing that equitable access to high-quality education and training will allow our people to develop skills and competencies from early childhood and throughout their lifetime, we must focus our efforts on improving the quality, mobility and access to education including in partnership with employers, and soft skills development."*
> *– 2016 APEC Leaders' Declaration, Lima, Peru*

Project DARE (Data Analytics Raising Employment) is an Asia-Pacific Economic Cooperation (APEC) initiative led by the United States (US Department of Labor) and co-chaired by the global education and research company Wiley and the Business-Higher Education Forum (BHEF). Project DARE seeks to **facilitate development of a data analytics-enabled workforce across the APEC region** to effectively support sustainable economic growth and prosperity globally.

Why Data Science and Analytics Competencies?

Jobs requiring a familiarity with data science and analytics (DSA) are rising dramatically, resulting in a shortage of qualified employees.[1] DSA is defined as the ability to gather, analyze and draw practical conclusions from data, as well as communicate data findings to others. In 2016, DSA-related jobs were at the top of those that employers in the Asia-Pacific region were having the most difficulty filling.[2]

By identifying DSA competencies required by employers in a data-driven world, economies will be equipped to educate their workforce – preparing students and workers for the yet-to-be-defined jobs of tomorrow and helping economies to fulfill their economic potential. DSA-enabled knowledge workers will have skills not easily replaced by automation; they will be better prepared to unlock the promise and potential of data and all the technologies that depend on data. We are all living in a big data, digital world. DSA skills will soon be fundamental at all levels of the workforce – from entry level to the C suite.[3]

Employers across every sector are being transformed by the data economy and have growing demands for DSA-enabled workers. Key sectors include health care, financial services, manufacturing, research, retail, construction, mining, agriculture, aerospace and government. Nowhere is this need greater than across APEC member economies. US data suggest that DSA-enabled workers represent one of the largest areas of employment and economic impact.[4]

Fig 1: The Data Science and Analytics Skills Shortage[5]

Economy	**Current DSA Workers**	**Projected DSA Workers Needed**	**Percent Change**
Malaysia	4,000 (Year 2016)	20,000 (Year 2020)	400%
The Philippines	147,420 (Year 2016)	340,880 (Year 2022)	131%
Singapore	9,300 (Year 2015)	15,000 (Year 2018)	61%
The United States	2,350,000 (Year 2015)	2,720,000 (Year 2020)	16%

To address this urgent need, in 2017 APEC Project DARE convened 50 business, government and academic leaders from 14 APEC economies to develop a set of "10 Recommended APEC Data Science and Analytics (DSA) Competencies" to serve as a resource to enable academia and training providers to align the development of curricula, courses and programs to industry/employer needs.

The following 10 competencies apply to teams comprising highly trained data scientists and a new emerging segment of DSA-enabled professionals. Data scientists and DSA-enabled workers are defined by a combination of these 10 competencies but possess different levels of mastery, comprising business and organizational competencies, technical competencies and workplace skills that drive value creation. This will help transform an organization's analytics capability.

Recommended APEC DSA Competencies

Business and Organizational Skills

1. **Operational Analytics:** Use data analytics and specialized business analytics (business intelligence) techniques for the investigation of all relevant data to derive insight for decision making.
2. **Data Visualization and Presentation:** Create and communicate compelling and actionable insights from data using visualization and presentation tools and technologies.
3. **Data Management and Governance:** Develop and implement data management strategies and governance, incorporating privacy and data security, policies and regulations, and ethical considerations.
4. **Domain Knowledge and Application:** Apply domain-related knowledge and insights to effectively contextualize data, achieved by practical experience and exposure to emerging innovations.

Technical Skills

5. **Statistical Techniques:** Apply statistical concepts and methodologies to data analysis.
6. **Computing:** Apply information technology and computational thinking, and utilize programming languages and software and hardware solutions for data analysis.
7. **Data Analytics Methods and Algorithms:** Capture, clean and inspect data. Implement and evaluate data analytics and machine learning methods and algorithms on the data to derive insights for decision making.
8. **Research Methods:** Utilize the scientific and engineering methods to discover and create.
9. **Data Science Engineering Principles:** Use software and system engineering principles and modern computer technologies, incorporating a data feedback loop, to research, design and prototype data analytics applications. Develop structures, instruments, machines, experiments, processes and systems to support the data lifecycle.

Workplace Skills

10. **21st-Century Skills:** Exhibit crosscutting skills essential for DSA at all levels, including, but not limited to, collaboration, communication and storytelling, ethical mindset, organizational awareness, critical thinking, planning and organizing, problem solving, decision making, customer focus, flexibility, business fundamentals, cross-cultural awareness, social and societal awareness, dynamic (self) reskilling, professional networking and entrepreneurship.

The 10 competencies were endorsed at the 2017 Senior Officials' Meeting Human Resources Development Working Group Plenary. Economies called for the competencies to be shared with academic institutions, vocational training programs and other stakeholders and to be implemented.

In 2018, Project DARE convened a two-day workshop in October for academia, government and industry to share their best practices implementing the 10 competencies, including a session on “What has been done for online delivery?” covering case studies in Indonesia; Mexico; the Philippines; and the United States. The diversity and number of workers/learners across the APEC region demand solutions built on online delivery

modalities. For example, the University of the Philippines launched a massive open online course (MOOC) on business analytics leveraging the "10 Recommended APEC Data Science and Analytics (DSA) Competencies." Further plans include an online university to focus on serving rural areas of the Philippines. In addition, Universitas Indonesia established an online learning platform for open learning courses. Wiley and BHEF have completed a development on a multimodal Foundations of Data Analytics interdisciplinary course for students who have a minimal prerequisite knowledge of statistics and programming and wish to develop familiarity with applied business analytics. It aligns the competencies graduates will need to enter organizations as high-functioning contributors with a basic knowledge of statistics, computer programming and other data-related subjects and skills.

Online Delivery: Promising Practices and Design Principles

The flexibility of online learning has always been a primary reason for its success. The ability for a learner to work wherever (distance learning) and whenever (asynchronous learning) is incredibly convenient for adult learners, a key target of reskilling in the DSA economy. Integrating opportunities for learners to interact together and with instructors in real time can help bridge the gaps in space and time that are a factor in online learning programs. To ensure success particularly in applied workforce DSA settings, administrators, instructors and stakeholders must embed 'nodes of synchronicity' into the structure of asynchronous online courses and programs to engage learners in the online classroom. This paper also recognizes the need to identify the economy context when designing engagement strategies (i.e., some economies might not have accepted the concept of full online engagement).

Course-based opportunities for live engagement

- Facebook Live posts: Facebook Live offers a unique type of engagement for live posts when used in the context of a course Facebook page. When the instructor 'goes live,' all members of the page are notified on their mobile devices through the Facebook app. They can choose to tune in and participate in the conversation through text and emojis in real time. Each live event can be archived on the Facebook page for later viewing. If the conversation is consequential for the class, the instructor can also see which members have viewed the post and which have not and direct the stragglers to the video.
- Online office hours: These can be useful for distance learners and campus-based learners alike and are offered via a preferred connection through FaceTime, Skype and phone as well as Google Hangout, Zoom and GoToMeeting.
- Scheduled group and individual conferences: Meeting with students outside of class is one of the foundations of faculty-student interaction in campus-based learning. Although writing-intensive courses seem to be increasing requirements for instructor-student live conferences, in general, instructors may overlook individual or group conferences as opportunities for live interaction. In

online courses, self-scheduled instructor conferences can be beneficial for large projects, individual research plans, undergraduate and graduate thesis projects, and semester-long research projects; individual students who either need additional help or desire more face time with an instructor can request them. This strategy works particularly well for non-distance learners who choose to enroll in an online course rather than a campus course.

