CourseConnect
Learning Design & Evaluation

Evidence-Based Learning Design in Online Courseware
CourseConnect is a customizable courseware library ideal for online, blended, and on-ground delivery. CourseConnect courses are learning management system (LMS), textbook, and device agnostic, allowing CourseConnect to work seamlessly within existing learning tools to deliver a quality, flexible learning experience. Each course is built upon course outcomes and lesson objectives using a backward design methodology and is designed to be customized by the instructor.

CourseConnect courses are based upon the latest academic research and thorough evaluation measures. In particular, the CourseConnect design uses structured instruction and backward design to ensure:

- Tight instructional alignment between objectives, instruction, and assessments
- Instructor presence and enhanced direct instruction that ensures close transactional distance with learners
- Integration of cognitive theories of multimedia learning into course design
- Incorporation of Keller’s ARCS Theory of Motivation to provide support for learner performance and engagement
- Validation of course integrity, learner performance gains, and interface design through numerous evaluation measures

This document outlines our research and evaluation agenda and demonstrates the efficacy of CourseConnect courses.
Instructional Alignment

Instructional alignment means the learning objectives, instruction, and assessments in a course align and work in unison to create the desired outcome. Aligning the components is the basic foundation of well-designed instruction (Dick, Carey, & Carey, 2005). CourseConnect course design begins with the desired learning outcomes. Subject matter experts and instructional designers collaborate on course outcomes, which are broken down into lesson objectives. They then collaborate on the most effective strategy to obtain these outcomes. The end result of this approach includes properly aligned assessments, practice, and instructional content (Wiggins & McTighe, 1998).

Structured Instruction

Recent meta-analyses of instructional approaches suggest unassisted discovery is far less effective than structured instruction, especially for novice learners, such as students in their first years of undergraduate work, students in their first online courses, or both (see Alfieri, et al, 2011). Each CourseConnect course is divided into structured lessons, with each lesson comprised of a checklist, lesson presentation, selected-response assessments, discussion questions, and performance-based assignments. To ensure structured instruction, each lesson presentation begins with a diagnostic pre-assessment, moves to a lesson introduction, and then cycles through topics that are further subdivided into an embedded learning model. Each CourseConnect course is divided into structured lessons, with each lesson comprised of a checklist, readings, a lesson presentation, selected-response assessments, discussion questions, and performance-based assignments.
Structured instruction and the associated interface elements presented in CourseConnect directly support models of human learning. Each CourseConnect course applies structured instruction by:

- Directing the selection of information
- Managing cognitive capacity
- Enabling the integration of sensory information into working memory
- Supporting the retrieval of knowledge and skills from long-term memory (see Clark and Mayer, 39-43)

The CourseConnect learning model maps to these principles of structured instruction at course, lesson, and topic levels.

Upon entering the Lesson Presentation, students have the opportunity to complete a short Study Guide quiz that helps them target their learning by prescribing study time to the topic based on an aggregate of their quiz score and confidence levels. Equipped with this personal-
ized recommendation, students now see the instruction as it applies to them personally, adding a sense of purpose and relevance. They progress through a prescribed learning model but have the freedom to explore and self-remediate as they wish.

CourseConnect lesson presentations are organized into lessons consisting of topics aligned to objectives. The user interface reinforces this structure in the navigation, displaying how much progress has been made and, through the headings and screen layouts, how the information fits into the learning goals.

Each lesson presentation begins with purpose, context, and relevance before delving deeper into the subject matter. Students have opportunities for practice (formative assessment) between each topic as a way to self-check before moving on to new subject matter. These Check Your Understanding (CYU) sections help students integrate content into working memory and can help in the retention of concepts.

After viewing the lesson presentation, students apply what they have learned in the assignment, examine the concepts with their instructor and peers in the discussion forum, and take the lesson quiz. Aligned to objectives, the lesson presentation content is designed to support student success in the assignment, discussion, and quiz.

Taking students through this purposeful structure of learning events maximizes comprehension and retention of knowledge. The practice provided in this learning activity structure also supports the assimilation of knowledge and skills into long-term memory (see Clark and Mayer, 39-43).

