White Paper

The Research Base of PLATO® Online Courses

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1.0 Introduction

Growth and evolution of Online Learning

In 2008 the authors of *Disrupting Class* predicted a bold growth curve for online learning, noting that by 2019 more than 50 percent of high school courses will be delivered online. Online learning is a high priority for schools across the United States, as well as for government agencies and education associations. The National Education Technology Plan released by the U.S. Department of Education in 2010 lists distance learning as one of seven major action steps designed to improve student achievement through technology. In its 2010 publication entitled *The Online Imperative: A Solution to Three Looming Crises in Education*, the Alliance for Excellent Education outlined the critical importance of online learning as a solution to support increases in educational attainment, cost-effective educational delivery models, and teacher effectiveness, especially in areas where there are teacher shortages. Growth in online learning enrollment is now estimated at about 30 percent per year.

PLATO Learning: Fifty Years of Leadership and Innovation

PLATO Learning's origins lie at University of Illinois in the early 1960s. PLATO (Programmed Logic for Automated Teaching Operations) was an answer to a pressing need for greater access to high-quality education. Initially funded by a number of grants that supported science and engineering education, including a National Science Foundation grant, PLATO became the first computer-assisted learning system.

During the early years, PLATO system designers committed to addressing those attributes that today are still critical to PLATO Learning's online development:

- engaging graphics and animation;
- social learning technologies to support teacher/student interaction;
- rigorous curriculum and assessment components
- personalized learning strategies designed to increase motivation and achievement.

Early on, learners accessed PLATO through stand-alone computer systems. Today, PLATO Learning provides access to high-quality education anytime and from anywhere through rigorous, Web-based course offerings. The timeline below highlights important milestones in PLATO Learning's development over the past five decades

1960—The PLATO system is developed at the University of Illinois at Urbana-Champaign.

1967—The National Science Foundation awards a grant to support PLATO system expansion to 150 terminals with text, graphics, animation, and data sharing at a cost of $12,000 each.

1969—The Internet is founded.

1971—PLATO courseware is introduced; an expanded set of curriculum offerings for K-adult learners is developed.

1971-2000—Increased access to technology to support instruction at all grade levels corresponds with expanded use of PLATO by thousands of learners worldwide on individual computer terminals and local area networks.

1994—The first postsecondary-level online learning programs are introduced.

2000-2003—Mergers with multiple companies leads to the introduction of PLATO to online learners via the PLATO Learning Network™ (PLN™). This system integrates the nation's largest standards-based alignment engine with management system technologies and expanded course offerings that are particularly focused on math, science, and literacy instruction. PLATO Learning later introduces the PLATO Web Learning Network™ (PWLN™), which leverages a Web-based platform that allows schools to extend courseware delivery beyond LAN/WAN system management.

2006—The PLATO Learning Environment™ (PLE™) debuts. This online learning platform provides integrated data, assessment, reporting, curriculum, and course management features to support school and district online learning programs

2007-Present—PLATO Learning developers expand online platform features and rigorous online course offerings in mathematics, science, social studies and English/language arts, including AP* courses. In addition, PLATO Learning continues to develop online learning technologies that include student/teacher communications, reporting and data features, and course management options that provide more personalized learning options and effective support of online course delivery. In 2010, as PLATO Learning celebrates its 50th anniversary, more than 1.5 million educators and students have daily access to PLATO courses.

The PLATO Promise

Ongoing evaluations of PLATO Learning products have helped identify key elements that customers appreciate and expect in PLATO's effective, proven online learning solutions. These criteria encompass all of our online learning product requirements for PLATO Learning curriculum:

- PLATO courses provide full curriculum coverage, addressing at least 90 percent of standards for each of our defined metric state and national standard sets for core courses or special courses and 100 percent of standards defined by the College Board for AP* courses.
- PLATO courses are primarily technology-facilitated, not document-based. They make full use of online learning technology to make learning easier and more valuable for both students and teachers.
- From credit recovery to AP*, PLATO courses engage students and make learning relevant to their lives.
- PLATO courses enable a single student to learn independently and in a self-paced way. There is no dependence on other students working simultaneously at the same customer site. This independent learning capability is true for credit recovery, first time, and AP* students.
- PLATO courses facilitate or suggest creative ways for students who are learning at their own pace to interact with other students, especially in higher-order learning activities.

- For class-based learning, PLATO courses provide teachers with resources (such as online discussions or blended classroom suggestions) to enhance the basic course interaction and learning.
- Whether implemented for independent or class-based learning, PLATO Learning plans for and provides simple guidelines for using courses in a blended mode (both face-to-face and virtual) or primarily virtual (with assessment being the primary exception.)
- PLATO courses require modest teacher engagement in learning activities. Learning is largely in the student's hands, with guidance from the teacher.
- PLATO courses automate or simplify a significant portion of student assessment, scoring, recording, and reporting.
- PLATO courses require modest teacher training, with no re-education in content or pedagogy.

2.0 Best Practices in Curriculum

Rigor, Relevance, and a Taxonomy for Learning

In 1956 Benjamin Bloom worked with a group of educational psychologists to develop a taxonomy that classified six levels of learning: 1) Knowledge, 2) Comprehension, 3) Application, 4) Analysis, 5) Synthesis, and 6) Evaluation.

Bloom's theories have been refined over the decades. In the 1990s, cognitive psychologist Lorin Anderson worked with educational psychologist David R. Krathwohl to publish an adaptation of Bloom's work that reflected a taxonomy more closely tied to 21st century learning. The Anderson-Krathwohl revision maintained Bloom's six levels but labeled each level with verbs rather than nouns, reconceptualized Synthesis as Creating, and moved Creating up to the highest level in the taxonomy. The six levels of learning in the Anderson-Krathwohl taxonomy are 1) Remembering, 2) Understanding, 3) Applying, 4) Analyzing, 5) Evaluating, and 6) Creating.

Building on the work of Bloom, Anderson, and Krathwohl, the International Center for Leadership in Education, under the leadership of Dr. Bill Daggett, created a Rigor/Relevance Framework model for learning and student achievement based on two dimensions. The first dimension is rigor, which refers to academic rigor, or level of knowledge and learning, as defined in the taxonomies of Bloom and Anderson-Krathwohl. The second dimension is relevance, meaning the ability to apply concepts or skills to solve real-world problems. Relevance, as defined in Dr. Daggett's Application Model of Rigor/Relevance, has a five-level continuum:

Level 1—Knowledge in one discipline
Level 2—Applying knowledge in one discipline
Level 3—Applying knowledge across multiple disciplines
Level 4—Applying knowledge to predictable real-world situations
Level 5—Applying knowledge to unpredictable real-world situations

Dr. Dagget's model demonstrates the application of knowledge or skills from the lowest level of knowledge within one discipline to the highest level, where knowledge is applied to real-world, unpredictable situations.