Program-level opportunities for live engagement

In addition to live instructor-student interactions, program administrators can also use live announcements at key points in the program and throughout the academic year. Examples of these opportunities might include:

- Orientation events
- Special campus-based events
- Announcements for program-wide distribution
- Midpoint check-ins
- Graduation announcements

When used wisely throughout a course or program, nodes of synchronicity offer online students and faculty the benefits of real-time contact. Even if these interactions are brief, they can be meaningful. Some online programs already have residency requirements that involve on-campus visits and interaction, but online tools can offer additional opportunities for synchronous interaction. The key to moving forward is to use tools that are either embedded in the program or course site or widely used by students in a particular course. One-to-one video chat (Skype or FaceTime), one-to-many live chat (Facebook Live) and user-selected platforms (digital office hours) provide students with a variety of options for interaction, bringing faculty and students together in time when they cannot come together in space.

Ensuring that online courses are not only reaching students but also building a skilled workforce

Many of the DSA learners most in need are working adults looking to pick up new technical or business skills in order to advance their careers. So far, though, online courses are not building a massively better-skilled workforce. Key drivers for this disconnect center around (1) lack of engagement course formats, which can be addressed with more synchronous touchpoints, (2) lack of real-world context and (3) inadequate sense of community.

Our learnings from our DARE advisor cohort make clear that DSA content developed, moving forward, must integrate:

- Real-world experience: Gain workplace experience and showcase skills to future employers, along with highlighting the opportunities for women and girls
- Immersive learning: Deepen learning by applying skills and concepts through projects
- 21st-century skills: Build essential skills like collaboration, communication and leadership

This list aligns closely with our core recommendations to APEC Leaders to "align incentives and action with support from government" across employers, universities and government. Specifically, all stakeholders should undertake joint workforce planning initiatives to map employer/economy needs and define educational pathways, including apprenticeships, vocational education and other industry engagement opportunities (e.g., competitions, capstone projects, data sharing projects) supported by government policies to incentivize employer-academia partnerships (e.g., funding, convening, open data, broadband infrastructure, etc.).

Looking Ahead

To create systemwide change, a sustained effort to close the digital skills gap is needed. Accordingly, in 2019, employers, academia and governments will convene as part of the **APEC Forum on Closing the Digital Skills Gap** to upskill and reskill at scale by setting and pursuing an ambitious APEC goal to close the digital skills gap by 2025, including the development of a corresponding roadmap led by champions from employers, academia and government. Project DARE identified an initial set of roadmap elements, such as:

- Developing an APEC compendium of digital skills definitions for use by employers, job seekers and academia
- Providing an APEC forum and/or report to share digital skills supply/demand data and insights
- Providing APEC capacity building, collaboration networks and tools to support/increase DSA faculty and incorporate DSA into the classroom (e.g., repository of resources for DSA faculty)

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Conclusion

In conclusion, high-quality career and technical education (CTE) is necessary to meet the growing need to address skills gaps that are seen by employers and educational institutions. To incorporate best practices, programs offering digital and distance CTE are evaluating technological requirements for their specific program and capacities, utilizing multimodal (blending learning) models that provide frequent feedback to users, and designing courses that are clear, organized and user-friendly and that provide opportunities for interaction and support to students and staff. Moving forward, this report will be circulated through the APEC Human Resources Development Working Group and Education Network, and member economies are encouraged to disseminate it through their respective ministries and agencies. The project team looks forward to further work in this field, including the APEC Forum on Closing the Digital Skills Gap, scheduled for 2019, for stakeholders to discuss how to encourage collaboration across academia, government and industry to close the digital skills gap and reduce youth unemployment by 2025.

Appendix A: Case Study on Implementing Innovative Curriculum Using the Interactive Video Network to Take a Welding Course

Submitted by North Dakota Career and Technical Education

Overview

North Valley Career and Technology Area Center (NVCTC) located in Grafton, North Dakota is using interactive equipment with the telecommunications-based distance learning to expand the opportunity of students in learning the skills associated with welding technology. The system brings the instructor to the student real time and synchronized. This system allows the students to experience real hands on lab experience with an experienced instructor to assist in the skill building learning process. NVCTC was awarded a North Dakota Career and Technical (CTE) grant to purchase and install broadcast equipment and welding instructional equipment in the four participating schools. The welding Instructor uses high definition monitors to observe students work in each of the schools and security system cameras are installed in each location for an overall classroom/lab activity observation.

Goals of the project

- Making instructor available to more students in a real time (synchronized) learning experience;
- Providing additional remote CTE lab sites which allow more students the experience of real hands-on lab opportunities;
- Delivering instruction by highly skilled and qualified instructors to assist in the learning process for students in remote or rural settings;
- Developing a model that effectively utilizes interactive video delivery in a lab and classroom setting to multiple sites that utilizes both classroom and lab work, and;
- Providing instruction in the areas of Welding Technology.

How schools with limited staffing for electives and physical travel distance can overcome the barriers.

Background

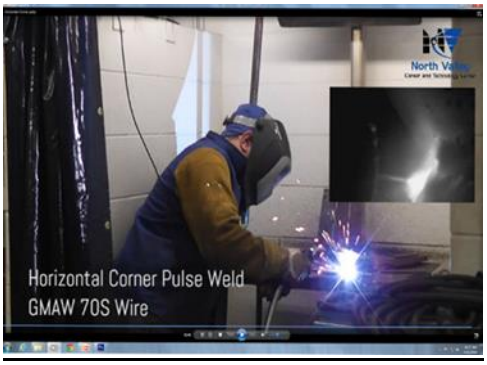
North Dakota has been involved with distance learning for almost thirty years. The formerly known WRITC/MVCC (West River Interactive Television Cooperative / Missouri Valley Communications Cooperative) became operational in the fall of 1992. Prior to the linking of the two cooperatives, the West River system had been in operation for three years, starting in the fall of 1989. Three school districts became the first two-way analog interactive television system in the state of North Dakota. Currently that consortium has 40 schools.

North Dakota consists of 148 primarily small rural public high school districts. North Dakota has a range of the state's largest School District of over 12,000 students to the smallest of 8. Median size K-12 district is 185 students. The make-up of our state is that the distance between schools becomes greater east to west.

The statewide Fiber Network connects all schools in the state with an Interactive video (ITV) network and dedicated ITV system in all schools. Most schools have multiple ITV classrooms, that have 2-way communication, are fully interactive, in real time that share teachers through this interactive television system. Teachers and students see and hear each other in real time and operate just like traditional classrooms except that their classmates and teachers are in different towns. The classes taught are primarily elective

classes and college level courses. With teacher shortages, small schools can receive classes that would otherwise be prohibitive. Career and Technology courses are offered between schools either ITV or online ranging from the areas of Agriculture Education, Aviation, Business Education, Family and Consumer Sciences, Information Technology, Health Sciences, Marketing, Technology and Engineering, and Trade, Industry and Technical Education. For a list of ITV and Online courses, schools, and enrollment you can go to our website: www.nd.gov/cte
The state of North Dakota has separate state funding for approved CTE programs which is above ND's student foundation aid. ND CTE department does provide distance delivery incentives as additional funding is awarded for each school that the course is provided access to. North Valley Career and Technology Area Center (NVCTC) was awarded a Creating Access for CTE Incentive grant for the 2013 -14 school year that consisted of four schools participating as one of the schools at the host site and three receiving schools with the farthest being about sixty miles away. The program was highly successful and expanded starting in the 2015-16 school year with another school site on the other side of the state (approximately 310 miles away).

Learning that works for North Dakota
CTE®



Technology in the lab

The technology systems are put in place to assist in accomplishing the goals of delivery for the class.

