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1. The context

Any organization’s knowledge transfer efforts are enhanced by blending traditional on-site or classroom models with virtual digital learning. The ISO Central Secretariat developed the DLS Toolkit to support ISO members in developing and implementing their own specific digital learning solution (DLS) strategy that should be tailored to meet their specific needs.

An DLS strategy should set out the vision, goals and plan for an organization to proceed with developing its digital learning solutions to meet the needs of the business and end users. It should focus on getting the right content to the right user at the right time through strategic planning of content creation, delivery and resources management.

The expected benefits an ISO member can achieve from implementing a digital learning strategy are: enhanced learning agility, improved population proficiency, a more comfortable learning experience, greater accessibility of skills and knowledge, and reduced cost. Furthermore, a 2021 study concluded that countries that invest in the replacement of their traditional teaching and learning processes with digital learning attain a greater vision of national competitiveness.

The ISO DLS Toolkit can become the starting point for the ISO member’s DLS strategy or support implementation of their strategy if one already exists.

The ISO DLS Toolkit Level 2 is intended for ISO members that have limited experience with digital learning. These members require a foundational understanding of the implementation details involved in rolling out a digital learning strategy.

Refer to Annex A for a glossary of terms, abbreviations and definitions.
2. Objectives and outcomes

The ISO DLS Toolkit aims to achieve the following two objectives:

1. Guide ISO members in implementing their own DLS strategy to support them in acquiring and applying the tailored knowledge they require.

2. Provide ISO members with suggestions on mapping instructor content to a shareable, living digital content library.

To accomplish these objectives, the toolkit will require particular attention to the following outcomes in terms of:

- **Learning agility**
  To enhance the resilience of learning capabilities and improve the achievement of learning outcomes by providing a blend of digitally enhanced delivery formats and time flexibility.

- **Learning proficiency**
  To improve the effectiveness and efficiency of knowledge transfer and application through better use of digital technology, microlearning and content curation.

- **Learning accessibility**
  To maximize the number of learners who have access to knowledge acquisition by optimizing the delivery method for the availability of digital technology, level of targeted skills and complexity of content.
Successful achievement of these outcomes relies on a five-step process of design, development and delivery of digital learning solutions. As illustrated in Figure 1, this process consists of the following steps:

→ **STEP 1:** Determine digital accessibility – The target audience will be surveyed to determine their level of access to digital devices, Internet bandwidth and proficiency with digital tools (e.g. video conferencing, digital learning platform, mobile applications).

→ **STEP 2:** Find the right delivery blend – Next, the results from the surveys in Step 1 become inputs into a high-level formula to find the right blend of self-paced, virtual classroom and face-to-face (F2F) delivery methodologies.

→ **STEP 3:** Develop/curate the learning content – With the right delivery blend in mind, the duration, scope and complexity of the learning activity (workshop, course or journey) will inform the development and curation of the required learning content and courseware. This step is subdivided into five sub-tasks.

→ **STEP 4:** Deliver the knowledge – The learning activity will be marketed, learners registered and preparation materials sent, and the workshop, course or journey will be delivered. This is the key step for **knowledge transfer**.

→ **STEP 5:** Measure the results – Finally, a follow-up will occur with learners after the activity to ensure that they perform their role as change agents and realize the desired outcomes and results from the learning activity. This is the key step for **knowledge application**.

This ISO DLS Toolkit is a roadmap to achieve the objectives, outcomes and implementation process outlined above.
Figure 1 – Five-step process of design, development and delivery of digital learning solutions
C. Coding + Programming

Resource
Emotional and Behavioural
Learnability

Design
App
UX
Visual
Usability
Web
UI
Project
3. Design, develop and deliver digital learning solutions

The design, development and delivery of DLS requires technology solutions that are ultimately implemented by people of various roles including a DLS manager, programme manager, DLS expert, instructional designer, digital platform specialist, subject matter expert (SME), instructor, media specialist, marketing communications specialist, IT technical support specialist, mentor, DLS librarian. Refer to Section 3, “Create DLS task forces”, in the Experienced (Level 3) document for a description of each of these key roles.
DLS task forces should be formed to implement a five-step process that is aligned with the Deming cycle (Plan-Do-Check-Act or PDCA) for the control and continual improvement of processes and products as follows:

- **Plan (P)**
  In Step 1 and Step 2 of the five-step DLS process, a DLS task force will plan digital learning activities by determining the digital accessibility of its audience, defining the scope of the content and designing the right blend of content delivery modalities.

- **Do (D)**
  In Step 3 and Step 4 of the five-step DLS process, multiple DLS task forces will execute the plan by developing content, curating specific learning activities in the digital learning platform and transferring knowledge via blended events.

- **Check (C)**
  Finally, in Step 5, a DLS task force will measure the results of its activities with focus groups, surveys, evaluations and learning analytics.

- **Act (A)**
  All DLS task forces will examine lessons learned and best practices from the “Check” step. This examination will inform adjustments to the DLS process, activities, content and platform.

The PDCA cycle starts again to ensure there are plans in place for continual improvement.
3.1 STEP 1 Determine digital accessibility

Digital learning is best for learners who:

- Come from geographically dispersed locations
- Have limited mobility and would face challenges attending in-person learning activity (this could include learners in conflict settings)
- Have limited daily time to devote to capacity building and would benefit from learning activities being split into shorter modules (i.e. virtual micro-learning)
- Have reliable access to the necessary technology and basic computer and Internet skills
- Appreciate learning at their own pace

**Digital access** is defined as the amount of Internet bandwidth and quality of digital devices available to access virtual content. It is critical to know the digital access levels of learners in the different regions to correctly blend the delivery of virtual and non-virtual content. Here, we define three surveys that will determine virtual delivery opportunities and obstacles for a learner country, region or specific learner group. The level of digital access will help determine the learning activity delivery blend described below.

- **A human-platform interaction technology survey** to determine hardware and software available to learners in different countries and regions. For example, will learners have access to phones, tablets, laptops, workstations or computer labs? What operating systems run the devices? Do learners have access to backup devices if one fails during a learning activity? How effective is tech support for the learners?
• **A digital access technology survey** to determine available network speed and stability for learners in different countries and regions. For example, what is the bandwidth and latency of networks where digital content will be accessed? Do learners have access to 3G, 4G, 5G, satellite or Wi-Fi? Are there data charges that will affect the user’s ability to complete the learning activity? Is the connectivity stable which is critical for synchronous activities? What is the latency between the platform delivering the content and the learner?

• **A digital content survey** to identify the priority of existing F2F workshops and courses that need to be converted to digital learning. A reasonable estimate of the required synchronous/asynchronous blend can be captured in this survey as per the blend formula described in Step 2 below. For example, an internal survey could be performed to determine which courses need to be transformed and at what priority for virtual delivery. This inventory will provide a framework for budgeting of resources for an overhaul of content conversion.

The process of task force assignment for determining digital accessibility begins with the DLS manager and programme manager who collaborate to write the questions for the three DLS surveys. DLS experts, instructional designers and digital platform specialists contribute to the surveys as well. Next, specific members of the DLS team conduct the electronic and telephonic surveys. Upon completion, the survey results are compiled and analysed by the DLS manager, programme manager and DLS experts.
3.2 STEP 2  Find the right delivery blend

Digital learning is a knowledge transfer approach that combines different modes of learning in an optimal delivery blend. Three primary content delivery methods can be blended to build the best digital learning solution:

- **Asynchronous** – Online, self-paced access to digital content and exercises. Asynchronous delivery requires remote access to a digital learning platform over a medium-grade broadband Internet connection from a smartphone, tablet or computer. In this DLS modality, instructors and mentors interact with learners in an ad hoc manner (i.e. eLearning).

- **Synchronous** – Online, instructor-led virtual classroom experience. Synchronous delivery requires remote access to a virtual classroom platform over a high-fidelity broadband Internet connection from a smartphone, tablet or computer. In this DLS modality, instructors interact with learners in real time as part of a scheduled learning activity (i.e. class, webinar, just-in-time coaching).

- **Face-to-face (F2F)** – In-person, instructor-led physical classroom experience. F2F delivery does not require any broadband Internet or digital devices. In this DLS model, instructors blend F2F classroom activities with asynchronous and synchronous modalities to achieve content mastery in a high-touch, interactive learning experience.

Blended learning is defined as a mix of any two or three of these modalities. For example, Virtual Instructor Led Training (VILT) hybrid courses consist of a 50/50 blend of asynchronous and synchronous modalities,
while Instructor Led Training (ILT) journeys lean heavily on F2F contact with an instructor (90%). See Figure 2 for more detail.

It is important to match the learning activity type to the desired competency outcomes and specific circumstances of the audience, content complexity and time frame. This is accomplished by finding the right delivery blend of asynchronous, synchronous and F2F content and exercises.

Table 1 below describes several typical learning activity types.