Standards-Based Courses

PLATO Learning courses are developed using rigorous state and national standards, including those from the National Council of Teachers of Mathematics (NCTM), the National Council of Teachers of English (NCTE), and the Thomas B. Fordham Foundation index of A-rated states. Teachers and program administrators also have access to state and national standards within the PLATO system, which allows them to customize courses to address local standards and pacing guides. Teachers can add, remove, or resequence course content to meet these local course requirements.

College and Career Readiness and K-12 Common Core Standards

Today the United States ranks fifteenth out of twenty-nine developed countries in the rate of college completion and tenth in the proportion of 25- to 34-year-olds with at least an associate degree. Currently, between 30 and 40 percent of students enrolling in college require at least one remedial class. Such courses don't give credits, don't qualify for tuition aid, and contribute to US students' low college completion rate. About half of all students who start college never finish. A recent survey of employers found that about 40 percent of the high school graduates they hired didn't have the skills to advance in their jobs. Many states across the country are engaged in P-20 (preschool through graduate studies) efforts aimed at closing achievement gaps, improving college and career readiness for students, and raising the proportion of college graduates. More than thirty states now have college- and career-ready standards, according to an Achieve, Inc. report released in 2010.

College- and career-ready standards are intended to define the knowledge and skills that students should attain during their K-12 education careers so that they will graduate high school fully prepared for college or a career. Efforts such as state-level college and career readiness standards and K-12 Common Core State Standards (CCSS) are under way to address these goals. The CCSS stress not only procedural skills but also conceptual understanding. Their goal is to make sure students are learning and absorbing the critical information they need to succeed at higher levels rather than engaging in practices that allow many students to learn enough to get by. Designed to be robust and coherent, the CCSS set a rigorous definition of college and career readiness by helping students develop a depth of understanding and an ability to apply concepts to novel situations, as college students and employees regularly do. The standards are intended to

- Align with college and work expectations;
- be clear, understandable and consistent;
- include rigorous content and application of knowledge through high-order skills;
- build upon the strengths of current state standards;
- be informed by other top-performing countries so that all students are prepared to succeed in a global economy and society; and
- be evidence- and research-based.

There is no one CCSS curriculum; the standards "do not dictate curriculum or teaching methods." As with any set of standards, implementation of the CCSS ultimately will be the responsibility of teachers, administrators, and local school boards. The CCSS are meant to be the common core; they serve as the baseline from which states fill out their own frameworks. As of this writing, more than 33 states have officially adopted the CCSS. As states adopt and implement new and revised college- and career-ready standards, PLATO Learning engages in an extensive curriculum correlation process to map PLATO courses against these standards and provide interactive, up-to-date correlation information to educators within the PLATO system.

College and Career Ready Students

The federal government, states, and school districts are engaged in numerous reforms to improve student achievement in college and career readiness. These reforms include policy changes and program requirements with emphasis on the following priorities:

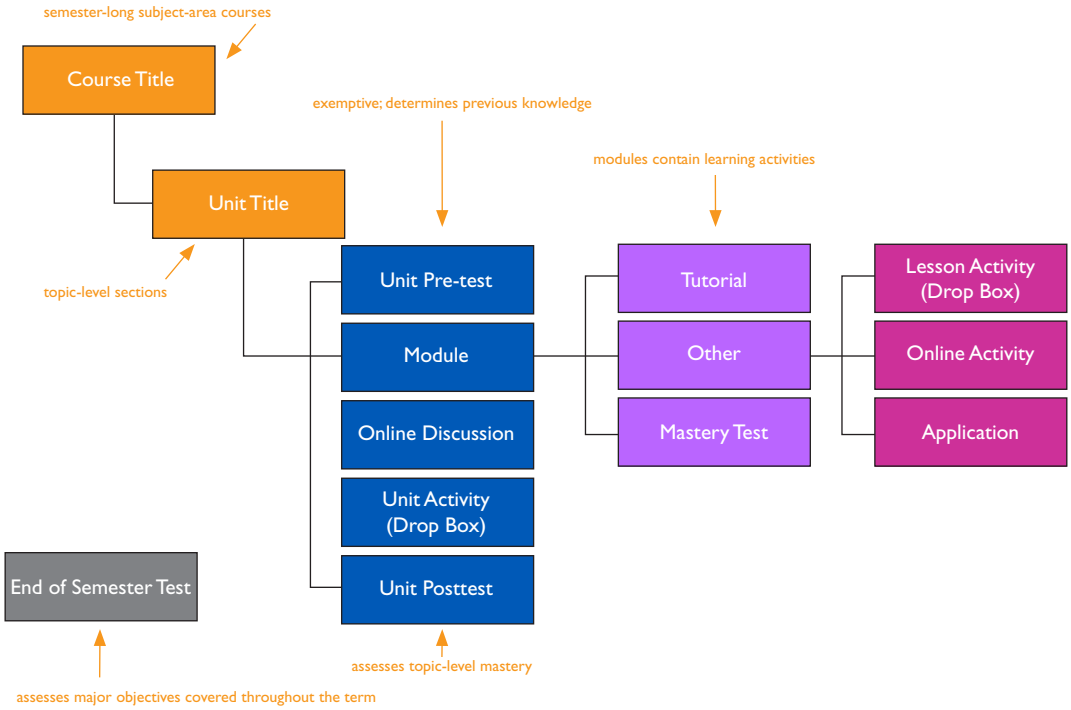
ESEA Priority	PLATO Alignment
Implement a School-wide Response to Intervention Model	▪ PLATO online courses support personalized learning, allowing teachers to target learning options to specific students.
Provide additional supports and professional development to teachers to support instruction for special needs and ELL students	▪ The PLATO system supports instruction for these highly specialized populations with a mastery-based learning model and data resources for teachers.
Use and integrate technology-based supports and interventions as part of the instructional program	▪ PLATO is a proven, technology-based support for instruction and is also highly effective in supporting multiple intervention strategies (e.g., extended time, intervention academies, credit recovery, transition support, etc.).
Improve student transition from middle to high school	▪ PLATO's course delivery solutions support targeted instruction for students to ensure that their achievement stays on track with their cohorts. ▪ PLATO's reporting features support continuous monitoring of student progress and individualized instruction options for teachers. ▪ PLATO's flexible delivery system supports student access for learning acceleration in a variety of settings, including extended-time options such as before and after school and summer school. ▪ PLATO's course offerings include middle school content to support students who are struggling with the transition to high school.
Increase graduation rates through, for example, credit-recovery programs, re-engagement strategies, smaller learning communities, competency-based instruction and performance-based assessments, and acceleration of basic reading and mathematics skills	▪ PLATO has a history of success in providing cross-functional, competency-based online courses that support multiple program delivery options. ▪ PLATO provides an engaging, data-driven online instructional model that ensures access to consistent, standards-based curriculum.
Increase rigor by offering opportunities for students to enroll in advanced coursework	▪ PLATO provides dozens of rigorous courses in core content areas, including AP* courses. ▪ PLATO courses are frequently customized to meet specific district advanced or honors program requirements.