Goals of the lab

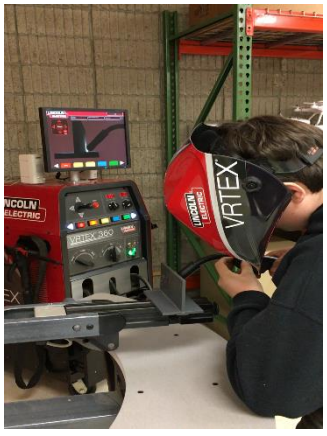
- The distance delivery equipment will support "hands-on" and synchronized instruction.
- Assurance that the lab experience at the remote site will equal or exceed current face to face experiences.
- Assurance that the student assessment will be at the same level of rigor as a face to face environment.

The ITV system consists of connection to a security camera in each outlying school, so the teacher has a constant visual of what is taking place in the labs. This also includes connectivity to a Polycom system that connects visual and audio among all sites during a class period.

A camera system is used to provide real-time monitoring for the welding in the lab. Analog output from camera displays directly on monitor. With this system the Instructor has the capability of observing the welding process as seen under the protective lens as the student welds. Cameras are also used for instructional aids or you tube videos to aid in the instruction of the proper methods of welding, which can be specialized for an individual need in instruction. This system has recording capabilities to record the welding done by the student.

In addition, you must factor in the welders and the welding related equipment needed. For ease of instruction suggest that you stay consistent with brand of welders used.

The virtual reality arc welding training simulator is another piece of technology that is also used and rotated among the sites. These computer-based training systems are educational tools designed to supplement and enhance traditional welding training. They allow students to practice their welding technique in a virtual simulated and immersive environment.

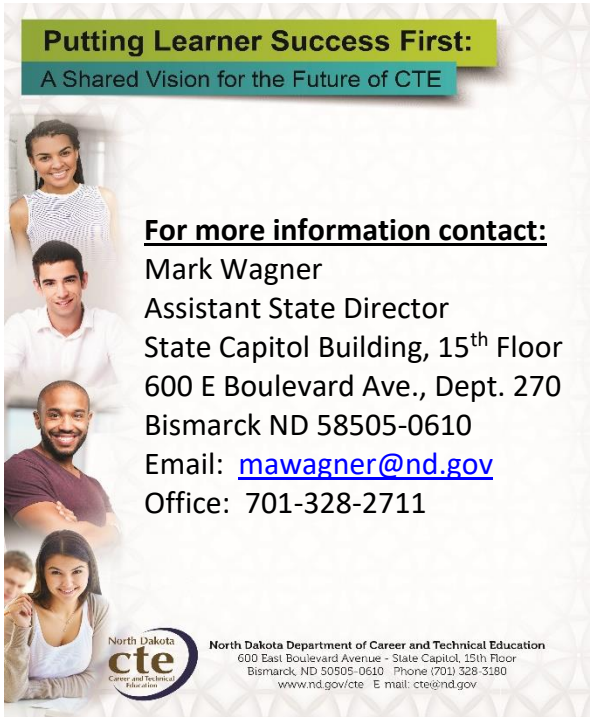


Key components to success

- Instructional Leader that is an expert in his/her field.
- Incorporating emerging technologies into the curriculum.

All the technology working together for the betterment of our students!

Allowing students to be able to attend Career Technical Education!

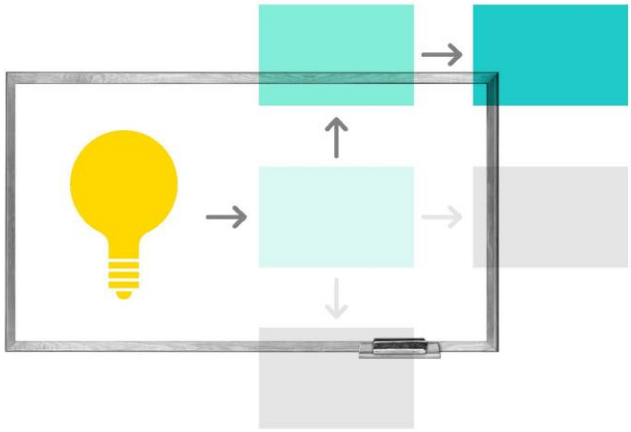


Appendix B: Scoping Your Digital Training Program

Submitted by General Assembly

SCOPING YOUR DIGITAL TRAINING PROGRAM

How to avoid delaying, reworking, or canceling digital training programs



INTRODUCTION

The scoping phase is an incredibly important, but frequently overlooked element of planning a digital training or transformation program. Program sponsors are bombarded with questions, opinions, and pressure to quickly move to launching a solution. We've found that underinvestment in scoping can result in dramatically longer time to launch programs, substantial rework, and often disappointing program outcomes *(See: Symptoms of Under-Investment in Scoping).*

This whitepaper describes what we've seen as consistent best practices in scoping across our 50 Fortune 500 clients.

Symptoms of Under-Investment in Scoping

- Launch date gets delayed as new stakeholders identified late in the process wish to weigh-in on program design
- Program needs substantial rework after launch as it is not aligned with other training or existing digital initiatives
- Program is cancelled or requires fundamental redesign as the right information was not incorporated in the program design
- Excitement and participation in program lags due to lack of business buy-in to the program
- Program results in no material achievements of business objectives

HIGH LEVEL PROGRAM SCOPING

There two things that training sponsors should keep in mind when answering questions for high level program scoping:

1. **Be as descriptive as possible.**
   For example: "Our objective is to improve our senior team's ability to quickly identify and act on the strategic implications of the consumer adoption of mobile devices" vs. "We want to help the senior team think more digitally."

2. **Be open to change through the design phase.**
   Thoughtful adaptation of these answers is very productive and entering the diagnostic phase without a strong hypotheses can leave the effort unfocused.

10 QUESTIONS

Leading organizations answer these 10 questions explicitly before jumping into program design:

1. **What is the objective of the program?**
   Getting consensus around a well defined program objective may be time consuming, but will be critical to reducing rework and delays in the design phase. Be as descriptive as possible ("We want to improve our ability to measure and maximize the ROI of digital campaigns by equipping our marketing team with a strong understanding of the KPIs of each social platform" vs. "We want to win in social.")

2. **What is the organizational context which is driving the need for the program?**
   Having a clear, consistent articulation of why this program is important, and why now, will help guide the tone of the program, and will be an important input into the communication plan.

3. **What will be the impact on our customers if this program is successful?**
   Outlining customer-related examples and objectives will provide a clear vision for the results and outcomes the training program will ultimately yield.

4. **What will be the impact on our organization and our employees if this program is successful?**
   How will we measure this? Measuring near term impact of training programs is challenging. Getting clear up front about how success will be measured will help you make decisions about pilot rollouts, identify when the program needs to be adapted, and will allow you to proactively address questions about training ROI and impact.

5. **How does this training program align with the company's business objectives and strategy?**
   Identifying training's role within broader business objectives will reinforce buy-in from various stakeholders and will empower participants to reach personal and organizational goals.

6. **Who are the key stakeholders that need to be involved? How will they work together?**

   Addressing the needs and roles of all necessary stakeholders upfront is critical to avoid reworking program design and pushing back the delivery date of training. By incorporating each stakeholder's input, you can ensure your program is aligned with existing digital and training initiatives.

7. **Which broad audience should this transformation focus on?**

   Identifying which high-level audience will have the largest impact on your organization's transformation will help identify the specific teams and stakeholders that should be included in your training initiative. Identifying specific participants without addressing the high-level audience involved in your transformation can lead to reworking of program design to fit broader objectives.

8. **What other initiatives or learning programs need to be considered when designing and delivering this program?**

   Synchronization across existing programs and initiatives is critical to avoid redundancy and/or contradiction. Programs that account for existing initiatives will help build buy-in across stakeholders, provide consistent messaging to training participants, and reinforce your organization's goals.

9. **What is the desired timing and sequencing of the transformation?**

   Defining the timeframe of your organization's transformation will help identify an appropriate delivery date for your training program. To avoid clashing initiatives, it is important that new learnings and objectives that your training program produces fit into the broader timeframe of your organization's transformation.