<table>
<thead>
<tr>
<th>Learning activity type</th>
<th>Definition</th>
<th>Async</th>
<th>Sync</th>
<th>F2F</th>
<th>Digital access</th>
<th>Dev effort</th>
<th>Human Contact</th>
<th>Proficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructor Led Training (ILT)</td>
<td>Classroom-based training with an instructor</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>--</td>
<td>Med</td>
<td>High</td>
<td>Mastery</td>
</tr>
<tr>
<td>Virtual ILT (VILT)</td>
<td>Instructor-led, online classroom</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>Great</td>
<td>Med</td>
<td>High</td>
<td>Mastery</td>
</tr>
<tr>
<td>eLearning</td>
<td>Self-paced learning supported by mentor</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Fair</td>
<td>High</td>
<td>Low</td>
<td>Competency</td>
</tr>
<tr>
<td>Webinars</td>
<td>Online, live, short learning event</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>Good</td>
<td>Med</td>
<td>Med</td>
<td>Awareness</td>
</tr>
<tr>
<td>Video podcasts</td>
<td>Online, short video instruction</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Good</td>
<td>Low</td>
<td>Low</td>
<td>Awareness</td>
</tr>
<tr>
<td>On-the-job training</td>
<td>Learning from mentors and eLearning during work</td>
<td>Med</td>
<td>Med</td>
<td>Low</td>
<td>Good</td>
<td>Low</td>
<td>Med</td>
<td>Competency</td>
</tr>
<tr>
<td>Just-in-time coaching</td>
<td>Detailed coaching from managers/trainers at work</td>
<td>Low</td>
<td>Med</td>
<td>Med</td>
<td>Good</td>
<td>Low</td>
<td>High</td>
<td>Mastery</td>
</tr>
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</table>

Table 1 – Typical learning activity types
Traditionally, ISO members have delivered different types of learning activities using the F2F delivery format. Now, with the growth of digital technology, they intend to expand their learning activity types into the virtual realm.

3.2.1 Digital learning delivery blend overview

Moving learning activities and course content from the physical classroom to a digital environment requires task force planning, a structured process and digital tools. In this section, the key variables for determining the right blend of digital delivery modes are discussed. These variables fall into two categories:

- **Scope** – To develop a DLS solution, one must define the dimensions (i.e. scope) of the learning activity. Scope includes two variables:
  
  a. Content complexity
  b. Content proficiency

- **Interactivity** – In addition, having better digital access and more contact time with instructors facilitates the delivery of learning content. There are two interactive learning variables that must be considered:
  
  a. Digital access
  b. Instructor contact

All these key variables feed into a graphical formula (see Figure 2) to determine the optimal digital learning delivery blend of asynchronous, synchronous and F2F modalities for each specific learning activity.

For example, typical short modules covering the high-level fundamentals of a given topic are well suited for self-paced eLearning using fair-quality broadband and little instructor contact. These learning activities rely heavily on the asynchronous delivery modality.

Longer, more in-depth blended courses require a higher level of instructor contact and digital access. These learning activities provide competency skills using a desired blend of asynchronous and synchronous delivery modalities.
Finally, traditional F2F journeys are ideal for complex topics that require mastery and a high level of instructor contact. These blended learning activities include very little asynchronous or virtual synchronous delivery. Instead, they rely almost exclusively on the F2F delivery modality. However, if in-person F2F instruction is not allowed or feasible, VILT (synchronous) is a good substitute. There is still a high level of human contact and select foundational topics can be taught with asynchronous pre-work in a blended modality.

With the adoption of digital learning solutions, F2F activities can be employed less often, more effectively and more strategically than before. One example is longer learning journeys where mastering certain skills requires a higher level of instructor contact.

Task forces should consider the scale of learning activities to be delivered within the DLS. This is a great point to prioritize content and build a shareable digital library for virtual organizations. The library could operate at a national level in the education system, or even manage content within an individual organization. If content compatibility is built into the DLS, then content can be shared with learners who would otherwise lack access to the knowledge transfer. A task force should discuss a business model where the value proposition is positive for all stakeholders.

### 3.2.2 Understanding blend variables: content complexity and proficiency

The first step in developing a DLS solution is defining the dimensions (i.e. scope) of the learning activity. Two key factors that determine this scope are content proficiency and content complexity.

**Content proficiency** is defined as how much knowledge is transferred to the learner and their desired level of competency once the learning activity is completed. Content proficiency correlates with content hours (seat time). Following are three levels of content proficiency that help to determine the right delivery blend for an activity:
• **Level 1 Awareness:** 1-6 hours of content
• **Level 2 Competency:** 7-24 hours of content
• **Level 3 Mastery:** 25+ hours of content

A desired proficiency level will guide the content curator / subject matter expert (SME) to estimate the number of resources that need to be moved from previous learning programmes/activities or developed from scratch. Further, the duration of seat time can be used to justify credit hours awarded towards a certification or digital credential.

**Content complexity** is defined as how many learning objectives (outcomes) are transferred to the learner during the learning activity. Following are three levels of content complexity:

• **Level 1 Easy:** 1-5 learning objectives
• **Level 2 Medium:** 6-20 learning objectives
• **Level 3 Hard:** 21-35 learning objectives

In most cases, content is not delivered all at once. Even a three-hour training session is likely to involve a break. As the curator builds the digital learning solutions strategy, it is helpful to categorize each learning activity in terms of scale – that is, combination of content proficiency and complexity. Following are examples of learning activity scopes categorized by content proficiency and complexity:

• **Module:** tiny learning activity (1-6 hours of content; 1-8 learning objectives can be achieved in a day)
• **Workshop:** small learning activity (7-18 hours of content; 8-24 learning objectives can be achieved in less than a week)
• **Course:** medium learning activity (19-24 hours of content; 24-30 learning objectives can be achieved in 2-4 weeks)
• **Journey:** large learning activity (24+ hours of content; 30+ learning objectives can be achieved in 2-4 months)
ISO members should test-drive Module and Workshop activities initially. A task force could define priority high-impact use case workshops that are already delivered F2F and port them to the DLS. This content can be seeded into the shareable DLS digital content library.

3.2.3 Understanding blend variables: digital access and instructor contact

In addition to content proficiency and content complexity, there are two interactive learning variables that must be considered: digital access and instructor contact. The assumption is that better digital access and more contact time with a human will facilitate the delivery of the learning content.

**Digital access** is defined as the amount of Internet bandwidth and quality of digital devices available to deliver virtual content. Following are three levels of digital access:

- **Level 1 Fair**: Learners have basic Internet access and a simple learning device (e.g. 3G/4G and a phone).
- **Level 2 Good**: Learners have stable Internet access and larger screen devices (e.g. Wi-Fi and a tablet/Chromebook).
- **Level 3 Great**: Learners have fast Internet access and access to a computer (e.g. broadband and a laptop/desktop).

**Instructor contact** is defined as the number of hours an instructor or mentor is involved in the delivery and support of content. This key determining variable drives the efficacy of learning by prioritizing content that requires human contact. Following are three levels of instructor contact that help you determine the right delivery blend for a learning activity:

- **Level 1 Low**: An instructor or mentor is not needed to transfer skills and the DLS will primarily be asynchronous.
- **Level 2 Medium**: An instructor or mentor is required for the delivery and support of some of the content and the DLS can be a blended asynchronous and virtual synchronous mix.

- **Level 3 High**: An instructor or mentor is required for the delivery and support of most or all the content, and the DLS learning activity can focus on F2F while still implementing asynchronous and virtual synchronous solutions, as needed.

### 3.2.4 Using a formula to find the right delivery blend

Once the scale of the DLS programme/activity is estimated in terms of **content complexity, content proficiency, digital access and instructor contact**, one can determine the appropriate DLS delivery blend. Figure 2 represents a graphical formula that breaks down these variables into categories to determine the ratios of asynchronous, synchronous and F2F delivery modalities (bottom of graphical formula).

The process of finding the right delivery blend is performed by one or more task forces that include the programme manager, DLS experts and instructional designers, who collaborate to prioritize all learning activities. Next, instructional designers, SMEs, instructors and digital platform specialists will form task forces to document the content scope and interactive learning variables for each of the learning activities. Upon completion, the programme manager and DLS experts will join the team and assist in finding the right delivery blend for each activity.
Scenario 1: E-Learning Module
- Content complexity = Easy
- Objectives = 3
- Content proficiency = Awareness
- Seat time = 3 Hours (Morning)
- Digital access = 1 (Fair)
- Instructor contact = 1 (Low)
- Delivery blend
  - Asynchronous = 95%
  - Synchronous = 5%
  - F2F = 0%

Scenario 2: VILT Hybrid Course
- Content complexity = Medium
- Objectives = 19
- Content proficiency = Competency
- Seat time = 24 Hours (3 Days)
- Digital access = 2 (Good)
- Instructor contact = 2 (Medium)
- Delivery blend
  - Asynchronous = 50%
  - Synchronous = 50%
  - F2F = 0%

Scenario 3: ILT Journey
- Content complexity = Hard
- Objectives = 32
- Content proficiency = Mastery
- Seat time = 42 Hours (Week)
- Digital access = 3 (Great)
- Instructor contact = 3 (High)
- Delivery blend
  - Asynchronous = 5%
  - Synchronous = 5%
  - F2F = 90%

Source: Praxis AI (www.prxai.com), Frank Alex Feltus and David James Clarke IV

Figure 2 – Graphical formula to determine the ratios of asynchronous, synchronous and F2F delivery modalities
**3.3 STEP 3Develop/curate the content**

Before developing or curating content for digital delivery, one must take a step back and look at the opportunities of teaching in a new light. It is important to consider how modern digital technology can improve learning and not simply map F2F instruction to a digital platform. A good DLS can make the current learning activity better than before.