**Direct Instruction**

Each CourseConnect lesson includes interactive lesson presentations that provide enhanced direct instruction—closing the transactional distance that learners may perceive in distance education. Each lesson establishes the learning intentions and how that success will be measured. As students interact with the screen content, they regularly encounter specifically tailored prompts and insights that provide context to help illuminate relevance and reflection. This specialized content can be in the form of an “instructor voice” (drawing atten-
tion to a specific concept for later use within the lesson) or “expert voice” (explaining how the concept is used in a professional or real-world setting). At the conclusion of each topic or concept, Check Your Understanding practice items provide targeted formative assessment and feedback within each topic. This enables students to compare their work to the correct answers before completing the independent practice found in the Assignments.

The direct instruction approach of CourseConnect underscores the impact of stating the learning intentions and success criteria, making them transparent to the student, and then engaging them towards these goals (Hattie, 2013).

Instructor Presence

CourseConnect supports instructor presence in courses in a number of ways. Discussions in each lesson bring together the students, their classmates, and their instructor to exchange ideas related to the specified learning outcomes. This standard course design feature provides a consistent opportunity for instructors to enhance their presence across all the lessons in their online courses.

As a means to further support instructor presence in the Discussions, each CourseConnect course includes an Instructor Resource Guide. This guide provides a range of resources including Discussion Facilitation Tips specific to each lesson in the course. Focusing on strategies the instructor can use to enhance each discussion, the tips are designed to support instructor presence throughout the course.

Finally, the degree to which a CourseConnect course can be customized by the instructor provides an opportunity to build instructor presence. Examples of customizations that may enhance instructor presence include adding original or existing media, augmenting assignments or discussions to reflect a specific focus, and sharing instructor-created video introductions or announcements for each lesson.

The consistent use of discussions in each CourseConnect lesson, the Discussion Facilitation Tips in the Instructor Resource Guide, and the customizable nature of CourseConnect create valuable opportunities for instructors to enhance their presence in their distance education.
Figure 2. CourseConnect closing transactional distance with learners through instructor presence and direct instruction.

courses. CourseConnect uses these course design features to close the transactional distance associated with distance education.

Cognitive Theory of Multimedia Learning

The cognitive theory of multimedia learning is a research-based approach examining how students learn through the use of media components integrated into course material. This theory has evolved around the concept that effectively combining visuals, text, and audio in programs for learning is complex and requires deep and sophisticated examinations of how humans process information (Mayer, 2005). The cognitive theory of multimedia also provides valuable insight into optimal practices for combining visuals, text, and audio to engage students in active learning. These principles enable learners to experience media rich information, presented in the best way to process, work with, and remember this information on a long-term basis.
The cognitive theory of multimedia learning is based on three assumptions, or principles of learning:

1. **Dual-channels assumption** states that humans process information via two channels, one for visual/pictorial information and one for auditory/verbal information (Mayer, 2001).
2. **Limited-capacity assumption** states that the capacity of each of those channels in human working memory is limited in capacity (Mayer, 2001).
3. **Active processing assumption** states that humans learning is an active cognitive process whereby learners construct meaningful representations from the experience/information received by two primary sensory channels (visual and auditory) (Mayer, 2001).

CourseConnect designers incorporate multimedia learning theory standards and best practices throughout all aspects of courseware development.
ARCS Theory of Motivation

The ARCS theory is a methodology designed to foster learner motivation in instruction (Keller & Suzuki, 2004). Motivating instruction seeks to gain and then sustain the learners’ attention. Once the instruction has gained the attention or interest, learners must feel that it has relevance to their lives. When learners feel the instruction is relevant, they then need to build confidence in their mastery of the content. Finally, the learners need to generate satisfaction from their mastery. If the learners are lacking motivation in any of the four areas addressed in ARCS theory, motivational design is used to improve motivation where lacking.

Motivated learners are more likely to be successful learners. The ARCS model allows instructors to create an effective motivational strategy in their courses. CourseConnect designers apply the ARCS theory in order to support learner motivation.

The CourseConnect design follows the ARCS model at the lesson and topic level. The lesson splash screen captures students’ attention with iconic imagery and topic thumbnail previews (Attention). These previews, complete with “grabber” text and an image, attract the students’ attention while highlighting the sequence and content to follow. The instruction begins with an Overview screen that pairs specific imagery and an engaging narrative. The goal of these screens, which are also found at the beginning and end of each topic, is to indicate why the forthcoming content is important and how it will apply to learners’ academic and professional lives (Relevance).