10. **How many resources and what budget can be committed to this program? What is the process for budgetary and resource approval?**

    Getting a clear picture on your budget is critical for defining your program's participants, external training partners, and internal resources that will inform curriculum. Additionally, preemptively exploring processes for budget approval is necessary to ensure that the necessary time is allotted leading up to your desired delivery date.

Looking for a template to help you quickly outline answers to each of these questions? Click here for our Scoping Phase Canvas Document.

FUTURE STATE MAPPING

After completion of the High Level Program Scoping, and before jumping into detailed discovery or design, we recommend creating a hypothesis of the next level of detail for the program objectives. When doing this, we'd suggest using our Future State Mapping Template and considering the following 2 dimensions:

Audience

Before beginning program design, consider the following two questions:

1. **What audience needs to be engaged to achieve the program objectives?**
   Digital initiatives often involve a number of stakeholder groups. For this reason, it' often important to think expansively about the audience that needs a new set of skills or capabilities to ensure the program has the desired business impact.
   (See Insert: Case Study — Expanding the Audience Group)

2. **How should the audience be segmented to enable effective program design?**
   For skills based programs (e.g., using hadoop for data analysis), participants can be cohorted based on need, level, or role. For mindset-driven, culture change, or programs focused on changing the way work gets done (e.g., implementing Agile), we typically see the highest impact from grouping participants based on "how work gets done". This generally results in a mix of participants from multiple roles and functions who work together on a week-to-week basis.

Training Objectives

For each audience segment, more detailed training objectives should be identified before diving into a formal needs analysis. Two factors should be considered during this process:

1. **Skills vs. Mindsets**
   In most cases, programs require a mix of mindset and skills focus to achieve desired impact: teaching someone how to use lean prototyping, without helping them understand why lean prototyping is effective is unlikely to result in impactful training.

2. **Role/Level-Based Objectives**
   Be clear about what you need each different audience to do after the program to achieve your business goal. For example, when trying to improve the user experience of digital products, you may need:

   - Senior leaders to understand *why* UX is important, *how* it fits into digital product design, and the basic principles of UX
   - Product managers to understand detailed principles of UX, be able to apply techniques related to: creation of personas, feature prioritization, customer interviewing etc.

Expanding the Audience Group

A global CPG client was looking to have their marketing teams better integrate digital tactics from the first stages of brand, budget, and campaign planning. After an initial pilot, it was identified that the finance department, who played a critical role in the budgeting and planning process, and the HR department, who oversaw talent acquisition and performance management, also needed to adjust their work flows to enable the marketing teams in achieving their goals. Programs were subsequently developed and deployed to the HR and Finance teams, which were rolled out in parallel to the marketing track of programs.

CONCLUSION

A thoughtful investment in the scoping phase will yield substantial return through the discovery, design, and delivery phases of your program or transformation.

For more information, please visit https://generalassemb.ly/corporate-digital-training or download one of our scoping templates below:

- Scoping Checklist
- High Level Scoping Canvas
- Future State Mapping Template

General Assembly's Corporate Training Team provides practical online and offline education for executives, marketers and sales teams to help large organizations succeed in the digital age. To find out more, visit generalassemb.ly/corporate-digital-training.

Appendix C: Presentation on the English Language Teaching Centre

Submitted by the Ministry of Education of Malaysia

The English Language Teaching Centre (ELTC) is primarily a training center under Ministry of Education (MoE) Malaysia for in-service English language teachers (ELT). There are currently about 40,000 ELTs in Malaysia's education system.

English as a subject area has always been at the forefront of teaching and learning innovations. In 2016, ELTC published an Operational Plan 2016-2020, which outlined several strategies and initiatives to engage teachers in professional learning and thus improve student outcomes. One such strategy is "online learning with a difference" - a 100% online learning strategy to improve proficiency, pedagogy, and technology. Previously, online learning primarily took the form of blended courses, either as 50/50 (online/face-to-face) or 80/20, depending on the type of course and its target group.

The development of the fully online courses was born out of necessity. MoE Malaysia needed to reach more teachers and encourage participation in online learning in more meaningful ways. Teachers, especially newly trained teachers, are increasingly using digital curricula in their teaching and learning. They needed pedagogical support as well as tools to help them to use different technological programs to enhance classroom practices.

ELTC further considered the current state of infrastructure and accessibility available at the school level throughout Malaysia. This covered connectivity, 1BestariNet, Chromebooks and other hardware, as well as smartphone devices. As such, teachers needed new approaches in leveraging these technologies for supporting their own learning and instruction.

The delivery of online courses required the use of a learning management system (LMS), which was selected based on two criteria: 1) Ease of creating online courses (the program's motto was that anyone can create) and 2) Ease of participation, i.e., any teacher can login and learn online. ELTC decided on Canvas LMS and is currently using the free version to deliver all of their courses. Canvas LMS is lecture friendly, and our ELTs have also found it to be very 'professional' and 'accessible'. This is due to the fact that lecturers did not need to create learning packages or go through extensive training, as compared to other LMS programs (e.g., Moodle). Having these programs stored on the cloud also meant that the course is available 24/7 without downtime. This accessibility is important, because unlike other organizations in MoE, ELTC does not have a technology specific department in managing learning management systems, since they are primarily made up of lecturers (non-ICT).

ELTC currently runs online courses which usually last 3 to 5 days. This is the first type of online courses:

1. Online courses averaging 3 to 5 days of online learning (8 hours per day)

   These courses cover literacy, fluency, grammar, and technology in teaching and learning.

However, the need to diversify online courses prompted ELTC to offer other types of courses. These types are:

2. Short online courses - 1 to 3 days of online learning (8 hours per day)

These shorter courses were developed out of feedback by teachers. They wanted shorter courses that are relevant to the specific technology they were using in their classrooms. One such course utilizes Google Classroom.

3. Micro-courses - 1 hour courses (1 hour per session)

Micro-courses are developed out of a need for teachers to fulfill training hours (required by MoE per year). These newer types of online courses are starting early 2019 as these require features which need integration into the delivery strategy. Two micro-courses are slated for 2019, *Teaching with Technology* and *Flipped Classroom.*

ELTC has partnerships with Google and Microsoft which gives us content and expertise for these technology courses.

As we are developing teacher learning as the way forward, our processes need rethinking and revising. Typically, teachers sign up for courses and after finishing the course, they gain a certificate of completion. To encourage teacher-efficacy and participation by implementing shorter courses, innovative credentials, like badges and digital certificates are helpful. Thus, innovations such as digital certificates are being developed as teachers need a verifiable way of ensuring their course completion is genuine. ELTC has developed a system which uses open source blockchains to generate immutable data that verifies the authenticity of the participant according to the database.

The other innovation ELTC is implementing in 2019 is the use of artificial intelligence (AI) in feedback. Feedback and analysis remain an important element in ensuring course improvement. ELTC is using AI to gather feedback and data analysis to illuminate the strengths and areas for improvement for all our courses. AI will be used for all courses in ELTC, not just those online.