Once the learning activity type and activity scope are understood and the desired delivery blend (synchronous to asynchronous) is optimized, one can begin to build the learning activity content. Building an effective online course requires more than just transferring existing classroom-based content into a digital format. One must decide how to transform that content in a way that will engage learners in the online environment.

As a guide for the construction of a DLS, the ISO member should implement an instructional design process built from the ADDIE (Analysis, Design, Develop, Implement, and Evaluate) model. In the model described in this section, existing content and learning objectives are first analysed and placed into a specific synchronous/asynchronous/F2F blended course design. Next, digital content resources, activities and assessments are developed or curated and implemented in the DLS platform. Finally, the DLS is tested, refined and evaluated for the intended blended delivery mode.
Step 3 is broken into **five sub-tasks** involved in developing and curating content for digital delivery (see **Figure 3**). The next sections discuss these five sub-tasks in detail.

---

**Step 3: Develop/curate the content**

- **Sub-task 1:** Design for digital delivery
- **Sub-task 2:** Develop/curate resources
- **Sub-task 3:** Develop/curate activities
- **Sub-task 4:** Develop/curate assessments
- **Sub-task 5:** Adjust learning activity content

---

**Figure 3** – Five sub-tasks of Step 3 for developing and curating content for digital delivery

### 3.3.1 Sub-task 1: Design for digital delivery

The first sub-task in preparing a learning activity for digital delivery is design. There is no need to begin from square one. Use the learning objectives and content from a current activity as a foundation for the online experience. Examine existing activities and content and make a note of key material to be retained, as well as areas that may be difficult to translate to the online experience. Start with a syllabus, if one exists. Consider how these materials may need to be revised, or whether they are even truly necessary for the online course/workshop. Using this analysis, build a high-level framework of the learning activity as follows:

- List and sort learning objectives into the order they will be delivered in the DLS platform.
- If possible, group the learning objectives into common topics to minimize content development. The content can be shared via DLS business plan.

This structure can then be used as a micro-learning architecture for the online content in support of the learning objectives.

Note: Design templates can be very valuable for organizing and moving content into the DLS platform. It is ideal to have templates ready for each design stage from resources to...
activities to assessments. They should be in a familiar format for the content curator (e.g. document, spreadsheet, JSON file) and be specific for the resources, activities and assessments to be developed or curated in Sub-tasks 2-4.

Refer to Annex B for examples of DLS design templates and the conversion process using real-world examples.

3.3.2 Sub-task 2: Develop/curate resources

Before building new learning resources, the content developer should perform inventory on what content exists that can easily be moved to a DLS. For example, one may have recorded videos that can be imported into the DLS immediately. Furthermore, other internal and outsourced SMEs may have accessible material that can be incorporated into the DLS with appropriate licensing agreements. Check if there are online videos or other web resources that have appropriate publicly available content. Once the “low-hanging” resources are inventoried, use a design template to:

- Assign the existing resources to the appropriate learning objective(s)
- Record the estimated time of delivery and the learning modality (asynchronous/synchronous)
- Determine how many more content hours need to be filled to deliver the learning activity
- Accommodate the optimal asynchronous/synchronous blend (determined with the blend equation from Step 2)

At this point, the learning activity is defined and the content developer knows how many remaining seat time hours need to be filled with content while maintaining the desired asynchronous/synchronous delivery blend. These hours can be assigned to learning objectives and balanced properly. A content development plan can be created with all remaining resource slots and allocated seat time for each resource. As one plans how the new specific resources will be developed, it is critical to keep two concepts in mind:

- **Multi-sensory delivery**: Mix content delivery types to activate specific learning styles of the audience (i.e. visual, auditory, reading/writing
and kinesthetic). Each learner employs a mix of learning styles for knowledge transfer and application. The dominant mix is unique for each person. To ensure engagement with each learner, the digital content must provide a variety of sensory resources and activities. Also, instructors must be trained to recognize that some learners may lag behind others because their unique learning style has not been activated or addressed.

- **Microlearning:** Break up the content into bite-size chunks. For example, break a 45-minute video into three 15-minute videos. Even better, drop one of the 15-minute videos and use the extra time to incorporate other content types.

Now that content exists, it can be inserted into the DLS platform.

Note: There is a learning curve for content curation that is specific to the digital learning platform. The content creator and/or curator will need to learn how to administer resources in that specific platform. They can then “train the trainers”. Further, it needs to be decided if the content creator inserts the content or if another resource is assigned to this sub-task – such as the instructional designer or digital platform specialist. This could lead to the creation of a new task force.

### 3.3.3 Sub-task 3: Develop/curate activities

Now that the content is organized and the learning resources are in the DLS platform, it is time to focus on making the learning activities as engaging as possible. This is especially important online because the instructor cannot see – and thus engage – with learners in person. That is why it is vital to find ways to make learning resources as personal, meaningful and interactive as possible. Fortunately, many digital platforms support interactive activities (known as “interactivities”) to enhance engagement.

**Learner-platform interactivities** in a DLS are where most of the “transformation” from traditional F2F to digital learning occurs. There are four levels of interactivities.
**Level 1: Passive** interaction with digital resources such as delivery of simple images, video and audio. Following are specific examples of Level 1 interactivities:

- **Video** – Record and share a personal video to introduce the instructor to the class and, if possible, invite learners to do the same. The instructor can also record videos to introduce or explain assignments.
- **Discussion** – Many online learning platforms have embedded discussion forums that you can leverage with the online class to spur participation and a sense of community. Use the frequency and tone of these activities to ensure all learners engage (the instructor may need to vary the tone and focus of each discussion activity to accommodate learner differences).

**Level 2: Limited** interaction with digital resources including animations, clickable features and video segments. Following are specific examples of Level 2 interactivities:

- **Interactive video** – Some online platforms and tools offer interactive video capabilities that can simulate real-world scenarios and offer immersive experiences for learners.
- **Interactive presentations and PDFs** – Classical presentations and PDF content can be paused so that learners can respond to tasks.
- **Assessment** – Some online platforms offer personalized learning based on pre-assessment. This can tailor the course to the learner’s existing strengths and weaknesses.

**Level 3: Moderate** interaction with digital resources such as animated video, customized audio, complex drag-and-drop interactions, and simulations. Following are specific examples of Level 3 interactivities:

- **Interactive exercises and simulations** – Other tools and resources online provide rich interactive experiences and simulations of realistic events.
- **Peer review** – If supported by the online platform, use peer review features in online assignments when possible. Evaluating the work of others is a powerful conceptual reinforcer and can strengthen bonds within the class.
- **Mentoring** – Allow for one-on-one mentoring experiences by using virtual office hours, live virtual coaching or asynchronous messaging tools.

**Level 4: Immersive** interaction with digital resources including virtual labs, interactive games, simulated job performance exercises, learner creation of customized audio or videos, and learner stories and scenarios. Following are specific examples of Level 4 interactivities:

- **Virtual labs** – If the content involves teaching science, math or information technology, virtual labs (e.g. Cloud-based desktops) offer opportunities for conceptual application as well as skill-based assessment with automated artificial intelligence (AI) powered grading.

- **Games** – Content can be presented in the form of games where learners must solve problems on their own that are relevant to the learning objectives.

Use the content-filled templates to load interactive activities into the DLS platform.

Deeper learner-platform interaction in an activity will encourage knowledge transfer. These activities are an opportunity to teach better. Simply because one is teaching F2F does not automatically mean one is being interactive, nor does it mean that digital tools are not effective to enhance instruction. A well-designed DLS can be more interactive by providing more engaging content and analytics and tools for learner-instructor collaboration. It is important that the DLS platform has the necessary features so that ISO members can achieve these benefits in the long run.
3.3.4 Sub-task 4: Develop/curate assessments

A final consideration is how the instructor will provide an assessment of learning. There are several types of assessments that can be captured in a template:

- **Knowledge checks and quizzes:** Many DLS platforms will allow learners to answer questions in multiple modalities, including multiple choice, fill in the blank, word matching, etc. A question bank template can be helpful in loading questions and answers into the DLS platform.