PLATO Online Courses Model

Throughout its history, PLATO Learning has used a mastery-based model to build the content at the heart of its courses and curriculum. PLATO Learning provides semester-long courses on a range of core and elective subjects. Developers start with a curriculum structure built around discreet learning objectives. Then each learning module, or lesson, is focused on one individual objective. Each module includes an introduction to the new material, a chance to practice or apply new knowledge, and an opportunity to demonstrate mastery of the objective before progressing to the next module. This structure is built into units of related material and includes pretests to assess prior knowledge, as well as posttests and end-of-semester tests to confirm mastery for broader levels of content beyond the lesson.

PLATO Online Courses Model

This diagram illustrates the basis of the curriculum model.



To understand the model, it's important to look closely at the structure and the details that support it.

Structure

- A scope and sequence is designed to comprehensively address national and state standards.
- A course, unit, and module (lesson) structure is designed to group learning objectives into meaningful subsequences based on curriculum topics or themes.

Unit Structure

- **Unit pretests** are exemptive tests that determine previous knowledge (see Assessments below).
- **Learning modules** provide specific instruction (see Modules below).
- **Online discussions** allow teacher-to-student and student-to-student discussion and debate about topics that require students to synthesize knowledge acquired during lesson mastery and apply critical thinking skills to answer questions, form opinions, express ideas, and respond to the ideas and opinions of others.
- **Unit activities** offer students the chance to demonstrate higher levels of skill by completing a rich task and submitting the resulting project, paper, essay, data, research, or presentation to their teacher via an online digital drop box.
- **Unit posttests** assess topic-level mastery at the end of each unit (see Assessments below).

Module Structure

Individual modules are designed to reflect the specific type of knowledge or skill addressed within the lesson (e.g., procedural knowledge or declarative knowledge). Module design elements include the following:

- **Tutorials** are designed to help learners acquire and build knowledge.
    - Tutorials include a variety of interactive practice activities, such as exploratory timelines and clickable diagrams. Judged activities include multiple-choice, matching, fill-in-the-blank, drag-and-drop, and multistep problem-solving questions. Other learning resources include embedded videos and links to valuable educational resources.
    - Some tutorials are specifically designed to help learners research, build, and deepen their knowledge. They are sometimes labeled Explorations.
- **Other activities** often are added to a module to meet specific learning needs.
    - **Lesson Activities** are similar to the unit activities described above, but they are focused on lesson-level objectives.
    - **Offline Activities** are similar to Lesson Activities but use a PDF file format and do not employ the drop box.
    - **Application activities** allow learners to apply knowledge to new situations and real-world problems.
- **Mastery tests** culminate each module (see Assessments below).