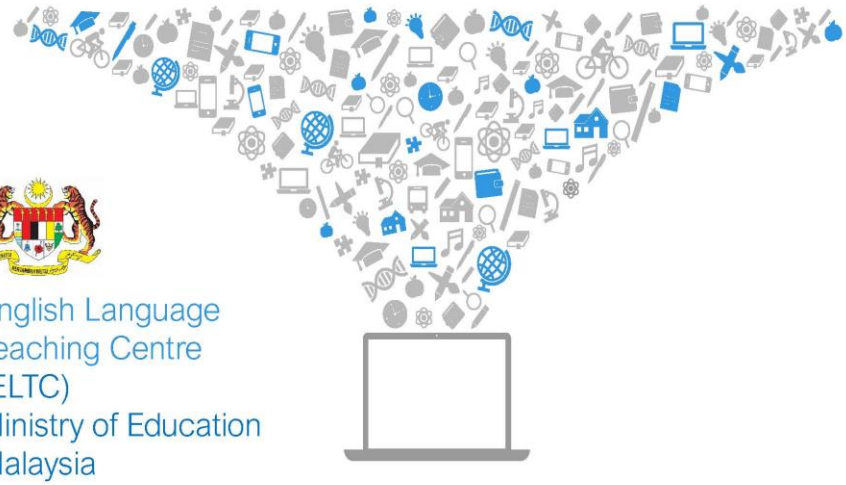
MoE Malaysia faces a few challenges in delivering online courses. First, there is no budget allocated for online learning. This is primarily due to the perception that online learning courses are ‘inferior’ to traditional courses (face-to-face) and becomes an option when there is no other alternative. At ELTC we strive to deliver quality online courses and do not consider quantity as a main driver. In doing so, we have a smaller catalogue, focusing on courses teachers have found particularly useful when used to support their classrooms. This requires identifying programs that are freely available without sacrificing quality.

Our next challenge is teacher adoption and participation. As mentioned, there are about 40,000 ELTs in Malaysia and many have been in the system for a long time. Online learning is a newer approach for MoE, and thus many teachers are unfamiliar with it. Participation in, for example, online forums, though mandatory, is often low. This stems from lack of familiarity or apprehension about how to participate online. Meeting these expectations can be difficult. Only through experiencing an online course will teachers become more adept to joining online courses.

Completion rates have been a persistent issue with online courses. One characteristic we have adopted for our online courses is that we give teachers an established time to complete a course. Even though courses may take 3 to 5 days, we provide teachers 3 weeks, which means that our facilitators have to ensure that teachers are on task, reminding them to complete the course within the allocated time.

Another important factor in getting teachers to participate in online courses is access to broadband (1Mbit is preferable). Additionally, teachers also must have a device which enables them to go online. These two pre-requisites must be met before any online learning can occur. Often, teachers in urban areas are able to meet these requirements, while teachers in rural areas struggle with this lack of online infrastructure.

Our last challenge is to ensure that teachers have the opportunity and access to high quality course curricula. Consequently, ELTC strives to identify and offer relevant courses. ELTC's focus will remain on quality, as further research and analysis is conducted to ensure our courses meet the needs of teachers in the classroom.



English Language Teaching Centre (ELTC) Ministry of Education Malaysia

'Engaging English teachers for professional learning'

Malaysia & ELTC

Location

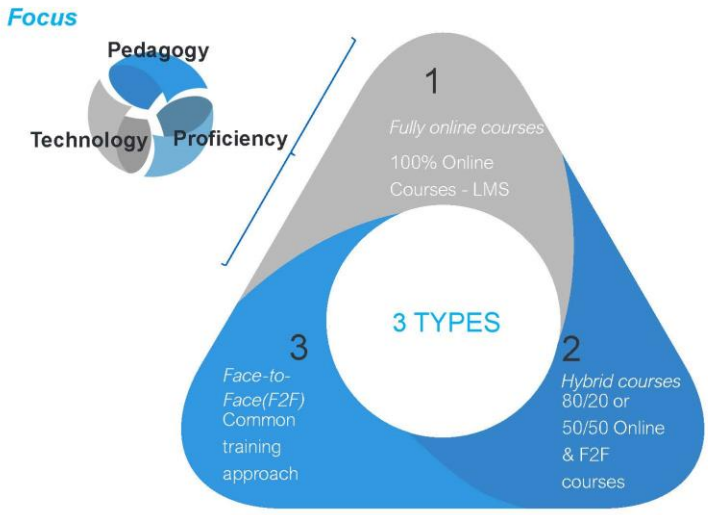
English Language Teaching Centre
Ministry of Education Malaysia
Kompleks Pendidikan Nilai
71760 Bandar Enstek
Negeri Sembilan

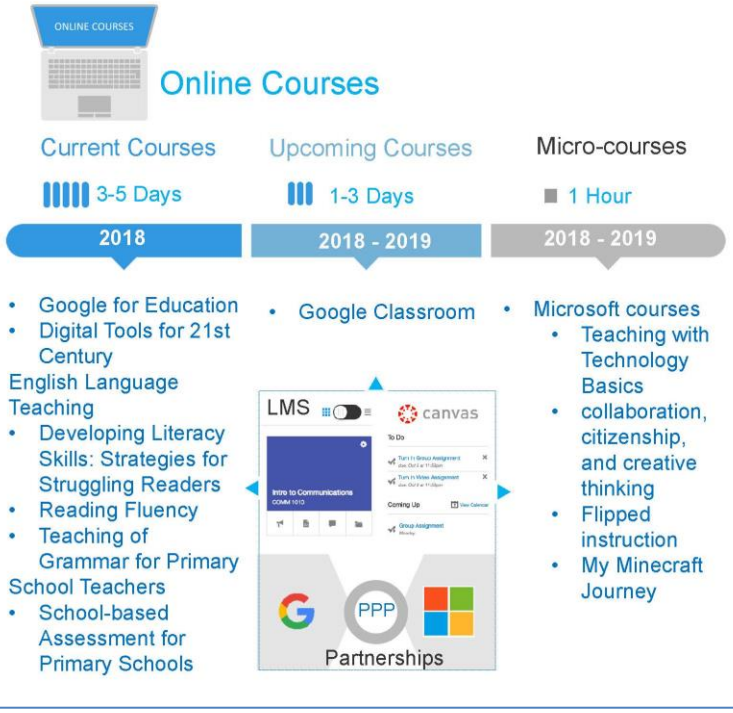
Quick Stats

English Language Teachers
39,908 (Primary & Secondary)

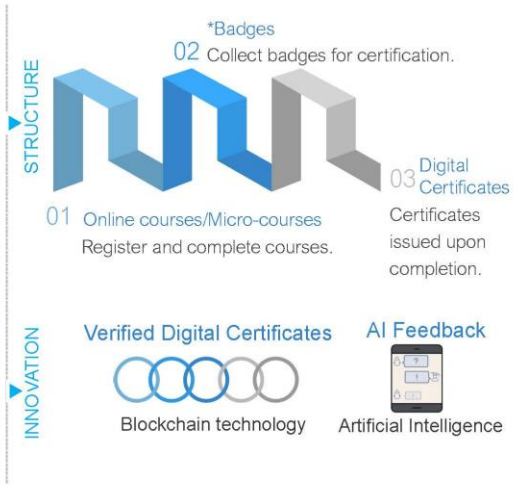
Connectivity & Devices
1BestariNet (Schools)
Chromebooks
Teachers
Broadband (Yes)
Smartphones

Teacher Professional Learning Strategies

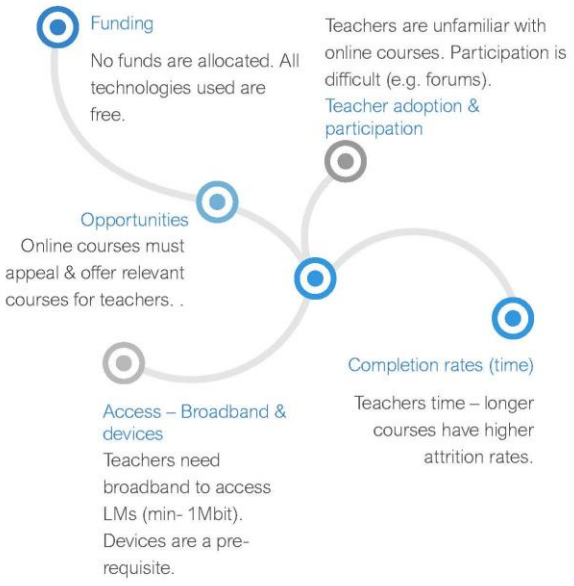




Current & Future Approaches



Teacher Professional Learning Challenges



Appendix D: Case Study on the North American Network of Science Labs Online

Submitted by the Western Interstate Commission on Higher Education

NANSLO

Providing online students with a web-based laboratory for conducting lab activities using high quality scientific equipment generating real data in real time.