- **Video-based assessments:** A learner video allows for assessment of hard and soft skills. Videos can be assessed manually by an instructor or peers (even programmatically using AI in some DLS platforms).

- **Virtual lab assessments:** Virtual lab products can be assessed manually by an instructor or mentors, or, if the DLS platform permits, the products can be assessed automatically with code checkers and AI tools.

3.3.5 Sub-task 5: Adjust learning activity content

There is just one last step before releasing the learning activity to learners (or peer review). One must first test and refine the resources, activities and assessments before delivery of the online activity.

Testing is especially important for online courses since the instructor will not always be available in person, in real time, to address any issues learners may have in accessing and interacting with the learning content. A diligent, focused testing effort is vital to ensure a positive, engaging experience for each learner. Finally, it is necessary to obtain learner feedback on activities so that content refinement can be a continual process.

The ADDIE process of developing and curating the DLS content begins with the team (i.e. programme manager, instructional designers, DLS experts and SMEs) who collaborates to design the learning activities for digital delivery. At the same time, the digital platform specialists consult with specific members...
of the DLS team to configure the digital learning platform for
blended content deployment.
Once the design, platform and asynchronous content are ready,
the core content team (i.e. instructional designers, SMEs and
digital platform specialists) uploads the learning resources,
activities and assessments into the digital learning platform.
Upon completion, the digital learning activities are tested and
refined by the extended content team (i.e. programme manager
and DLS experts).
3.4 STEP 4  Deliver the knowledge

Once the optimal delivery blend has been determined and the content has been developed/curated, knowledge transfer can begin. This is where the rubber meets the road. It is imperative to match the digital learning platform capabilities to the optimal delivery blend and learning activity type(s).

**Ideally, the delivery blend, level of content interactivity and learning outcomes should drive the digital learning platform selection – not the other way around.**

The digital learning platform is only the beginning of the knowledge delivery step. In addition, one must onboard the digital learning solution with learners, instructors and champions.

### 3.4.1 Digital learning platforms

New modes of digital learning delivery are emerging, with Netflix-style on-demand digital content allowing for “anytime, anywhere self-learning” and interactive, synchronous virtual classrooms. The ISO DLS requires a digital learning platform that provides learning agility, proficiency and accessibility that match the needs of the ISO member stakeholders.

The digital learning platform must leverage the strengths of experiential, informal and formal learning methodologies:

- **Experiential:** Virtual labs, simulations and video practice engage learners and validate their skills at scale.

- **Informal:** AI-powered interactive tools increase learner engagement and empower learners to take control of their own learning experience.
- **Formal**: Structured programmes align learning with objectives and outcomes to provide insights into individual and enterprise-wide skills.

There are several digital learning platforms with strengths in each of these three areas. In terms of formal learning, the Learning Management System (LMS) is an excellent platform with robust, structured learning tools and features; yet this type of system lacks the collaborative features and user interface geared for today’s modern learner. For informal learning, several new social video collaboration platforms have garnered much attention; however, learning on these systems is too unstructured and not tied directly to learning outcomes.

To optimize the learner experience, a new category of digital learning platform has emerged called a Learning Experience Platform (LXP). The LXP integrates the structured strengths of formal learning with the social, empowering benefits of informal learning. LXPs are typically hosted in the Cloud by the commercial provider, so the internal resource and cost requirements are low. Also, LXPs typically include the synchronous virtual classroom and collaboration capabilities required by blended workshops, courses and journeys.

It is imperative to match the features of the digital platform to the requirements of the learning activities. There is no one-size-fits-all platform. There are several factors that contribute to the decision of which digital learning platform to choose for any given learning activity, including:

- **Features and benefits**: How extensive is the portfolio of features for learners and administrators? How well do the platform capabilities match the needs of the audience, content, outcomes and optimal delivery blend?
- **Platform licensing cost**: How much does it cost to license the platform?
- **Effort to configure and support the platform**: What level of human effort and cost is required to configure and support the platform? Are templates and existing digital models provided to give a head start on content development?
• **Hosting and IT cost:** How will the platform be hosted? What type of internal or external resources will be required to install, manage and maintain the platform?

• **Intellectual property ownership:** Who owns the intellectual property (IP) of the learning content, delivery platform and DLS solution once the installation, configuration and development are complete? Most platforms (including commercial) allow authors to retain IP ownership of learning content.

Table 2 below compares the strengths of three different levels of digital learning platforms: bronze, silver and gold.

<table>
<thead>
<tr>
<th>Description</th>
<th>BRONZE</th>
<th>SILVER</th>
<th>GOLD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Features and benefits portfolio</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Platform licensing cost</td>
<td>Low</td>
<td>Medium/High</td>
<td>Low/Medium</td>
</tr>
<tr>
<td>Effort to configure, support platform</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Hosting and IT cost</td>
<td>High</td>
<td>Included</td>
<td>Included</td>
</tr>
<tr>
<td>Asynchronous support</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Synchronous support</td>
<td>Customization</td>
<td>–</td>
<td>✔️</td>
</tr>
<tr>
<td>Intellectual property ownership</td>
<td>Host</td>
<td>Commercial</td>
<td>Commercial</td>
</tr>
</tbody>
</table>

*Table 2 – Different levels of digital learning platforms*
Entry-level, open-source platforms provide a basic set of features with a very low licensing cost (free, in most cases). However, these systems require high levels of expensive configuration, customization and hosting. Standard commercial platforms provide more features but require higher costs in licensing and hosting. Premium platforms (such as LXPs) provide the greatest collection of features, support for asynchronous and synchronous learning activities, and convenient Cloud-based hosting.

Each digital learning platform includes a vastly diverse collection of features and benefits for learners and administrators. It is important to match the platform capabilities with the audience, content, outcomes and optimal delivery blend.

Following are a few of the most popular learner features of open-source and commercial platforms:

- **Modern User Interface (UI)** – The digital learning platform will deliver interactive content to learners via a web browser on computers, tablets and mobile phones. Navigation will be managed by a structured course dashboard and calendar. More advanced commercial platforms (LXP and some LMS systems) support a responsive, customizable UI and role-based journey selection.

- **Collaboration and virtual classroom** – Learner collaboration with peers and instructors/mentors will be supported with online discussion forums and wikis. More advanced commercial platforms support additional levels of collaboration with group projects and synchronous virtual classroom.

Note: Most large blended courses and journeys require synchronous virtual classroom capabilities from the digital learning platform.

- **Experiential learning** – Immersive Level 4 interactivities require advanced, hands-on simulations, virtual labs and video assessment. These online, digital capabilities call for advanced commercial platforms.

- **Assessment** – One of the foundational capabilities of all digital learning platforms is assessment. Most systems support knowledge-based
quizzes while more advanced commercial platforms add experiential assessment and adaptive personalized learning paths.

- **Mentoring and messaging** – The digital learning platform will support communications between learners, mentors and instructors with notifications and posts in an integrated mentoring system. More advanced commercial platforms add event-based nudging based on performance analytics and thresholds.

- **Gamification** – Learner engagement can be dramatically improved with the addition of points, grades and healthy competition. More advanced commercial platforms enhance engagement with other gamification features, including leader boards, digital badges, credentials and recharging.

- **Learner dashboard** – Activity tracking and dashboard-level analytics are important to guide learners as they matriculate through learning activities. More advanced commercial platforms support resource-level analytics, skills gap analysis and ePortfolios.

Refer to Annex C, Section 1 in the Experienced (Level 3) document for a detailed breakdown of typical learner experience capabilities.

Following are a few of the most popular **administrative features** of open source and commercial platforms:

- **Authoring/composing** – All digital learning platforms provide some level of course authoring, themes, multilingual support, bulk course creation and plug-ins. More advanced commercial platforms expand authoring capabilities with AI-powered curation, templates, context-sensitive support and customizable branding.

- **Learner management** – User registration, batch enrolment and education records are standard capabilities of all digital learning platforms. More advanced commercial platforms support premium profiles, social learning and ePortfolio management.

- **Performance analytics** – All digital learning platforms include a baseline level of reporting and analytics, including usage and activity at the course
and site level. More advanced commercial platforms expand analytics to include business intelligence and heuristics.

- **Scorebook/gradebook** – Scoring and grades are foundational capabilities for all digital learning platforms. More advanced commercial platforms support peer feedback, group projects, AI-powered scoring, rubric management and experiential assessment.

- **Security** – Authentication, privacy, encryption, security updates and role-based permissions are critical elements of all digital learning platforms. More advanced commercial platforms support FERPA standards, data export provisions and information security standards.

- **Messaging and notifications** – All digital learning platforms include a baseline level of messaging and notification for communications between learners, instructors and mentors. More advanced commercial platforms allow administrators to set thresholds for event-based nudging and proactive problem resolution.