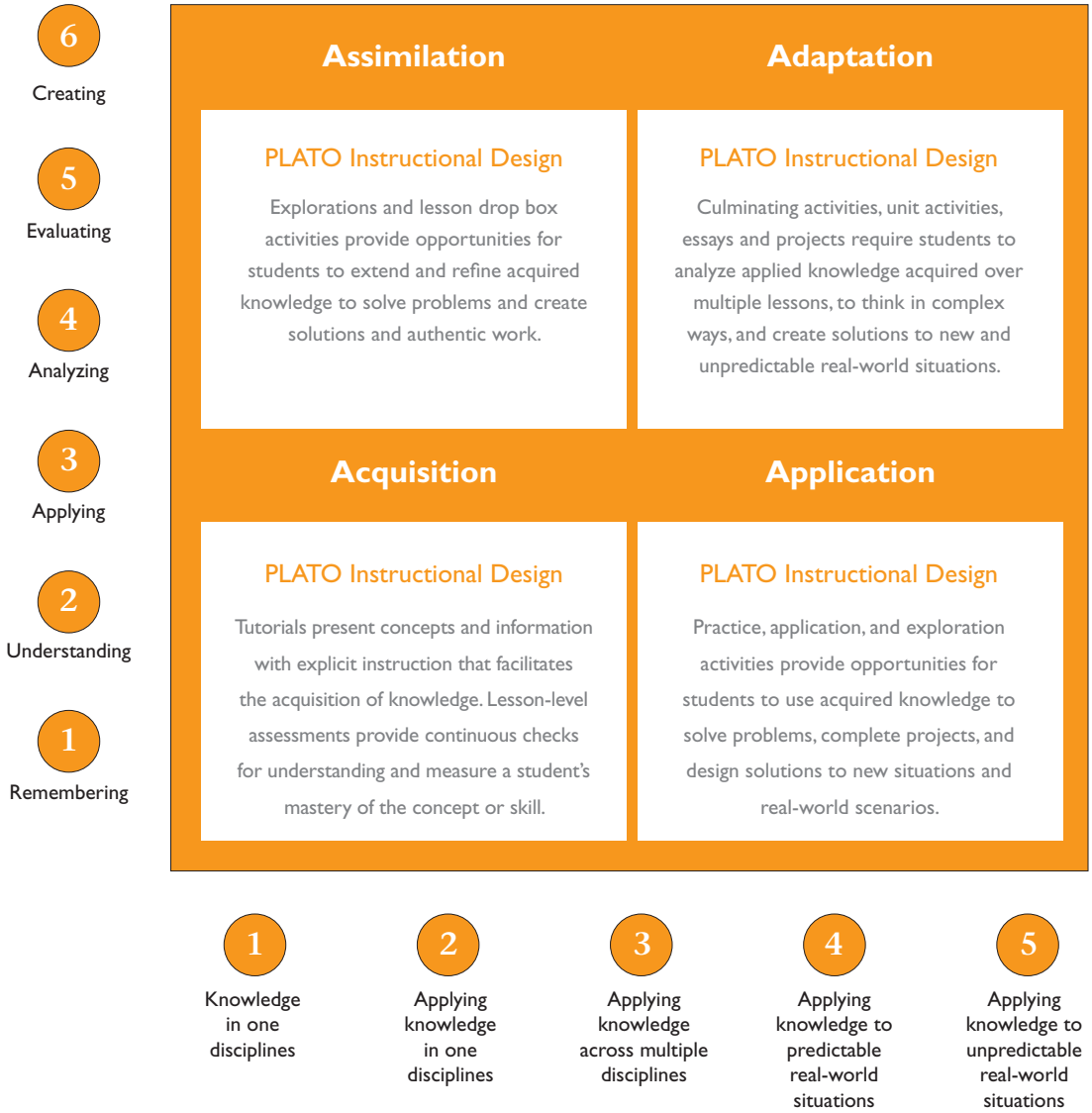
Assessments

Each PLATO online course includes multiple assessments designed to continuously check understanding, measure mastery, ensure knowledge retention, and predict preparedness for course exams. The assessments include these tests:

- Mastery Tests measure whether students have mastered lesson objectives and are prepared to move on to the next learning objective in the instructional sequence.

- Unit Pretests measure students' knowledge of the unit learning objectives before beginning the lesson instruction and allow students to test out of lessons by demonstrating mastery. Unit pretests are most often used when accelerated learning (e.g., credit recovery) is important.
- Unit Posttests measure students' understanding of both the basic knowledge and higher level skills within each unit. They help ensure that students are building and retaining knowledge from lesson to lesson throughout the unit.
- End-of-Semester Tests measure students' mastery and retention of the instruction in every lesson and unit within the semester.

PLATO Learning's courses are designed to explicitly incorporate the multiple levels of rigor and relevance discussed earlier within an integrated online learning environment. Each PLATO online course incorporates basic and higher levels of learning within the rigor and relevance dimensions in Dr. Daggett's application model. The following diagram illustrates how PLATO's instructional design applies the rigor/relevance framework and application model to create rigorous 21st century online courses:



3.0 Best Practices in Online Learning

Numerous organizations publish standards for online learning. The International Association for K-12 Online Learning (INACOL) has a set of standards for high-quality K-12 online teaching and learning. The International Society of Technology in Education (ISTE) produced a set of guidelines in its report *What Works in K-12 Online Learning*. Organizations such as the Institute for Higher Education Policy, the North Central Regional Education Laboratory (NCREL), and others have presented their own sets of guidelines or standards for online learning.

Many of these guidelines and sets of standards are valuable resources for planning and executing online learning programs. Some are more focused on higher education than on K-12 schools. The set most instructive to understanding the PLATO Learning approach to online learning is the INACOL National Standards for Online Teaching. This set of guidelines keeps a solid focus on the teacher and important instructional principles, rather than on the technology, infrastructure, or administrative challenges that online programs face. As PLATO Learning partners with teachers to provide high-quality educational outcomes, this focus on the teacher and instruction suits our approach well.

The table below lists the INACOL National Standards for Online Learning and provides an illustration of how PLATO Learning's approach matches up with each standard.

	Standard	PLATO Instructional Approach
A	The teacher meets the professional teaching standards established by a state-licensing agency or the teacher has academic credentials in the field in which he or she is teaching.	Use of PLATO content can not substitute for a district or school ensuring their employment of highly qualified teachers.
B	The teacher has the prerequisite technology skills to teach online.	PLATO provides on-site and virtual sessions for professional development of technology skills that goes well beyond click training on our products, digging into implementation strategies and follow-up coaching to support student success.
C	The teacher plans, designs and incorporates strategies to encourage active learning, interaction, participation and collaboration in the online environment.	PLATO curriculum includes interactive multimedia and simulations for active learning, hands-on project tasks and lab experiences for participation, online discussion forums, and specific discussion topics tied to the curriculum for collaboration experiences/
D	The teacher provides online leadership in a manner that promotes student success through regular feedback, prompt response and clear expectations.	PLATO Courses include immediate system-generated feedback throughout each lesson for students to understand their progress in the midst of the instruction. PLATO Courses have consistent expectations for mastery of each lesson, and provide clear descriptions of the objective of all work. Teachers also have tools within the system to provide feedback to students, including a digital drop box that allows annotated responses to student-submitted work.
E	The teacher models, guides and encourages legal, ethical, safe and healthy behavior related to technology use.	PLATO Courses include targeted online resources that teachers can trust to focus student technology use. PLATO includes a course on Computer Applications which involves some targeted instruction in the area of online behavior.

F	The teacher has experienced online learning from the perspective of a student.	Through our virtual training sessions, PLATO provides online learning experiences for teachers. The PLATO Learning Environment allows teachers to engage in PLATO Courses as learners as well as an instructor.
G	The teacher understands and is responsive to students with special needs in the online classroom.	PLATO content has instructional redundancies (audio support, selectable text, visual support, off-line tests) which provide tools for teachers to leverage in response to students with special needs.
H	The teacher demonstrates competencies in creating and implementing assessments in online learning environments in ways that assure validity and reliability of instruments and procedures.	PLATO Courses contain multiple online assessments of each major objective taught, including lesson-level mastery tests, unit-level pre-tests and post-tests, and end of semester tests. In addition, PLATO carries out and publishes studies of program efficacy to validate our online learning solutions.
I	The teacher develops and delivers assessments, projects, and assignments that meet standards-based learning goals and assesses learning progress by measuring student achievement of learning goals.	PLATO content is built against national and high quality state standards. Our management system provides a correlation for each lesson and assessment to sets of specific state standards. Progress in mastering individual lessons in the PLATO online courses can be seen as evidence of mastery of these standards-based learning goals.
J	The teacher demonstrates competencies in using data and findings from assessments and other data sources to modify instructional methods and content and to guide student learning.	PLATO's management system provides extensive reporting tools to help teachers track student progress in our curriculum and guide student learning. We also provide professional development which focuses on use of our reports for data-driven decision making. In addition, PLATO provides assessments to judge student mastery of objectives and modify instructional content to the specific student needs.
K	The teacher demonstrates frequent and effective strategies that enable both teacher and students to complete self- and pre-assessments.	PLATO Courses have unit-level pre-assessments that support teachers and students in this activity. Many lessons leverage learner self-assessment to build skills for lifelong learning.
L	The teacher collaborates with colleagues.	The PLATO management system allows for teachers to collaborate with colleagues by sharing teaching responsibilities for a class and sharing customized learning materials with their peers across their school or district.
M	The teacher arranges media and content to help students and teachers transfer knowledge most effectively in the online Environment.	PLATO Courses are built with rigorous instructional design standards targeted specifically at online environments. PLATO Courses are media-rich and have curriculum structures based on quality learning standards. In addition, the management system allows teacher to customize course structures and add their own media and content to support students' transfer of knowledge.