NANSLO's Vision, Value, Validation . . .

https://youtu.be/znvQhNl2vMY

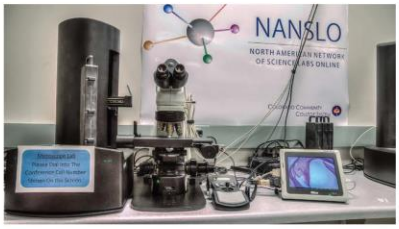
The North American Network of Science Labs Online (NANSLO), an international consortium of online science laboratories operated by accredited community colleges in the U.S. and Canada, provided online students with a way to conduct lab activities over the Internet between 2011 and 2016. During that time, over 2,000 online students in introductory science courses accessed the NANSLO laboratories to conduct lab activities with their lab partners in the vicinity and across the world. NANSLO, based at the Western Interstate Commission for Higher Education (WICHE), remains an exciting innovation and a model for providing online instructors and students with high quality science lab learning experiences despite having to close the laboratories in 2016 when its grant funding ceased. Many resources developed during its operations are still available today at www.wiche.edu/nanslo.

NANSLO Addressed Critical Student Access Issues

NANSLO provided a web-enabled laboratory environment that addressed the lack of access to high quality science lab experiences for online students, especially in rural areas. It also provided campuses with a solution to enrollment bottlenecks in face-to-face laboratories that can result in lower degree completion rates.

How NANSLO Worked for Faculty and Students

Faculty at institutions in Alaska, Colorado, Montana, South Dakota, Wyoming, and British Columbia created 28 science lab activities for introductory science courses and worked with the NANSLO team to develop them for remote delivery to their students. Faculty then used NANSLO's scheduling system to reserve blocks of time for their students to conduct lab activities and accessed a dashboard to review reports on their students' performance in NANSLO laboratories located at three institutions in Colorado, Montana, and British Columbia.



Students scheduled appointments online to conduct lab activities in a NANSLO laboratory at times convenient to them. They used a computer to connect to a NANSLO laboratory via the Internet at the selected appointment times. Via NANSLO's web-enabled control panels, these students manipulated buttons, dials, and visual panes to control robotics connected to scientific equipment. Sharing control of the NANSLO laboratory equipment among lab partners, students conducted assigned lab activities just as they would in a face-to-face laboratory.

WICHE
Western Interstate Commission for Higher Education

Students could view the equipment through the camera presets as it moved during the lab activities, generate and capture real-time data while discussing results with lab partners via teleconference. They could experiment with different settings on the equipment while brainstorming the impact of those changes and download high resolution images projected in the control panel display window for lab reports.

In this online collaborative environment, students actively engaged with their lab partners as each saw the same visuals streamed through the NANSLO viewing window and picture-in-picture capability. Using the scientific process, they interpreted, predicted, classified, modeled, and drew conclusions from what they saw, and also collected data. If they had a question, they could get instant assistance from NANSLO laboratory technicians.

> "The experience was more than satisfying and we [the student and her lab partners] were extremely pleased to be able to do this remote lab activity." – *NANSLO Student*

NANSLO's Value to Institutions

NANSLO's network of laboratories delivered a high quality laboratory experience for other institutions' expanding online student populations, saving them from investing in additional infrastructure – space, equipment, and faculty/laboratory technicians. NANSLO laboratories had the flexibility to serve more students than some traditional campus laboratories as they could easily configure and re-configure equipment for lab activities requested by faculty and quickly expand to the appropriate student capacity. By using one laboratory for multiple science disciplines versus face-to-face laboratory space dedicated to just one science discipline, NANSLO improved efficiencies. In addition, NANSLO could offer evening hours very popular with online students, especially those who work or cannot come to campus.

NANSLO's Value to Students

Students built *learning, communication, and innovation skills* as they used the scientific method. They communicated with lab partners while taking turns on the control panel, analyzed data to create lab reports, collaborated with lab partners to share ideas for creative problem solving, reflected on the activity and its expected and actual results, and shared hypotheses.

These students developed *Information, media, and technology skills* as they remotely accessed data and information for evaluation. Students learned to remotely control scientific equipment with computer interfaces and to generate and download data and high quality images. They also analyzed and drew conclusions from real information collected in real time.

These students also gained *life and career skills* by using an Internet-delivered method for completing lab activities that was flexible and adaptable to each student's needs. They performed lab activities with asynchronous direction from faculty and interacted with lab partners of diverse backgrounds. They managed their time in the online laboratories and completed the lab assignment without relying on faculty interaction, albeit they could get immediate assistance from NANSLO lab technicians.

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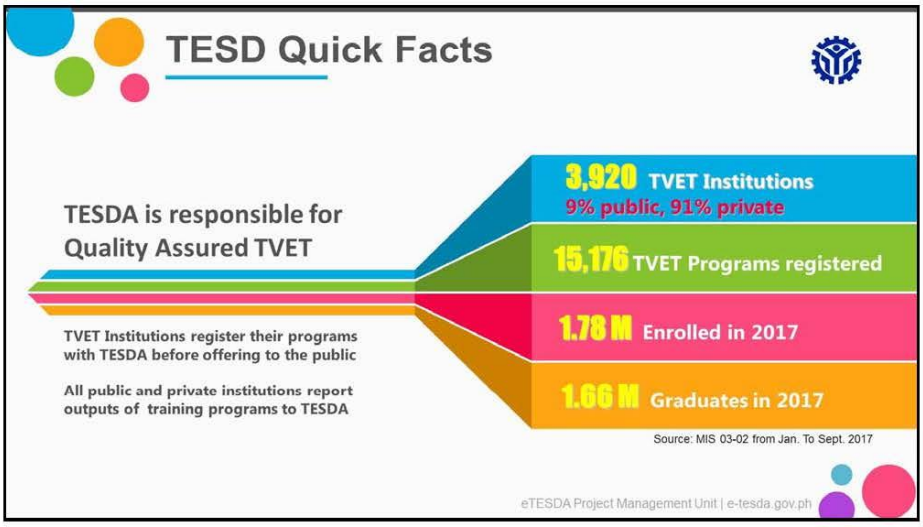
Appendix E: Selections from TESDA Online Program Presentation

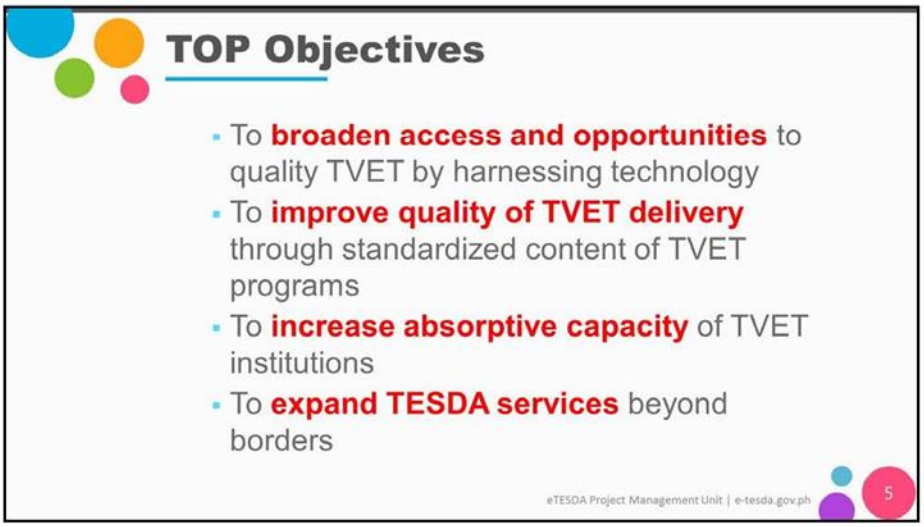
Submitted by the Technical Education and Skills Development Authority of the Philippines