- **Interoperability** – All digital learning platforms include some level of interoperability and integration with other platforms and learning tools, including SCORM, xAPI, and LTI standards. More advanced commercial platforms support SAML multi-platform content integration and iFrame interface delivery.

Refer to Annex C, Section 2 in the Experienced (Level 3) document for a detailed breakdown of typical administrative experience capabilities.

The digital learning platform can be hosted in two ways: on-premises or in the Cloud. On-premises solutions require extensive IT resources to install, manage and maintain the required application servers, content repositories and databases. Cloud-based solutions outsource these activities, but there is a monthly cost associated with the service. A task force that includes instructor “end users” should discuss if a Cloud, on-premises or hybrid solution best fits the ISO member’s needs. Further, the task force can decide on a full implementation of the DLS or a crawl-walk-run strategy for one or more platform options.
Regardless of the hosting methodology, all communications within the platform or between platforms will need to be secure and encrypted. Furthermore, the system must adhere to strict accessibility regulations, data export provisions and information security standards.

Refer to Annex C, Section 3 in the Experienced (Level 3) document for a high-level summary of the IT security features and hosting information required of modern digital learning platforms.

3.4.2 Onboarding the DLS

Successful onboarding of the digital learning solution itself is essential to the delivery and application of learning outcomes and results. It is a roadmap of marketing and enrolment for all the critical DLS players, including senior managers, instructors, instructional designers, mentors and learners. This activity occurs after onboarding the DLS strategy and before launching each learning activity. See Section 5, “DLS change management” of the Experienced (Level 3) document for more information.

Once the ISO member stakeholders are on board and all critical players have been trained, it is time to launch the learning activities themselves. In Phase 1, one should consider starting with 2-3 pilot workshops/courses and gathering relevant feedback before scaling to a larger implementation.

The DLS launch involves three activities:

- **Marketing** – It all starts with communications, excitement and mindshare. Spread the word! Make a plan to get the news out about how knowledge transfer with a DLS can be more effective than traditional learning methods. Promote the value. Marketing can take several forms including e-mail, external websites, web pages, physical posters, international events and existing newsletters.

- **Enrolment** – The ISO member will use the same enrolment mechanisms for a DLS as for traditional workshops and courses, or it will implement a new one. Digital learning has a flexibility of scale that will allow the support of much larger class sizes. Also, DLS activities can accommodate learners from geographically dispersed populations. This presents
a wonderful opportunity for collaboration between ISO member stakeholders that did not exist in traditional, F2F, location-based activities, thus paving the way for a shareable digital content library.

• **Delivery** – Ultimately, the purpose of the DLS is to deliver knowledge transfer with interactive content via the digital learning platform. Another significant benefit of digital learning is the enhanced frequency of learning activities. For example, an ISO member can schedule DLS activities more frequently because instructors are utilized much more efficiently (i.e. no travel required). In fact, asynchronous workshops and courses can be run continually since no specific schedule exists. Additionally, member-specific versions of DLS activities can be created easily using the original workshop/course as a template. Of course, one cannot ignore the importance of follow-up to ensure knowledge application has occurred effectively. This is critical to determine the successful accomplishment of learning outcomes.
3.5 STEP 5 Measure the results

In the final step, a task force will complete the continual improvement process by checking the effectiveness of the digital learning activities and adjusting the specific DLS processes, content and platform to achieve the relevant training outcomes and objectives.

In Phase 1, a small number of learning activities will be delivered online. These activities will be assessed for effectiveness in Step 3, “Develop/curate the content”, and Step 4, “Deliver the knowledge”. This evaluation will provide lessons learned and best practices that can be used to enhance existing learning activities and improve the processes for developing and delivering future learning activities.

There are several models for learning evaluation and continual improvement. The key is to map the strengths of a given model to the specific needs and desired outcomes of the learning activity. In Step 5, a task force will evaluate three key elements of the digital learning experience:

- Learning activity development
- Knowledge transfer
- Knowledge retention

Each of these elements maps well to certain aspects of various learning evaluation models, including Kirkpatrick’s four levels of training evaluation, Kaufman’s learning evaluation model, Anderson’s value of learning model, and Brinkerhoff’s success case method.
3.5.1 DLS learning activity development evaluation

The ISO member shall evaluate the effectiveness and cost of digital learning activity development and delivery so that future learning activities can be built and delivered more efficiently. This element of DLS evaluation corresponds with Level 1 of the Kirkpatrick training evaluation model: “Reaction”. Reaction defines the degree to which participants find the training favourable, engaging and relevant to their jobs. Furthermore, Kaufman’s model of learning evaluation splits Kirkpatrick’s Level 1 into two priorities: “Input” and “Process”. Input evaluates the learning content and Process determines the quality of the learning delivery. A task force will discuss the appropriateness of these models to its needs. First, the content developers, curators and implementers will evaluate the learning activity development experience. Specifically, the SMEs, instructors and mentors will convene to perform the following measurement tasks that will provide for specific DLS adjustments:

- **DLS platform gap analysis**: A task force will identify features of the DLS platform that were well suited for the intended blend of delivery and those that may have been missing. This information can be collected in a survey or workshop proceedings.
  
  → **Action**: Add these requirements for selection of future DLS platform solutions.

- **Resource usage analysis**: The focus group will quantify how many person-hours were used to develop/curate the learning activities, any expenditures (including outsourcing) used during the transformation process, and how many hours were required to deliver each learning activity.
  
  → **Action**: These data can be averaged for each learning activity as a cost baseline to inform budgeting for future learning activity development. The result is a potential change in the delivery blend formula for one or more learning activities.
Second, a given instructor and technology personnel will evaluate the DLS delivery experience. Specifically, the instructors, digital platform specialists and IT technical support specialists will convene to perform task measurement that will provide for specific DLS adjustments:

- **Delivery technical gap analysis:** This focus group will respond to specific questions such as: What worked well and where were the pain points in delivery? Was the digital access assessment accurate? Were there unforeseen corrections made to the delivery process, for example to correct incompatible software or increase bandwidth? This information can be collected in a survey or workshop proceedings.
  
  → **Action:** If it is discovered that the accessibility survey did not provide accurate data, then the learning activity delivery blend can be adjusted for future learning activities. Further, gaps in perception of digital accessibility and the reality in the group can be conveyed to the learner group to see if technical adjustments are possible.

- **DLS platform cost analysis:** Data will be collected for person-hours used in installing the DLS platform, responding to learner and instructor support requests, and costs of hosting the platform.
  
  → **Action:** These data can be averaged for each learning activity as a cost baseline to inform budgeting for future learning activity hosting. Downstream analysis includes the correlation of blend mode with actual cost.

### 3.5.2 DLS knowledge transfer evaluation

The effectiveness of knowledge transfer is ultimately gauged by examining the learner. Thus, significant evaluations will be made for each DLS learning activity. This feedback will allow for specific learning activity adjustments during or after delivery. Also, this feedback will provide wisdom for the creation of future learning activities.

Knowledge transfer effectiveness is commonly measured by Level 2 of the Kirkpatrick training evaluation model: “Learning”. Learning defines the
degree to which participants acquire the desired knowledge, skills, attitude, confidence and commitment as a result of the learning activity.

Each of the metrics listed below contributes to measuring Kirkpatrick’s Level 2.

- **Learning activity enrolment** numbers provide insights on learners engaged in training. This number also tracks how many learners un-enrolled during training.

- The **number of learners passing and failing** the learning activity helps determine the quality of the content delivered.

- **Most viewed course materials** can be identified with DLS platform analytics that determine learner attention to the content. This will help identify which pieces of content learners liked and which content was effective.

- Tracking and analysing performance data in detail via **test scores and learner responses** will provide a better understanding of whether learners are retaining information well enough for them to apply it in life situations.

- The amount of **time spent in specific learning objective resources** of the learning activity will identify areas that are challenging to the learner.

- **Grouping high and low performers** will identify sub-groups that responded poorly to the learning activity.

- **Determining the number of assessment attempts** will identify difficult or poorly delivered content. If learners repeatedly retake assessments and have little improvement, this area should be investigated in more detail.

- **Tracking learner position** helps ensure the learning journey is heading in the right direction. If a learner falls behind in a journey, then this could be indicative that the learner is behind in understanding the content and may require special assistance.
3.5.3 DLS knowledge retention evaluation

Knowledge retention can be measured with skills and assessments after the learning activity has been delivered. High knowledge retention rates indicate that the learning activity is effectively teaching learners the new skills they must learn to improve their performance. After all, behaviour change and enhanced performance are the goals of most learning programmes. On the other hand, if learners do not remember what they learned, they will not be able to apply the knowledge in their workplace.