21st Century Learning

Today's students live and learn in a world that is increasingly more digital, more interactive, and more complex. As technology progresses in new directions, it is becoming more interactive, portable, flexible, and powerful than ever before, and the world's people, economy, and environment are increasingly interconnected.

In their research paper on 21st century learning environments, the Partnership for 21st Century Skills states that "…a learning environment can be virtual, online, remote; in other words, it doesn't have to be a place at all. Perhaps a better way to think of 21st century learning environments is as the support systems that organize the condition in which humans learn best – systems that accommodate the unique learning needs of every learner and support the positive human relationships needed for effective learning."

The Partnership for 21st Century Skills has also defined the skills and competencies that students need to prepare them for success in today's global economy. Following is an alignment of PLATO online courses solutions to the Partnership for 21st Century Skills Framework:

Core Subjects and 21st Century Themes

P21 Framework	PLATO Online Courses
Mastery of core subjects and 21st century themes is essential to student success. In addition, schools must promote an understanding of academic content at much higher levels by weaving 21st century interdisciplinary themes into core subjects: ▪ Global Awareness ▪ Financial, Economic, Business and Entrepreneurial Literacy ▪ Civic Literacy ▪ Health Literacy ▪ Environmental Literacy	▪ PLATO's comprehensive catalog of online courses meets the needs of diverse groups including: students on track to graduate, students at risk of not graduating, and advanced college bound students. ▪ PLATO online courses address the concepts and skills related to global awareness and understanding other nations and cultures in courses such as World History, Civics, Geography, Art History and Appreciation, and others ▪ Concepts and skills related to financial, economic, business, career options, and entrepreneurial literacy are directly addressed in courses such as Consumer Math and Economics ▪ Concepts and skills related to civic literacy, understanding governmental processes, exercising right, and making civic decisions are directly addressed in courses such as Civics and U.S. Government ▪ Concepts and skills related to health literacy in courses such as Health, Biology and Life Science ▪ PLATO courses are designed with interdisciplinary themes using real-world scenarios of global economy, careers, culture, and environment.

Learning and Innovation Skills

P21 Framework	PLATO Online Courses
Learning and innovation skills are what separate students who are prepared for increasingly complex life and work environments in today's world and those who are not. They include: ▪ Creativity and Innovation ▪ Critical Thinking and Problem Solving ▪ Communication and Collaboration	▪ Throughout PLATO courses, projects and unit culminating activities encourage students to think creatively and develop innovative solutions while providing the opportunity to research, brainstorm, refine, evaluate, and present their ideas and opinions. ▪ Online discussions and collaborative projects encourage students to discuss and debate new ideas, understand the view point of others and work creatively with others to solve real-world problems and present solutions.

Information, Media and Technology Skills

P21 Framework	PLATO Online Courses
Today, we live in a technology and media-driven environment, marked by access to an abundance of information, rapid changes in technology tools and the ability to collaborate and make individual contributions on an unprecedented scale. Effective citizens and workers must be able to exhibit a range of functional and critical thinking skills, such as: • Information Literacy • Media Literacy • ICT (Information, Communications and Technology) Literacy	▪ The instructional design of both PLATO online tutorials and explorations provide access to information from a wide variety of sources, (e.g.: educational web links within lessons). Students collect, analyze, understand and use information to master lesson content. ▪ Concepts and skills related to applying technology to access information, solve problems, and create information are directly addressed in courses like Computer Applications and Technology. ▪ Students leverage online tools to collaborate and communicate with peers and instructors. ▪ Students leverage technology tools such as Word, PowerPoint, and Excel to research, analyze and evaluate information and create new information, authentic work, and presentations.

Life and Career Skills

P21 Framework	PLATO Online Courses
Today's life and work environments require far more than thinking skills and content knowledge. The ability to navigate the complex life and work environments in the globally competitive information age requires students to pay rigorous attention to developing adequate life and career skills, such as: ▪ Flexibility and Adaptability ▪ Initiative and Self-Direction ▪ Social and Cross-Cultural Skills ▪ Productivity and Accountability ▪ Leadership and Responsibility	▪ Online discussions provide opportunities for students to participate actively with peers, collaborate effectively in a team environment, demonstrate appropriate behaviors, respond open-mindedly to the ideas and opinions of others while being monitored by an instructor. ▪ Lessons that include self-checked activities require students to work independently in a self-directed manner without direct oversight. ▪ Culminating activities and real-world projects within PLATO courses provide opportunities for students to work independently, and demonstrate initiative to advance beyond basic skill levels. ▪ Courses like English, Health and Civics deal with concepts of integrity and ethical behavior and using power appropriately to influence and persuade others.

21st Century Support Systems

P21 Framework	PLATO Online Courses
Developing a comprehensive framework for 21st century learning requires more than identifying specific skills, content knowledge, expertise and literacies. An innovative support system must be created to help students master the multi-dimensional abilities that will be required of them. The Partnership has identified five critical support systems to ensure student mastery of 21st century skills: • 21st Century Standards • Assessments of 21st Century Skills • 21st Century Curriculum and Instruction • 21st Century Professional Development • 21st Century Learning Environments	▪ PLATO online courses are designed to explicitly address 21st century skills and prepare students for success in work and life in the 21st century. ▪ PLATO online courses include a wide variety of assessments designed to measure a student's mastery of knowledge, understanding of deeper concepts, and retention of information. ▪ PLATO courses apply a competency approach where each standards is measured with a mastery test before a student moves forward in the curriculum sequence. ▪ PLATO professional development models help teachers with the complex challenges of teaching within a 21st century environment. The PLATO professional development model includes: ○ Implementation Planning ○ Program Orientation and Training ○ Coaching and Mentoring ○ Implementation Review ▪ The PLATO Learning Environment provides a robust technology platform that enables educators with diverse levels of experience and technical expertise to apply 21st century best practices leveraging a suite of easy-to-use online tools and curriculum.