While on the Overview screen, students are prompted to complete a short Study Guide activity. This activity helps students plan their path through the lesson by identifying which topics require more of their attention. Students answer a few quick questions while also indicating their level of confidence in their answers. This metacognitive dimension results in a more personalized learning experience because the
Study Guide recommends study levels based on the exact response combinations: correct/incorrect matched with “I know this” and “I’m not sure.” This helps the student monitor their learning as they progress through the lessons but also gives them more variety in how they measure their learning (Confidence).

**Figure 4.** Study Guide (left); Check Your Understanding (right)

Topic Introductions reinforce the approach found in the lesson overview of pairing imagery (Attention) and an engaging narrative. Students are presented with the targeted learning outcomes and can see what is expected of them as they move through the content. These outcomes mirror their learning goals and align with their assessment later in the lesson (Relevance).

As learners progress through the topics, they apply what they have studied before moving on to the next topic through Check Your Understanding questions. This part of the CourseConnect learning model is designed for students to have an “instructor-free zone” to self-assess and self-remediate. Instead, immediate feedback, which can be distractor-specific, helps students see a quick glimpse of how they are retaining the information. They may complete this practice as many times as they wish or even return to the beginning of the topic for self-remediation. This helps students monitor their learning (Confidence). By providing students regular opportunities to practice and self-remediate in the lesson presentation, they can be better prepared for formal assessments in the lesson, such as the assignments and discussion forum (Satisfaction).
Value of Evaluation

Extensive evaluation is integral to making data-driven decisions, particularly in an iterative development process. Evaluations provide stakeholders with detailed and reliable analysis of their product, processes, and future initiatives (Russ-Eft, Preskill, 2001). By committing to regular formative evaluation, we continue to measure the effectiveness of CourseConnect’s learner-centered design including instruction, media, functionality, and assessments.

No one data point tells the whole story. It is imperative to verify across multiple forms of evaluation before coming to reliable and actionable conclusions. A multi-faceted approach provides a more detailed and accurate view because it eliminates information that cannot stand up to extensive scrutiny. For example, picture CourseConnect students pausing before submitting their answers on a practice item. Several conclusions can be drawn from this single observation, yet many are incomplete or even wrong. The students might be confused or frustrated, or they might be considering exiting the lesson altogether. However, if we utilize multiple measurements, we can get clarity on the specific behavior. Eye-tracking software may show us that they are re-reading the instructions, while a talk-aloud technique could reveal that the reason behind re-reading is that the question is oddly worded. This simple example holds an important principle: evidence from varied perspectives provides more valuable data.

We gather evaluation evidence from learner-centered design testing, instructional design evaluation, and third-party evaluation.
Learner-Centered Design Testing

We use three types of testing:

1. **Instructional design heuristic reviews** in which experts review prototypes against a set of heuristics in order to identify any issues that may limit or interfere with learning

2. **Formative usability testing** with users to identify usability issues around high-value tasks

3. **Deep physiological engagement testing** to establish patterns of user engagement and its effect upon learning

In the past three years CourseConnect has undergone extensive usability testing. Data from these eight tests continue to inform the new 3.0 user interface and Study Guide, specific learning design enhancements, and the integration of media and functionality. This testing includes usage across platforms and (mobile) devices.

**Figure 5.** Evolution of CourseConnect from 2.0 flash-based format (left) to 3.0 responsive course available across multiple devices (right).
Testing Goals

Participants complete assigned tasks in our courseware in a lab setting led by a certified usability specialist. The participants (currently over 100 tested) are students and faculty from universities, community colleges, and career colleges who vary demographically and in their familiarity with online learning. Testing objectives have included the following:

- Determine perceived intuitiveness of the user interface features and representative icons.
- Determine clarity/intuitiveness of the navigation.
- Evaluate learner ability to access content pages from any lesson page and to activate learning tools.
- Evaluate learner engagement as measured by EPOC headset.
- Examine differences in learning outcomes based on levels of engagement.