This element of DLS evaluation corresponds with Levels 3 and 4 of the Kirkpatrick training evaluation model: “Behaviour” and “Results”. Behaviour defines the degree to which participants apply what they learned when they are back on the job, including a measure of processes and systems required to drive the desired behaviour. Results defines the degree to which targeted outcomes occur because of the training, including leading indicators of behaviour change.

There are two mechanisms for follow-up evaluation:

- **Follow up testing**: Learners are asked assessment questions from the learning activity at specific intervals after training completion. These questions can be delivered remotely via online surveys or re-entry into the DLS platform.

- **Follow up interviews**: At specified times after the learning activity, learners are asked if they were able do their work more effectively, have stayed in the same position at work, received financial rewards (e.g. raises) or were given more work responsibilities, which is an indication of increased trust by managers.

In addition to the measurement tasks listed above, the ISO member can include a set of KPIs that can be used to measure the achievement of outcomes (i.e. the likely or achieved short-term and medium-term effects/results of a learning activity’s outputs) related to the digital learning activities.
Anderson’s value of learning model takes Level 4 a little bit further by incorporating the alignment between the learning activity’s goals and the strategic goals of the ISO member. Only when the goals are aligned can a learning activity’s results be accurately measured.

In many instances, we can learn as much from failure as success. The Brinkerhoff success case method approaches learning evaluation at a higher level by comparing success/failure stories from extremely successful activities to those that failed miserably. In evaluating these stark differences, one can discern valuable lessons to be learned and best practices for improvement.

One example of the Brinkerhoff success case method is the impact assessment survey. This survey is administered to learners 6-12 months after a learning activity is delivered. The goal of the impact survey is to document the impact the learning activity has had on each learner’s skills, job performance and behavioural or organizational change. With learning, the cause and effect relationship is not always clear. One must collect several case studies to accurately reflect the extent to which a learning activity has created the desired results (behaviour change) in the learners. Also, the results of the impact survey can be used to adjust and improve the learning activity itself.

That completes the five-step process for design, development and delivery of digital learning solutions. In this section, the processes, activities and tasks required to implement the Deming cycle (Plan-Do-Check-Act) for DLS control and continual improvement were detailed.
4. DLS change management

By applying the discipline of change management, the successful adoption of the DLS will increase dramatically. Change management is the combination of processes, activities and approaches that manage various stakeholders involved in the DLS initiatives and implementation during the transition phase from the old way of training to digital learning.

Change management should not focus only on evaluating reports to either take a decision or introduce a change. Change management is about communication and exchange, dialogue and questions, leadership and support.

DLS change management begins by onboarding all stakeholders and key players in the DLS strategy and five-step process for designing, developing and delivering digital learning solutions. Once everyone is on the same page, one can kick off the DLS learning activities using change management best practices for learners, instructors and managers.

The reader is referred to the Experienced (Level 3) version of the DLS Toolkit for a detailed discussion of DLS change management.
5. Conclusion

This Level 2 version of the DLS Toolkit outlined the five-step process of design, development and delivery of a digital learning solution, including Step 1, “Determine digital accessibility”, Step 2, “Find the right delivery blend”, Step 3, “Develop/curate the learning content”, Step 4, “Deliver the knowledge”, and Step 5, “Measure the results”.

For a deeper dive, the reader is referred to the Experienced (Level 3) version of the DLS Toolkit that covers or extends these additional advanced topics: DLS change management, DLS implementation, digital learning platform features and an onboarding training plan for the DLS Toolkit.

The successful implementation of a well-designed digital learning strategy in the 21st century will enhance learning agility, improve population proficiency, provide a more comfortable learning experience, elevate accessibility of skills and knowledge, and reduce costs.

List of annexes

- Annex A: Glossary of terms
- Annex B: Digital learning case studies
## Terms and abbreviations

<table>
<thead>
<tr>
<th>Abbreviated term</th>
<th>Description</th>
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<tbody>
<tr>
<td>3G/4G/5G</td>
<td>Mobile network communications standards used for access to DLS</td>
</tr>
<tr>
<td>ADDIE</td>
<td>Analysis, Design, Development, Implementation, and Evaluation (instructional design model)</td>
</tr>
<tr>
<td>AI</td>
<td>Artificial intelligence</td>
</tr>
<tr>
<td>APDC</td>
<td>ISO Action Plan for developing countries</td>
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<tr>
<td>DLS</td>
<td>Digital learning solution</td>
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<tr>
<td>DLSE</td>
<td>Digital learning solution expert</td>
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<tr>
<td>DLSM</td>
<td>Digital learning solution manager</td>
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<tr>
<td>DPS</td>
<td>Digital platform specialist</td>
</tr>
<tr>
<td>FERPA</td>
<td>Family Education Rights and Privacy Act</td>
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<tr>
<td>F2F</td>
<td>Face-to-face instruction</td>
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<tr>
<td>GSP</td>
<td>Good standardization practices</td>
</tr>
<tr>
<td>ID</td>
<td>Instructional designer</td>
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<tr>
<td>ILT</td>
<td>Instructor-led training</td>
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<tr>
<td>INST</td>
<td>Instructor</td>
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<tr>
<td>IP</td>
<td>Intellectual property</td>
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<tr>
<td>IT</td>
<td>Information technology</td>
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<td>Description</td>
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<tr>
<td>IT/S</td>
<td>Information technology support specialist</td>
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<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
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<tr>
<td>ISO/CS</td>
<td>ISO Central Secretariat</td>
</tr>
<tr>
<td>JSON</td>
<td>JavaScript Object Notation (data sharing file format)</td>
</tr>
<tr>
<td>LMS</td>
<td>Learning management system</td>
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<tr>
<td>LTI</td>
<td>Learning tools interoperability</td>
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<td>LXP</td>
<td>Learning experience platform</td>
</tr>
<tr>
<td>MCS</td>
<td>Marketing communications specialist</td>
</tr>
<tr>
<td>MEDIA</td>
<td>Media specialist (videographer/graphic designer)</td>
</tr>
<tr>
<td>PDCA</td>
<td>Plan-Do-Check-Act</td>
</tr>
<tr>
<td>PDF</td>
<td>Portable Document Format (file format)</td>
</tr>
<tr>
<td>PM</td>
<td>Programme manager</td>
</tr>
<tr>
<td>SCORM</td>
<td>Sharable Content Object Reference Model</td>
</tr>
<tr>
<td>SAML</td>
<td>Security Assertion Markup Language</td>
</tr>
<tr>
<td>SME</td>
<td>Subject matter expert</td>
</tr>
<tr>
<td>UI</td>
<td>User interface</td>
</tr>
<tr>
<td>VILT</td>
<td>Virtual-instructor-led training</td>
</tr>
<tr>
<td>WI-FI</td>
<td>A family of wireless network protocols used for access to DLS</td>
</tr>
<tr>
<td>XAPI</td>
<td>Experience Application Programming Interface (also “Tin Can”)</td>
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</table>
Annex B –
Digital learning case studies

One of the best ways to learn a new strategy or skill is through example. Case studies provide experiential guides for those looking to implement a digital learning strategy of their own. In this annex, we will explore the following three case studies:

1. Detailed case study: DLS course at Clemson University
2. Summary case study: Digital learning at LEGO
3. Summary case study: Digital learning at Henkel
1. Detailed case study: DLS course at Clemson University

In 2020, the COVID-19 pandemic forced colleges and universities around the world to teach their courses online. Instantly, digital learning became the new normal in higher education. Over the summer and fall of 2020, millions of teachers in higher education, K-12, and enterprise learning & development were forced to transform their courses online. Suddenly, these teachers found themselves wearing many hats: designing and implementing content, employing various teaching styles, juggling the needs of students and managing the virtual classroom. Teaching became a delicate balance between classroom facilitator, instructional designer, teacher and course developer.

One of these teachers, Prof. Frank Alex Feltus, rose to the challenge in the fall of 2020 and built a digital learning solution (DLS) for his bioinformatics course. This programme turned out to be critical during the pandemic as demand for science graduates skyrocketed. Through Prof. Feltus’ DLS, students acquired and applied the computational skills required to keep up with innovations in medical and agricultural research.

This case study follows Prof. Feltus as he employed the five steps of the ISO DLS design, development and delivery process to create and deliver his digital course.
1.1 STEP 1 Determine digital accessibility

Step 1 of the DLS design, development and delivery process focuses on the target audience. To determine their level of digital accessibility, Prof. Feltus met with the university technical staff and briefly surveyed the students to determine their level of access to digital devices, Internet bandwidth and proficiency with digital tools (e.g. video conferencing, digital learning platform, mobile applications).

It was determined that Clemson University students had a “great” level of digital access:

- **Human-platform interaction technology**
  All students had access to computers, tablets, and/or smartphones. Tech support was provided by the university.

- **Digital access technology**
  All students had fast and stable Internet access through their personal residences or shared university facilities.