Data-Driven Online Instruction

The collection, analysis, and use of education data are central to the improvement of student outcomes envisioned by educators and administrators. This data is also needed to ensure that students, schools, and school districts are meeting local, state, and federal policy mandates. In an education context, data-based decision making consists of educators and administrators systematically collecting and analyzing various types of data to guide a range of decisions to help improve the success of students and schools. A number of activities and decisions undertaken by schools and districts involve data-based decision making, such as screening students for placement, using progress monitoring to determine curricular changes, and interpreting annual performance data to identify areas of weakness for future educational focus.

In today's classroom, educators must implement programs and make decisions that impact students' learning and academic future. They have limited time available to explore individual student strengths and areas of need. To address this challenge, educators and administrators require immediate access to student performance data and results in a format that supports informed classroom teaching and decision making throughout the school year.

To ensure the success of all learners, it's important to monitor their performance and progress continuously. Doing so will help educators make sound instructional adjustments as needed. The effectiveness of educational technology on student learning depends not only on what outcomes are targeted and how the technology is integrated into instruction, but also on how teachers evaluate student performance in classrooms and adjust instruction accordingly. Technology offers teachers a broad range of tools to collect and analyze data and richer sets of student data to guide instructional decisions.

The PLATO system provides users with the ability to easily record and track student information, including data needed for current federal mandates. PLATO reports provide instructional direction in clear, easy-to-understand formats that can be viewed at the student, class, school, or district levels and can be filtered by various categories. Students and parents may access the system at any time to review academic progress. Teachers can export reports into several file types and email data to parents.

The PLATO system provides multiple categories of reports:

- **Curriculum Reports:** Through class and individual progress reports, educators can track and report on student progress.
- **Assessment Reports:** The Adequate Yearly Progress (AYP) reports (class level only) allow educators to report on a single variable or two variables to assess progress toward AYP goals.
- **System Reports:** Usage reports allow account administrators to monitor how licenses are being used, which courseware is being used, and what parts of the PLATO system are being used.

Below is a summary of reporting features of PLE.

Report Name	Purpose
Curriculum Reports	
Learner Progress by Class and Assignment	This report monitors multiple learners' progress, status, and scores on activities within multiple assignments.
Learner Progress by Learner	This report monitors a student's progress, status, and scores on activities within multiple assignments across all classes.
Learner Daily Usage by Class and Assignment	This report monitors the activity of students in a class as they log in and out of the PLATO system and progress through their assignments each day. The report includes data on how much time each student spent on the system and how long each student worked on content in selected assignments for a specified date range.
Learner Daily Usage by Learner	This report monitors how much time a student spends working on class assignments in the system.
Class Usage Summary	This report provides information about how learners in a class are spending their time in the system.
Assignment Module Mastery	This report compares a learner's progress against the progress of class peers for a single assignment.
Curriculum Strengths and Needs by Class	This report offers a view of student performance on courseware assessments for a given class.

Curriculum Strengths and Needs by Location	This report gives administrators a view of student performance on courseware assessments for a given location.
Curriculum Test Progress	This report provides educators with a snapshot of how learners in a class are performing on the assessments for a course assignment.
Grade	This report calculates final or midterm grades for students in an assigned course with standard pacing.
Data Extract	This report allows administrators and teachers to see all summary usage and progress data for a group of students or for all students in a class, school, or district. The data available is based on the locations where administrators and teachers are assigned.
Class Roster	This report allows you to print out or export a list of learners in a class. It is available only on the Manage Classes page and not in the Reports mini-app.
Assessment Reports	
Assessment Strength and Needs by Class	This report offers a view of student performance on a state standards test for a given class.
Assessment Strength and Needs by Location	This report gives administrators a view of student performance on a state standards test for a given location.
Assessment Progress by Assignment	This report tracks average scores for a class on specific assignments of like fixed benchmark tests covering the same content.
Assessment Progress by Test Series	This report tracks average scores for all students in a location for tests taken during a specified date range. The report specifically tracks this information for all three tests in a Test Packs test series.
Demographic Summary	This report identifies demographic patterns in assessment results.
Class List of Assessment Scores	This report provides a quick snapshot of how students in a class performed on a fixed benchmark test assessment assignment.
System Reports	
License Usage	The purpose of this report is to provide peak usage information for concurrent licenses for only a specific period of time.
Resource Usage	The purpose of this report is to show a listing of overall system usage and a listing for each client in the system.
Site Traffic	The purpose of this report is to show how, when, and how many users from an account are accessing PLE.

STEM Initiatives in Education

The State Education Technology Directors Association (SETDA) report, *Science, Technology, Math and Engineering*, from September 2008 stated: "It is our responsibility to ensure that our children are prepared to lead our country in the 21st Century and compete in the global marketplace. In order to do that, we need to provide our children with an education that includes a solid foundation in science, technology, engineering, and mathematics (STEM)". *The Report of the Academic Competitiveness Council* defined the national STEM goal for student learning as: Prepare all students with the science, technology, engineering, and math skills needed to succeed in the 21st-century

technological economy, whether in postsecondary education or the workforce; and graduate students with the capability and motivation to become STEM professionals, educators, and leaders.

Some specific STEM initiatives have been established:

- Securing America's global leadership in the fields of Science, Technology, Engineering, and Mathematics
- Strengthen the rigor and relevance of STEM curriculum to ensure that every student is STEM literate upon graduation from high school
- Strengthening the educational pipeline that leads to STEM careers
- Increasing the number of college graduates opting into STEM careers
- Provide high quality teachers in STEM domains to ensuring high quality STEM education for all students.
- Develop an interdisciplinary approach to learning that integrates the four STEM disciplines.
- Provide real-world context for learning that makes STEM education relevant to students and the 21st century global economy
- Provide access to resources outside of the classroom, including web accessible instructional material and STEM professionals working in the STEM fields

PLATO Online Learning Supporting STEM Education

Rigorous and relevant curriculum that supports STEM literacy

PLATO online courses provide rigorous, explicit instruction on concepts. The courses build higher order thinking and require students to apply learning to create solutions to problems in relevant, real-world situations. These specific PLATO courses support STEM literacy:

Mathematics

- Pre-Algebra
- Algebra 1
- Algebra 2
- Geometry
- Consumer Mathematics
- Advanced Calculus AB, *AP* Edition*

Science

- Biology
- Chemistry
- Physical Science
- Life Science
- AP Chemistry, *AP* Edition*
- AP Biology, *AP* Edition*

Technology

- Computer Applications and Technology

Here are some specific ways that PLATO online courses support STEM initiatives:

- **Interdisciplinary approach to learning across each STEM domain**
  PLATO online courses are designed with an interdisciplinary approach to instructional lessons that integrates concepts and applies real-world examples and problem solving across each STEM domain.