The Philippine Technical Education and Skills Development Authority, or TESDA, is responsible for ensuring that the nation's technical vocational institutions provide adequate workforce development to all its citizens. This authority is responsible for assuring quality in Technical Vocational Education and Training programs, or TVET. This brief snapshot of the TESDA presentation from Webinar #2 on Content was included in this report as an example of the provision of digital learning platforms capable of reaching a broad portion of the public. The TESDA online programs are free, and therefore ensure that challenges of economic disparities, rural-urban divides, gender, migrant workers and refugees, and other groups facing structural barriers to access are being addressed. 2017 figures show 1.78 m enrollees in TVET programs, with 1.66 m graduates, out of a population of nearly 105 m. Addressing APEC's 2019 priority for greater inclusion of women and girls in career education, more than 62% of those enrolled are female. Digital TVET holds the promise of broadening access to more of the Philippine population by harnessing scalable technologies of online instruction, increasing the absorptive capacity of vocational institutions, and expanding services beyond existing borders. Reaching beyond the Philippines, nearly 23% of TESDA users are international, including overseas Filipinos in the US, Canada, Hong Kong, China and Singapore, all APEC members.

The TESDA online program concept seeks to utilize online platforms such as Massive Open Online Courses (MOOCS) to reach as many citizens as possible. Courses offered allow students to practice particular skills that are intrinsic to different career pathways in sectors such as agriculture, entrepreneurship, healthcare, information tech, and training. Within the APEC region, TESDA's approach thus serves as a viable example for digital learning initiatives that place an emphasis on mastery of specific skillsets free of charge for those seeking to be hired more directly in particular industries.


TESDA Online Program
eTESDA Project Management Unit
www.e-tesda.gov.ph


TESD Quick Facts
TESDA is responsible for Quality Assured TVET
TVET Institutions register their programs with TESDA before offering to the public
All public and private institutions report outputs of training programs to TESDA
3,920 TVET Institutions
9% public, 91% private
15,176 TVET Programs registered
1.78 M Enrolled in 2017
1.66 M Graduates in 2017
Source: MIS 03-02 from Jan. To Sept. 2017
eTESDA Project Management Unit | e-tesda.gov.ph


TOP Objectives
To broaden access and opportunities to quality TVET by harnessing technology
To improve quality of TVET delivery through standardized content of TVET programs
To increase absorptive capacity of TVET institutions
To expand TESDA services beyond borders
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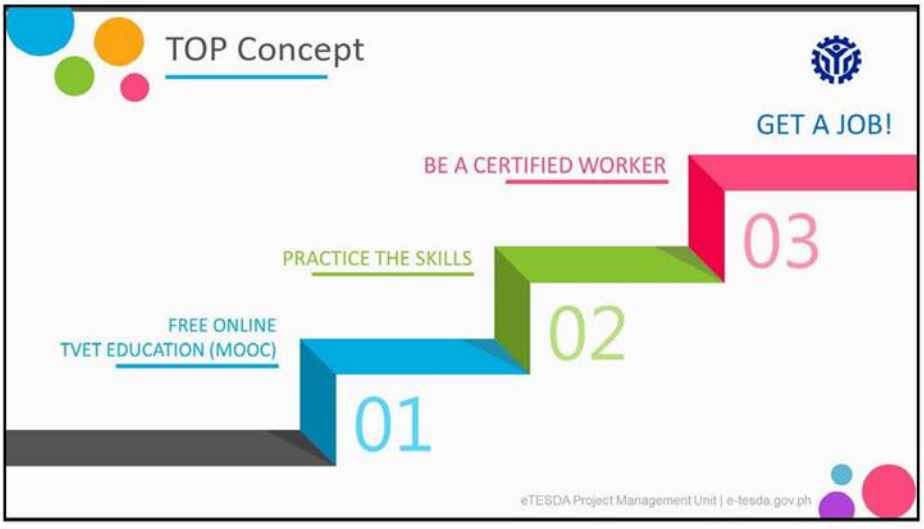
5


TOP Concept
GET A JOB!
BE A CERTIFIED WORKER
03
PRACTICE THE SKILLS
02
FREE ONLINE
TVET EDUCATION (MOOC)
01
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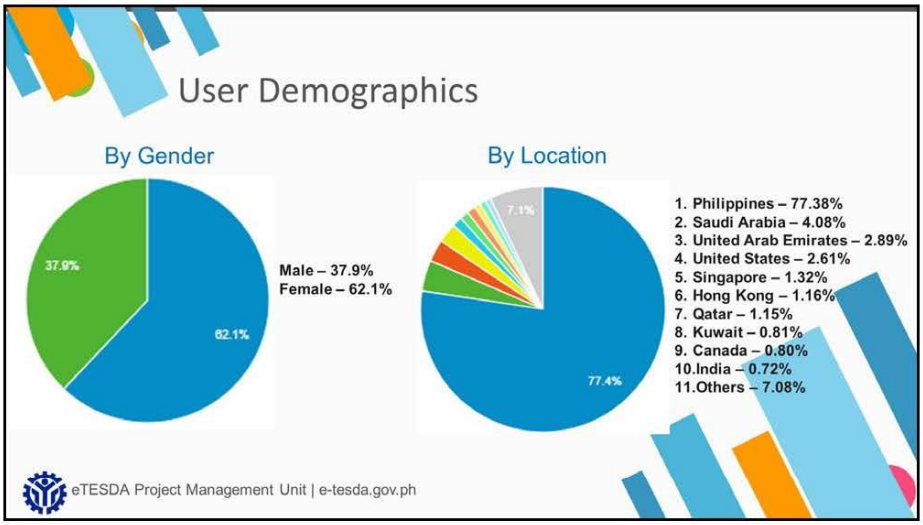
User Demographics
By Gender
37.9%
62.1%
Male – 37.9%
Female – 62.1%
By Location
7.1%
77.4%
1. Philippines – 77.38%
2. Saudi Arabia – 4.08%
3. United Arab Emirates – 2.89%
4. United States – 2.61%
5. Singapore – 1.32%
6. Hong Kong – 1.16%
7. Qatar – 1.15%
8. Kuwait – 0.81%
9. Canada – 0.80%
10.India – 0.72%
11.Others – 7.08%
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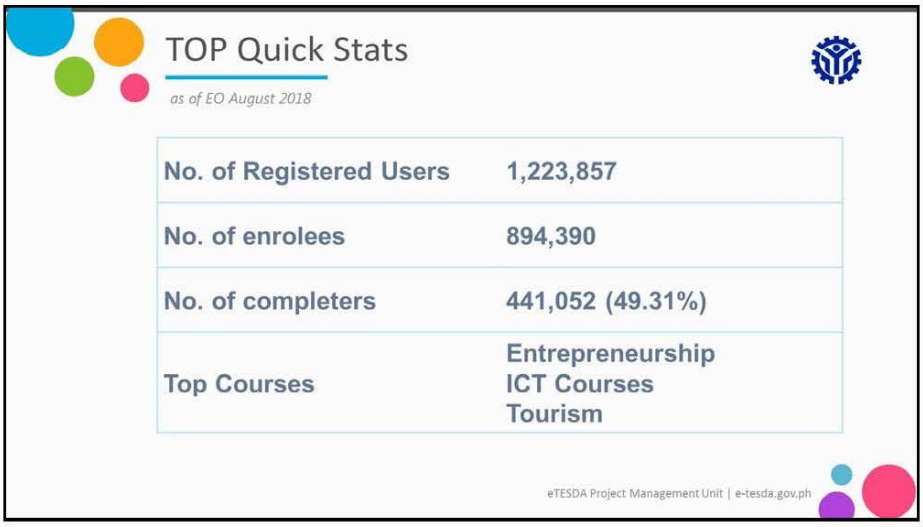
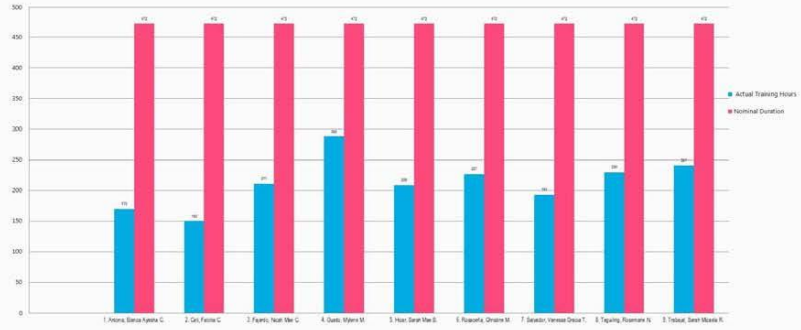