- **Digital content**
  Prof. Feltus and Clemson University determined that all traditional F2F classes (Tuesdays and Thursdays at 8:00 am ET) would be delivered as remote synchronous sessions. This meant a “medium” level of instructor contact.
1.2 STEP 2 Find the right delivery blend

In Step 2 of the DLS design, development and delivery process, the results from the surveys in Step 1 become inputs into a high-level formula to find the right blend of self-paced, virtual classroom and face-to-face delivery methodologies.

During the summer of 2020, Prof. Feltus worked with several colleagues to match his learning activity type to the desired competency outcomes and specific circumstances of his students, content complexity and time frame (four months). Given these variables, he determined that a “virtual ILT course” was the best target activity type:

- Asynchronous – 45%
- Synchronous – 45%
- Face to face – 10%
- Digital access – Great
- Instructor contact – High
- Content proficiency – Mastery (35 hours of content)
- Content complexity – Hard (28 learning objectives)
Figure 1 represents a graphical formula that breaks down these variables into categories to determine the ratios of asynchronous, synchronous and face-to-face (F2F) delivery modalities (bottom of graphical formula).

**Figure 1 – Using the graphical formula to estimate the bioinformatics DLS delivery blend**
1.3 STEP 3 Develop/curate the learning content

Step 3 of the DLS design, development and delivery process is all about content. With the right delivery blend in mind, the duration, scope and complexity of Prof. Feltus’ course informed the development and curation of the required learning content and courseware.

During the content conversion process, Prof. Feltus took the opportunity to reinvent his traditional F2F classroom into a hybrid, interactive, virtual learning experience. Building an effective online course requires more than just transferring existing classroom-based content into a digital format. One must decide how to transform that content in a way that will engage learners in the online environment.

During the summer of 2020, Prof. Feltus used the ADDIE model to guide him through the five sub-tasks involved in developing and curating content for digital delivery (see Figure 2 below).

![Figure 2 – Five sub-tasks for developing and curating content for digital delivery](image)

1.3.1 Sub-task 1: Design for digital delivery

In Sub-task 1, Prof. Feltus jump-started his course design with a collection of online tools and an interactive workshop provided by Praxis AI entitled “Going Online: Teaching in the Virtual Classroom”.

The online conversion began with his existing syllabus (see Figure 3). This traditional class-based approach was rapidly converted to a microlearning taxonomy for ingestion in the digital platform. No more one-hour lectures, big labs and giant midterms. In building his online course, Prof. Feltus learned that he was trying
to squeeze too much content into one block – and it was difficult for his students to consume. Breaking content into smaller pieces made that process much more natural and supported the concept of multisensory diversity.

<table>
<thead>
<tr>
<th>Class</th>
<th>Date</th>
<th>Topic</th>
<th>Reading</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>23-Aug-18</td>
<td>Introduction to bioinformatics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>28-Aug-18</td>
<td>National center for biotechnology information (NCBI)</td>
<td></td>
<td>HW#1</td>
</tr>
<tr>
<td>3</td>
<td>30-Aug-18</td>
<td>Genome organization and evolution</td>
<td>03_Ekblom_Wolf_2014.pdf</td>
<td>Term project</td>
</tr>
<tr>
<td>4</td>
<td>04-Sep-18</td>
<td>Reference genomes; <em>in silico</em> hypothesis testing</td>
<td></td>
<td>HW#2</td>
</tr>
<tr>
<td>5</td>
<td>06-Sep-18</td>
<td>Genome comparison</td>
<td>05_Rogers_Gibbs_2014.pdf</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>11-Sep-18</td>
<td>Digital information &amp; programming</td>
<td></td>
<td>HW#3</td>
</tr>
<tr>
<td>7</td>
<td>13-Sep-18</td>
<td>Extracting gene knowledge with a genome browser</td>
<td>07_Mudge_Harrow_2016.pdf</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>18-Sep-18</td>
<td>Extracting gene knowledge from other databases</td>
<td></td>
<td>HW#4</td>
</tr>
<tr>
<td>9</td>
<td>20-Sep-18</td>
<td>Pairwise sequence alignment; BLAST algorithm</td>
<td>09_Dobin_etal_2013.pdf</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>25-Sep-18</td>
<td>Dynamic programming algorithm</td>
<td></td>
<td>HW#5</td>
</tr>
<tr>
<td>11</td>
<td>27-Sep-18</td>
<td>Multiple sequence alignment; PSSMs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>02-Oct-18</td>
<td>Hidden markov models; protein domains</td>
<td></td>
<td>HW#6</td>
</tr>
<tr>
<td>13</td>
<td>04-Oct-18</td>
<td>Structural bioinformatics; structure databases</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>09-Oct-18</td>
<td>Protein domain databases</td>
<td>14_Madej_etal_2013.pdf</td>
<td>HW#7</td>
</tr>
<tr>
<td>15</td>
<td>11-Oct-18</td>
<td>Protein structure prediction</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In Prof. Feltus’ new DLS architecture, modules became learning paths, topics became skills (include multiple objectives) and course materials were transformed into multisensory resources (e.g. readings, videos, activities, quizzes). Brain science supports the power of diverse learning styles: kinesthetic, auditory, visual. Prof. Feltus leveraged templates from the interactive workshop.

**Figure 3** – Existing bioinformatics syllabus defines content.
to build more multisensory diversity into his course resources and his students responded very positively. See Figure 4 for a description of the new bioinformatics DLS architecture.

<table>
<thead>
<tr>
<th>Learning Path</th>
<th>Skill</th>
</tr>
</thead>
</table>
| Introduction to bioinformatics| • Introduction to bioinformatics.  
                                | • Introduction to Linux  
                                | • Using Jupyter notebooks  
                                | • What is a genome and a gene? |
| Genome data mining             | • The human genome overview  
                                | • Ontologies: GO and SO  
                                | • National Center for Biotechnology Information (NCBI)  
                                | • *In silico* hypothesis testing |
| Sequence alignment             | • Pairwise sequence alignment  
                                | • Multiple sequence alignment  
                                | • Hidden Markov Models (HMMs)  
                                | • Genome comparison |
| Structural bioinformatics      | • Structure databases  
                                | • Protein domain databases  
                                | • Protein structure prediction  
                                | • Nucleic acid structures |
| Functional genomics           | • High throughput DNA sequencing  
                                | • RNA expression analysis  
                                | • ENCODE project  
                                | • Protein expression analysis |
| Systems biology               | • Introduction to systems biology  
                                | • Interaction databases  
                                | • Functional enrichment analysis  
                                | • Metabolic pathway analysis |
| Wrap-up                       | • Continuing your bioinformatics training  
                                | • Final assessments |

Figure 4 – High-level design for bioinformatics course broken into learning paths and skills
1.3.2 Sub-tasks 2-4: Develop/curate resources, activities and assessments

In Sub-tasks 2 through 4, Prof. Feltus turned his attention to the essential components of his virtual course – specifically the online resources, activities and assessments.

- Resources encompass the knowledge aspects of the online course: videos, PDFs, AI-curated content, etc.
- Activities are where the action is. They include experiential hands-on labs for hard skills, video assessments for soft skills and collaborative group projects for virtual teamwork.
- Finally, assessments provide the opportunity for faculty to test and score learners in a variety of creative ways.

Each skill in Figure 4 was broken into multisensory microlearning resources and assessments. The precise content for the first of 26 skills is shown in Figure 5. Subsequent skills had a similar resource mixture, so this skill was cloned as a template for other skills:

<table>
<thead>
<tr>
<th>Learning Path</th>
<th>Module/Lesson/Skill</th>
<th>Format</th>
<th>Resource name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to bioinformatics</td>
<td>Introduction to bioinformatics</td>
<td>Video</td>
<td>How to use the Praxis AI system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Video</td>
<td>Introduction to bioinformatics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Virtual lab</td>
<td>Getting an account on the Palmetto cluster and accessing the Praxis Cloud</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Video</td>
<td>Computational biology in 21st century</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quiz</td>
<td>Quiz</td>
</tr>
<tr>
<td>Learning Path</td>
<td>Module/Lesson/Skill</td>
<td>Format</td>
<td>Resource name</td>
</tr>
<tr>
<td>---------------</td>
<td>---------------------</td>
<td>--------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td></td>
<td>Discussion</td>
<td>Asynchronous discussion board.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Virtual Classroom</td>
<td>Synchronous discussion.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Al Content</td>
<td>Al Resource 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Al Content</td>
<td>Al Resource 2</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 5** – Typical resource breakdown for a bioinformatics skill
1.3.3  Sub-task 5: Adjust learning activity content

In the final sub-task before launching his online course, Prof. Feltus tested and refined his new DLS resources, activities and assessments. Testing is especially important for online courses since the instructor will not always be there in person to address any issues students may have.

Prof. Feltus used a DLS testing template to monitor any issues he found in his course. Refer to Figure 6 for an example of the template.