  Sample lesson: *Calculus in Physics, Engineering, and Biology (Advanced Calculus)*
  In this lesson, students explore applications to physics, biology, and engineering; create and evaluate integrals that represent volumes as well as surface areas that may include pressure and center of mass; and create and evaluate integrals that represent blood flow and cardiac output.

- **Real-world learning in STEM disciplines**
  PLATO online courses incorporate real-world scenarios and require students to solve real-world problems across STEM domains.

  Sample lesson: *Differentiation in the Real World (Advanced Calculus)*
  In this lesson, students apply differentiation techniques in rate-of-change problems, explain the difference between the average rate of change and the instantaneous rate of change, and set up and calculate problems to find the rate-of-change differentiation. Students explore the use of differential calculus in real-world disciplines such as economics, physics, electrical and mechanical engineering, biology, and chemistry. For example, mechanical engineers measure the power exerted on an object by analyzing the rate of change using differential calculus.

- **Incorporating STEM careers into learning**
  PLATO online courses are designed to apply learning to specific STEM careers, engage students in exploring STEM careers, and make STEM careers relevant to students within the context of our 21st century global economy.

  Sample lesson: *Integration by Parts (Advanced Calculus)*
  In this lesson, students evaluate integrals by using integration by parts; they identify integrals that cannot be completed using previously learned methods; and they and find the indefinite and the definite integrals using integration by parts. This lesson directly integrates STEM careers into the mathematical concepts by explaining how engineers use complex integrals to help design large structures, such as the Burj Khalif tower in Dubai.

- **Incorporating STEM resources from outside the classroom**
  PLATO online courses integrate both Web-based instructional resources and links to authentic information, data, media, and content from STEM professionals into lesson explorations and tutorials.

Sample lesson: *Cells: Prokaryotic and Eukaryotic (Biology)*
In this lesson, students compare prokaryotic and eukaryotic cells in terms of size and complexity. The lesson activity provides external Web links that give students the opportunity to explore content and collect information and data from real-world sources. The Web-based resources in this lesson include animations that highlight the structural parts of cells, data and information developed by practicing university professors, and interactive media that gives students the chance to practice their knowledge and skills.

- **Connecting learners to STEM professionals**
  PLATO online courses model exposure to STEM professionals through a variety of contexts and situations.

  Sample lesson: *Gene Frequencies (Biology)*
  The context for this lesson is a dialogue between a high school student and her mentor, a working geneticist. Their interaction links the lesson instruction to the working world and introduces career paths available to students interested in this subject matter.

- **Embedding technology throughout the learning process**
  In addition to offering a specific course in Computer Applications and Technology, all PLATO online courses leverage a wide variety of technology tools during the learning process to provide a rich, relevant, engaging 21st century learning experience.

  - ***Software tools:*** PLATO online courses integrate word-processing, spreadsheet, and presentation software tools into the learning process to provide students with the experience of using these technology tools to conduct research, collect data, write papers, and make presentations. It is critical that high school students learn to effectively use tools that will be required in their post-secondary education and careers

  - ***Digital drop box:*** This feature enables students to submit papers, research, or presentations to their teacher for review, feedback, and grading. The digital drop box helps facilitate communication between students and teachers in a 21st century technology setting.

  - ***Discussions:*** The online discussion tool allows teacher-to-student discussion and monitored student-to-student discussion on topics that require students to synthesize knowledge and apply critical thinking skills to answer questions, form opinions, express ideas, and respond to the ideas and opinions of others.

Scientific Inquiry and Science Labs in Online Instruction

Scientific Inquiry

Scientific inquiry refers to the diverse ways in which scientists study the natural world and propose explanations based on the evidence derived from their work. Inquiry also refers to how students develop knowledge of scientific ideas as well as an understanding of how scientists study the natural world (National Science Education Standards 1996). In a position paper on scientific inquiry the National Science Teachers Association (NSTA) described the inquiry-based learning process as "… a powerful way of understanding science content. Students learn how to ask questions and use evidence to answer them. In the process of learning the strategies of scientific inquiry, students learn to conduct an investigation and collect evidence from a variety of sources, develop an explanation from the data, and communicate and defend their conclusions." Science inquiry melds a powerful and natural learning process with the scientific process.

Some key components of scientific inquiry and learning include:

- Incorporating content knowledge
- Use a pedagogical approach that encourages students to explore and question.
- Use instructional strategies that leverage relevant student experiences to answer questions.
- Provide students with the resources, tools, and environment for scientific inquiry and research.
- Learn to ask questions that can be answered through scientific investigation.
- Learn to collect research and data in conducting scientific investigations.
- Learn to analyze data and research, think critically, and draw conclusions based on evidence.
- Practice writing and presenting conclusions.

Although there is no single recipe for the scientific method, it is very close to the constructivist learning process. The scientific method, however, is more intentional and quantitative. It includes both "experience and experiment" and "social transmission," meaning that scientists publish their findings and review, analyze, test, and critique the work of others. Inquiry learning marries the learning process to the science process. Like the scientific method, inquiry learning has no single recipe, but the BSCS 5E Instructional Model is flexible and widely used:

BSCS 5E Instructional Model

1	Engagement	Observe, question, hypothesize.
2	Exploration	Design and investigate.
3	Explanation	Analyze and share (peer review).
4	Elaboration	Go deeper. Connect to the real world. Connect to other concepts.
5	Evaluation	Do I really understand this? Can I use it?

Scientific Labs

SAnother critical component of inquiry-based scientific learning is the laboratory investigation, or science lab. Science labs allow students to understand the natural world by conducting investigations, collecting and recording data, analyzing research, and documenting and presenting findings.

In 2005 the National Research Council (NRC) Board on Science Education defined four key principles for design of effective laboratory experiences in *America's Lab Report*:

- Clearly communicate the purposes
- Sequence lab experiences into the flow of instruction
- Integrate learning of science concepts and processes
- Engage in ongoing discussion and reflection

PLATO online courses include inquiry-based activities that support the practices of prediction, hypothesis, and data interpretation, as well as lab investigations that are integrated into the overall instructional sequence of a course. Lab investigations take a variety of forms: wet labs to be experienced in a formal laboratory setting (the school science lab), kitchen sink labs that can be conducted at home with common household elements, and Web-based labs that leverage the Internet and online simulations. PLATO online courses also provide numerous opportunities for students to analyze experimental data and practice the process of drawing conclusions from laboratory procedures and outcomes.