We leverage multiple technologies throughout these studies to increase the reliability of the data (i.e. cross-referencing, counter-balancing) but also to deepen our understanding of what occurs when students learn with CourseConnect. This information is very important because we collect data on not only a task "successfully completed," but we also measure how it was completed and examine why students were able to complete it (or not). Participants also complete surveys and participate in focus groups to provide more detail and context to the data they generated.

Figure 6. Evaluation professionals observing students testing.
Testing Types and Associated Technologies

We typically conduct three primary types of testing: design testing, usability testing, and engagement testing. Each of these is measured using eye tracking software, two-way mirrors, screen recording technologies, usability software, and neurosignal headsets.

<table>
<thead>
<tr>
<th>Study Type</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>Focuses on the effects of the visual components of CourseConnect.</td>
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<tr>
<td></td>
<td>Examples: color palette, screen layouts, media and image displays</td>
</tr>
<tr>
<td>Usability</td>
<td>Measure the efficiency and ease of use behind CourseConnect functionality and interactivity.</td>
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<tr>
<td></td>
<td>Examples: navigation, orientation, learning model, toolbars, formative assessment items</td>
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<tr>
<td>Patterns of Engagement</td>
<td>Quantifies student attention and engagement across entire Course Connect learning experience.</td>
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<tr>
<td></td>
<td>Examples: visual and media, lesson and topic opening narratives, learning model and content flow</td>
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Physiological Engagement Testing

In December 2012 our team partnered with the Learning Sciences Institute at Arizona State University to compare levels of engagement of the new 3.0 version of CourseConnect against the previous 2.0 version. We were interested in what specific features showed evidence of higher engagement and to what extent those measures of engagement explain potential differences in learning outcome measures.

Neurological headset and eye tracking software tracked 50 traditional and nontraditional students as they completed a CourseConnect lesson. The study showed statistically significant higher levels of engagement were documented on pages with interactivity, chunking, and text that used second-person pronouns and directed questions.

These results, along with other studies conducted, helped inform our design and development work moving forward.

- Conversion of content to a more editorial style with narrative elements
- Maintain the practice of chunking content into granular instruction
- Introduce directed questions aimed at metacognition and reflective thinking
- Introduced targeted interactivity and practice

Figure 6. Student wearing neurological headset (left); Eye-tracking and EEG showing levels of engagement (right).
Study Guide

Study Guide was introduced to students as a functional prototype portion of a usability study back in March 2012 in the IDEA center lab in Chandler, AZ. We had applied the research, incorporated feedback from stakeholders and other Pearson groups, and now we wanted to test drive with some online undergraduate students. Per usual, the study was recorded and streamed live to members of the design team. Students had specific tasks required of them such as navigation through the feature, interpretation of results provided, and overall opinion of the experience. Students easily understood how to interpret their results and liked the color coding (red-yellow-green) but didn’t always notice how the parts of the results screen were integrated. Through our live observations, we also found opportunities to clarify the “most recent” Study Guide as well as reinforce some visual cues in the item-level feedback. All of this was useful information for revisions and testing.

Subsequent studies delved deeper into the use cases of the Study Guide. Could students draw meaning from their scores? Did they feel like it was worth their time? How would they use the Study Guide over the course of a semester? How do Study Guide results, while not a gradable activity, affect motivation levels?

By 2013 we had a refined version of the Study Guide, both in user experience and in instructional theory. We then sought to test its usage across devices. Students completed Study Guides, interpreted their results, and shared how their study guide scores would impact their approach to the upcoming lesson. In alignment with CourseConnect’s responsive design, Study Guide was created for use across devices. The students confirmed Study Guide’s responsive design by demonstrating fluent use across devices. Still, we found tweaks here and there that could provide a cleaner experience. Additionally, in all of our recordings, surveys, live observations, and consultations with faculty and student advisory boards, we noticed students kept thinking of the Study Guide as test-prep tool instead of a way to match prior knowledge to the content and time management of their learning before the lesson.