<table>
<thead>
<tr>
<th>Resource/Activity/Assessment</th>
<th>Issue</th>
<th>Screen-shot</th>
<th>Status</th>
<th>Resolution/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Getting an account on the Palmetto Cluster</td>
<td>Palmetto link in Lab Guide doesn't load</td>
<td>A</td>
<td>Open</td>
<td>Need to switch from iFrame to Pop-ip</td>
</tr>
</tbody>
</table>

**Figure 6** – Issue tracking template for course refinement
1.4 STEP 4 Deliver the knowledge

In Step 4 of the DLS design, development and delivery process, Prof. Feltus marketed the new bioinformatics course to his students, sent them registration materials and delivered the programme. This is where the knowledge transfer occurred.

To optimize his students’ learning experience, Prof. Feltus chose to use a Learning Experience Platform (LXP). In partnership with Praxis AI, the bioinformatics digital learning platform comprised interactive learning resources, data-intensive research labs, virtual collaboration, online classrooms, AI-powered curation, assessment and mentoring, all delivered in a virtual, centralized learning experience.

Refer to Figure 7 for an illustration of the online bioinformatics course dashboard in the LXP digital learning platform.

Figure 7 – Bioinformatics course dashboard in the LXP digital learning platform
In the Cloud-based digital learning environment, Prof. Feltus and his students were able to collaborate on experiential research computing projects asynchronously and in real time to significantly enhance their foundational research computing skills.

Beyond the digital content, Prof. Feltus innovated his student-teacher and peer-to-peer interactions. As it turns out, “communication” is a big problem with lecture-based teaching, especially in large classes. It’s impossible to communicate with everybody effectively. With the online digital learning platform, Prof. Feltus and his students were empowered to communicate more frequently and effectively – through discussion boards, one-on-one mentoring, office hours and the asynchronous content itself.

The LXP platform also provided automated ways of nudging students based on thresholds of certain performance – or lack of performance. Prof. Feltus used nudging to encourage lagging students to catch up with the rest of the class. This type of communication is critical for student engagement.

Prof. Feltus was inspired to innovate his assessments as well. His course began and ended with the remote hands-on science labs. These labs also offered opportunities for experiential assessment. In the remote asynchronous course, he was also empowered to break up his knowledge-based assessments (aka micro-assessments). Then, at the end of the course, he used a summative video assessment to allow students to record themselves answering questions in real time. Being able to combine all these types of assessments provided tremendous flexibility and the ability to bring hard skills and soft skills together, to bring qualitative and creative assessment into a holistic quantitative course.
1.5 STEP 5 Measure the results

Finally, in Step 5 of the DLS design, development and delivery process, Prof. Feltus followed up with his students to ensure that they perform their role as change agents and realize the desired outcomes and results from the bioinformatics course. This is the key step for knowledge application.

Following are selected observations from Prof. Feltus’ COVID-accelerated digital learning course in bioinformatics at Clemson University. In short, he is convinced that the digital version of the course is significantly better than the in-person version he has been teaching for 14 years. Here is a summary of the ways in which digital learning is helping shape the future of education:

- Prof. Feltus’ biggest surprise was the level of engagement and interactivity on the forums and mentoring channels – 50 messages a day. It was exciting for him to see how many students embraced remote collaboration. He is convinced that he is interacting with his students more online than in any previous in-person version of his course.

- Based on the comments from the channels above, Prof. Feltus’ students are loving the experience. They agree that the level of communication has improved dramatically.

- The remote hands-on labs are a big hit. In his non-digital course, Prof. Feltus didn’t have the platform to provide “anytime, anywhere labs” for his students. Also, he has learned how to use the platform to streamline the grading process for 27 labs x 100 students. Workflow efficiency is key.

- The depth and breadth of online analytics are insightful and powerful. Prof. Feltus believes he had much more visibility into student performance and usage than with his previous courses. Students can’t hide in the back row anymore.

The true value in these innovations is the repeatable, rapid, immersive process of transforming traditional science lectures and labs into a collaborative online research platform. Prof. Feltus spearheaded the conversion of his own bioinformatics course as a template for other innovations in science education, including climate science, artificial intelligence, nursing and behavioural health.
2. Summary case study: Digital learning at LEGO

The LEGO Group’s mission is to inspire and develop the builders of tomorrow. For the company’s Learning & Development team, that involved responding to the global pandemic and finding new ways to inspire and skill their employees digitally.

LEGO’s digital learning strategy was empowered by LinkedIn Learning. The decision to invest in digital learning licences for every knowledge worker proved the crucial foundation for building a powerful learning brand within the LEGO Group – and empowering employees to take ownership of their personal development during a difficult and challenging time.

The LEGO Group’s Learning & Development Manager, Johannes Lystbæk, led the transition to digital learning. This is how he described the strategy:

“We always assume that there is unrealized potential within our organization, and our role is to find new ways to unleash that potential. We realized that people learn in different ways in the modern workplace, and we are on a journey to innovate what we offer and motivate people to explore what’s available. Digital learning is a big part of that.”

2.1 The challenge

LEGO’s digital learning strategy was developed to address the following four corporate learning challenges:

- Continue to deliver knowledge and skills to remote employees during the global pandemic
- Increase the visibility of learning content and inspire employees
- Integrate with the LEGO Group’s customized Learning Hub and other resources
- Support learning paths around key topics for the business
2.2 The solution
The LinkedIn Learning platform and content provided the ideal digital learning toolkit for LEGO and its employees. Following is a summary of the components of their collaborative solution:

• 7 500 digital learning platform licences covering all the LEGO Group’s knowledge workers
• Customized learning paths around 12 priority topics
• Marketing and communications strategy informed by digital learning content
• A new learning and development brand (Learning @ LEGO Group) along with a new visual identity
• Learning @ LEGO Group communications and engagement campaign on internal communication channels: office screens, e-mails, Intranet, etc.

In addition, LEGO’s digital learning toolkit involved a customized LEGO® Learning Hub, including a range of different learning resources focused on business, media and technology – three priority content areas for LEGO. In addition, personalized learning and analytics helped improve learner engagement.

2.3 The results
The decision to invest in digital learning licences for each of the 7 500 knowledge workers proved the crucial foundation for building a powerful learning brand within the LEGO Group. Here are a few of the results from LEGO’s digital learning toolkit:

• 7 500 participants
• 90% engagement (activation of digital learning platform accounts within 12 months)
• Average learner access: two times per month

The speed with which LEGO® employees embraced digital learning proved the value of the solution. The Learning @ LEGO Group now has its own brand, its own learning engagement campaigns and its own role in helping improve the outcomes of the business.
3. Summary case study: Digital learning at Henkel

Henkel is the manufacturer of household brands such as Persil, Schwarzkopf and Loctite. Henkel operates in 75 countries and has a workforce of 50,000 employees in 12 countries. Before and during the global pandemic, Henkel felt compelled to improve the accessibility of its learning programme, proficiency of its employees and reduce the costs of delivering training in 12 countries.

3.1 The challenge

Henkel’s previous training programme prevented consistent learning and wasn’t available to everyone in the organization. Henkel wanted to align its training to better reflect its global messaging and strategy, and it wanted to implement a blended learning programme based on the 70:20:10 model:

- 70% on-the-job training
- 20% informal training interactions with peers and coaches
- 10% formal training events (digital or in person)

Henkel required a digital learning solution that was accessible to Henkel’s diverse and international team and focused on employee development and lifelong learning.

3.2 The solution

Henkel partnered with CrossKnowledge to develop its digital learning toolkit. Like LEGO, Henkel decided to build a centralized Henkel Global Academy to serve the company’s individual business units, diverse job roles and distributed regions. The Academy provided formal courses on soft skills and leadership development, in addition to coaching and on-the-job training opportunities.
The Academy determined that the best way to deliver consistent, distributed employee development was through two distinct channels: 1) a Learning Center for all employees, and 2) a Leadership Center for leaders and high-potential individuals.

To align the training with Henkel’s global message, the Academy incorporated Henkel’s four strategic pillars into the programme:

1. Outperform
2. Globalize
3. Simplify
4. Inspire

Together, Henkel Academy and CrossKnowledge created a blended learning programme which was easily integrated into Henkel’s existing performance management process. The 70:20:10 programme was designed to meet individual development needs while providing employees with professional and soft skills training that is consistent across the organization.

### 3.3 The results

Learner engagement was enhanced through familiarity. This was a priority for development of the DLS Toolkit. The Henkel Academy mapped CrossKnowledge content onto their existing competency model so that learners could search using key terms that were familiar to them.

This familiarity resulted in excellent programme reach and growth:

- Growth of connected learners: 50%
- Total time spent viewing learning resources increased by 300%
- 75% of learners continued to return to the digital learning platform

Because of the implementation of its digital learning strategy, Henkel is now enjoying a more engaged and skilled workforce. As a company, it is better prepared to adapt to market challenges and the demands of digital transformation.
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