TOP Quick Stats
as of EO August 2018
No. of Registered Users 1,223,857
No. of enrolees 894,390
No. of completers 441,052 (49.31%)
Top Courses Entrepreneurship
ICT Courses
Tourism
eTESDA Project Management Unit | e-tesda.gov.ph

2. Use of the TOP in Blended Learning: Case of the TESDA Women's Center



Findings

- **Training duration was reduced to more than 50%**
  - *Number of training hours spent by the trainees show that on the average, the trainees spent **213 hours or 26.6 days (46%) only** to complete the Blended Food and Beverage Services NC II **compared to 472 hours or 3 months** nominal duration of the regular Food and Beverage Services NC II.*
- **Absorptive Capacity increased by 150%**
- **100% Certification Rate**

Appendix F: Selections from the Quality Assurance of Online Learning Toolkit

Submitted by the Tertiary Education Quality and Standards Administration, Australia Department of Education and Training

With the rapid expansion of online courses, ensuring that quality standards are met is both practical and critical to ensuring that they benefit their users, ensuring that citizens' economic mobility and education do indeed demonstrate a positive correlation. Australia's framework draws on the combined efforts of stakeholders in government and academia within 13 APEC economies and led to the drafting a Quality Assurance of Online Learning Toolkit in 2017.

This report includes Australia's toolkit insofar as it adopts principles of quality that cut across a majority of member economies, and therefore can serve as a resource for APEC countries seeking to learn and benefit from programs in career education that are at more advanced levels when it comes to workforce readiness. The toolkit divides this into several different domains. This starts with the investment in an innovative culture that permeates the staffing development and leadership culture of the participants involved. Following this, there is the need for committed student engagement, providing resources that allow their experience and support in training for new careers to be encouraging and sustainable. Students' belief that they are adequately supported in their online development is critical in this regard. The result of these efforts is a stronger performance by both students and teachers, made possible by the curriculum design. The principles informing this design include the interactive learning experience, demonstrable learning outcomes of the students, and a thorough assessment and evaluation of the program. This toolkit features design principles that are featured for developing online courses accessible to educators seeking to develop professional courses and training modules.

Australia's toolkit articulates in considerable detail the principles of quality curriculum design. As a case study of exemplary educational approaches within APEC, Australia's toolkit approach integrates prior case studies of educational practice, learning resources, and examples that distance learning designers and managers can use and adapt for their particular curriculum foci and learning goals. Case studies featured in the toolkit include programs from institutions in Mexico, Indonesia, and Japan, and from Peking University, China, and several Australian universities.


Australian Government
Department of Education and Training
Tertiary Education Quality and Standards Agency
APEC
Asia-Pacific
Economic Cooperation
QUALITY ASSURANCE
of ONLINE LEARNING
TOOLKIT
September 2017

Introduction

This toolkit has been developed in response to the growth of online and blended education in higher education in APEC economies in the last decade.

This toolkit has been developed in collaboration with a wide range of stakeholders. In 2016, experts from government, quality assurance agencies and higher education institutions from 13 APEC economies gathered together at the APEC Quality Assurance of Online Learning Workshop to discuss and refine the draft toolkit. Further validation workshops were scheduled in Vietnam, Indonesia and Mexico in 2017. All of this feedback has been instrumental in preparing this document.

As online education methods grow and diversify, the need to ensure that these new forms of delivery support rather than reduce the value, quality and validity of higher education qualifications is important. Additionally, as the use of online technologies becomes more integrated into traditional teaching and learning, the need to recognise the outcomes of higher education regardless of delivery mode has become a priority.

In many economies, agencies are developing approaches towards the quality assurance of online and blended education. For some economies, online education remains on the fringe of systems that account for higher education quality. Other approaches consider online and blended learning within already established quality assurance systems.

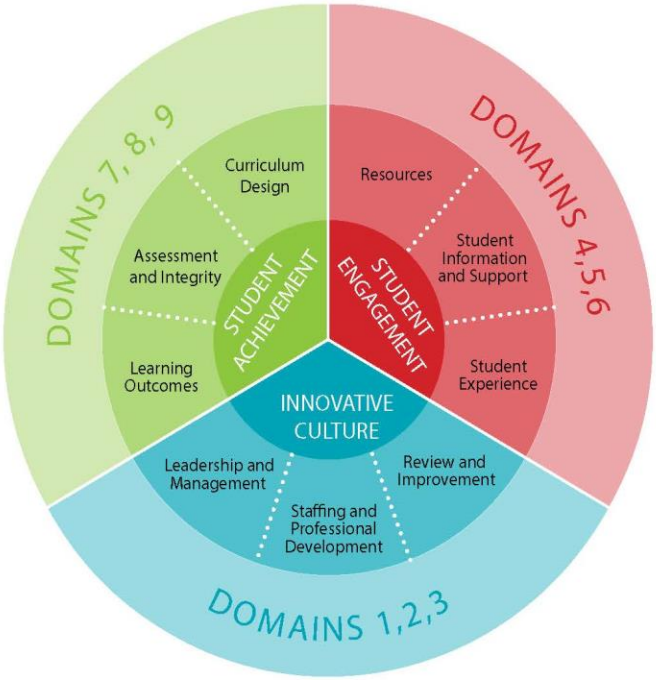
This toolkit supports an integrated model of quality assurance whereby each domain can apply to any mode of delivery. However, the toolkit provides an approach to the quality assurance of each domain that is specific to online or blended education.

Together, the domains represent a holistic vision of a 'quality culture' for online and blended education.

This toolkit is informed by current and emerging research into institutional practices for online and blended education. The quality of institutional practice is stimulated through external or regional quality assurance systems that recognise the specific approaches to assessing the standard of online and blended delivery.

A broad suite of frameworks, rubrics, assessment criteria, and systems for the quality assurance of higher education have also been considered in developing the toolkit. These include frameworks, like the following four domestic approaches, that assess online and blended programs, and others that assess programs regardless of mode.

Figure 1: Domains and their contexts



Source: Adapted from Ossiannilsson 2012

Quality domains

The domains (Figure 1) represent areas of institutional practice that quality assurance practitioners can assess in relation to the delivery of online and blended education. They represent distinct operational but interconnected facets of higher education practice that can be assessed by external agencies and integrated into internal institutional systems. The domains are consistent with findings from meta-analysis of quality models that showed most frameworks relate to three areas and six dimensions.

As the domains are generated from areas of institutional practice that in themselves do not have a hierarchical ranking, the domains should not be given a hierarchical order. That is, the domains are all equally important and the numbering in this toolkit is for ease of reference rather than an implied order or hierarchy.

Tools and resources

This toolkit includes a number of tools in the form of existing resources, examples and case studies, to assist economies to develop a consistent approach to QA online education. These are not intended to capture all available resources and may be added to over time. Further, an additional domain could be added that refers specifically to cultural and/or contextual issues of the economy utilising the toolkit.