In the fall of 2013, we attacked this head on. Students understood the
role of the Study Guide once they had time to work with it in the context of CourseConnect, but we didn’t want them to treat it as just a test-prep and focus too much on individual items, for example. We wanted them to create Study Guides and go into each lesson fully informed. The design team worked with senior leadership and other stakeholders to make some small but meaningful changes to the Study Guide. One change was a stronger, cleaner launch screen that showed value of the Study Guide before and after each lesson. This context helps students know how and when to use the Study Guide. The second change was replacing the study “Level” with study “Time.” This more closely mirrors the main objective of the Study Guide, which is where to focus your time and effort when entering a lesson (Less Time [Green], More Time [Yellow], Most Time [Red]).

As we collect data from testing participants and web analytics on an ongoing basis, we continue to improve the Study guide and all of CourseConnect’s features.

Figure 7. Replacing study “Level” with study “Time” and a cleaner launch screen are examples of small but meaningful changes that help students better understand the purpose of the Study Guide.
Instructional Design Evaluation

CourseConnect course design involves a series of reviews and evaluations that ensure the integrity of the content. These include: multiple subject matter reviews, instructional design reviews, editorial reviews, quality assurance reviews, and assessment reviews. These reviews are often conducted against quality standards and rubrics to ensure that each course is thoroughly and consistently evaluated.

Third-Party Evaluation

Evaluation is a central part of our iterative design process. In addition to being a three-time SIIA CODiE award winner, CourseConnect has been evaluated by a number of third-party reviewers.

American Council on Education

The American Council on Education (ACE) is the nation’s largest higher education organization, representing the presidents of U.S. accredited, degree-granting institutions, including two- and four-year colleges, private and public universities, and nonprofit and for-profit entities. ACE provides course equivalency information through its ACE College Credit Recommendation Service (CREDIT)—the most widely used course evaluation program that stresses academically sound methods. More than 2,000 colleges and universities consider ACE CREDIT recommendations in determining the applicability of coursework and examination results to their courses and degree programs.

ACE CREDIT has recommended over 50 CourseConnect courses for college credit. During these reviews, ACE evaluators assessed and validated whether CourseConnect courses have the appropriate qualities for college credit recommendations eligible for academic transfer. ACE CREDIT reviews are carried out by experienced college and university faculty who assess the content, scope and rigor of an organization’s curricula and make appropriate recommendations for comparable college credit. Students can use these credit recommendations to satisfy general education or degree requirements or to demonstrate knowledge and proficiency in a particular subject.
Quality Matters

The Quality Matters (QM) Program is a nationally recognized leader in quality assurance for online courses and is considered a benchmark for online course design. QM rubrics have been used in the peer review certification process by more than 700 academic institutions, and recently a custom version of the QM rubric, the Quality Matters Publisher Rubric, was created to address the unique needs of courses created by publishers. Gaining QM Publisher Course Certification is valuable because it means the course has passed the Quality Matters standards, which sets the bar for the variety of courses in the online marketplace.

It can be a challenge to implement a QM certification program at a university, due to resource availability, faculty training, and the time commitment it takes to create an online course that will pass QM standards. Pearson CourseConnect courses are all designed and developed with the same design requirements, standards, and processes, enabling many of the QM standards to be met automatically. This is possible because QM has reviewed and approved CourseConnect’s overall design.

United States Distance Learning Association

The CourseConnect team is engaged in an ongoing partnership with the United States Distance Learning Association (USDLA) so that CourseConnect courses meet the guidelines for accessibility of all learners. The guidelines cover requirements as set forth by the Americans with Disabilities Act (ADA), Sections 504 and 508 of the Rehabilitation Act, the Center for Applied Special Technology (CAST), and the Worldwide Web Consortium (W3C, WCAG 2.0 A or AA compliance). Collectively, these guidelines address the needs of students with physical and learning disabilities, as well as provide strategic choice related to assignment deliverables, opportunities for practice with feedback and reflection, and resources for tracking personal progress and pacing for all learners.

While the CourseConnect partnership with the USDLA and the associated in-depth accessibility analysis are ongoing, it is important
to note a number of CourseConnect 3.0’s accessible features. These include HTML (Flash-free) content that is more accessible to screen readers, Audio-to-Go as an audio-only alternative to the Lesson Presentation, and the Study Guide user interface which uses colors and contrast to support accessibility. This analysis also takes into account the instructional strategy during course authoring to assure that technology and content work together to create a robust and highly accessible learning environment for everyone.


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