4.0 Best Practices for Today's Learner

Who are the generation X-Y-Z learners? As educators, it is critical that we understand who our learners are, what's important and relevant to them, and what engages and motivates them. Data suggests that today's students are savvy digital users:

- **Internet Use**—The Internet is fully entrenched in the lives of young people; 94 percent of teens now use the Internet or email.
- **Access in Internet**—Among teenage Internet users, 89 percent access the Internet from home, 77 percent do so from school, 71 percent do so from a friend or relative's house, and 60 percent do so from a library.
- **Daily Internet Use**—Nearly two thirds (63 percent) of teenage Internet users now go online daily, and more than one third (35 percent) of teens who are online use the Internet multiple times each day.
- **Access to Technology**—Six in ten teens (59 percent) now have a desktop or laptop computer, but computers are not the only technology that teens use to communicate. Cell phone use has grown rapidly among teens in recent years: 71percent of teens currently have a cell phone, up from 45 percent in 2004 and 63 percent in 2006. Overall, more than four in ten teens (45 percent) personally have both a computer and a cell phone. Among older teens, ownership of cell phones (81 percent) and computers (65 percent) is particularly high.
- **Electronic Communication**—Eighty-five percent of teens ages 12 to17 engage at least occasionally in some form of electronic personal communication, which includes text messaging, sending e-mail or instant messages, or posting comments on social networking sites *(Writing, Technology, and Teens 2008)*.

- **Text Messaging**—Daily text messaging by teens to friends has increased rapidly since early 2008. Some 38 percent of teens texted daily in February 2008, and by September 2009, that figure rose to 54 percent of teens who use texting daily. Of the 75 percent of teens who own cell phones, 87 percent use text messaging at least occasionally. Among those teens who text,
    - half send 50 or more text messages each day, or 1,500 texts a month, and one in three send more than 100 texts a day, or more than 3,000 texts a month; and
    - 15 percent send more than 200 texts each day, or more than 6,000 texts a month *(Teens and Mobile Phones 2010)*.

- **Social Networking**—More than half (58 percent) of all teens maintain a profile on a social networking site such as Facebook or MySpace, 27 percent have an online journal or blog, and 11 percent maintain a personal Web site.
    - Fully 60 percent of Internet-using teens (58 percent of all teens) have profiles on social networking sites such as Facebook and MySpace. For those who use them, social networking sites are a hub of teen communication. Fully 95 percent of social networking teens use social networking sites to communicate with their friends in one way or another, with commenting on photos and posting messages to friends being the most popular methods *(Writing, Technology, and Teens 2008)*.

- **Computer and Video Gaming**—Fully 97 percent of students ages 12-17 play computer, Web, portable, or console games. Research reveals the following statistics:
    - 50 percent of teens played games "yesterday."
    - 86 percent of teens play on a console like the Xbox, PlayStation, or Wii.
    - 73 percent play games on a desktop or a laptop computer.
    - 60 percent use a portable gaming device like a Sony PlayStation Portable, a Nintendo DS, or a Game Boy.
    - 48 percent use a cell phone or handheld organizer to play games *(Teens, Video Games, and Civics 2008)*.

Motivating Today's Learner

High-quality online instruction encourages discovery, integration, application, and practice.

While learning at a distance is not a new phenomenon, the emergence and popularity of the virtual classroom has transformed education in recent years, providing unique learning opportunities to students through a vast array of digital resources and content. This evolution has caused educators to rethink traditional approaches to teaching and learning. The flexibility, convenience, and level of personalized learning offered by online instruction have been widely detailed as significant benefits for students; however, these benefits may not be sufficient to sustain students if they are not prepared to engage in an online educational setting. Many instructors consider the motivation level of students the most important factor in successful instruction. Motivation is not only a causal factor of learning; it also mediates learning and is a consequence of learning as well (Wlodkowski 1985). Simply stated, students who are motivated to learn will have greater success than those who are not. Furthermore, students who experience learning success will be more motivated to do so in the future.

Motivation is important, even vital to learning. Goal orientation directs behavior (Pintrich 2000), and a positive self-efficacy promotes effort and persistence (Bandura 1997; Pintrich and DeGroot 1990). While many theories of motivation exist, previous research has consistently found that motivated students exhibit higher levels of achievement. Within the various theories of motivation are the concepts of intrinsic and extrinsic motivation. Intrinsic motivation refers to a learner's internal desire to perform a task for no reward other than personal satisfaction or enjoyment. When a student is motivated by rewards and incentives external to the learner's interest and satisfaction, these factors are called extrinsic motivators. Research indicates that intrinsic motivation is much more successful at reinforcing desired behavior than extrinsic motivation (Malone and Lepper 1987; Csikszentmihalyi 1990). In fact, care must be taken with extrinsic rewards. Over time, students who are intrinsically motivated, but rewarded extrinsically, can devalue their intrinsic interest in learning (Husen and Postlethwaite 1994).

Fostering adequate motivation for the online learner is one of the critical factors for creating a successful online learning environment. Yet responding to the motivational requirements of students in online learning environments has been reported to be a significant challenge due to the lack of student engagement and interest, teacher interactions (learner isolation), and opportunities for success in such learning environments (Keller 1999; Bonk and Dennen 2003). Teachers who want to motivate students to stay on task, increase their knowledge and skills, and improve their ability to process information in an online setting must guide the initiation, direction, intensity and persistence of learning behavior. Challenge, interest, feedback, and success are four components of an online learning environment that impact student motivation.

Challenge: Students are motivated when they are working toward personally meaningful goals whose attainment requires activity at a continuously optimal level of difficulty. This condition is vital to the learning process. To increase the level of engagement, students must be provided with tasks that continue to be interesting, meaningful, and relevant at a level of difficulty that is challenging but within reach.

PLATO Application:

PLATO Learning provides an online learning environment designed to overcome these noted challenges to increase student motivation and enhance the learning experience by providing instructional tools that leverage the most current advances in instructional and media design combined with rigorous research-based content. PLATO provides an engaging, age-appropriate learning experience that focuses on real world applications of content. Instruction is presented using a variety of techniques, including:

- use of pre assessments that measure a student's level of mastery with concepts and focus a student on what they need to learn next – therefore providing an optimal level of challenge
- use of on-screen manipulatives which simulate hands-on experiences for the learner

- multiple response modes including multiple choice, fill in the blank, drag and drop, sequential problem solving and open ended promon-screen resources such as notebooks for note taking, glossaries and dictionaries to enhance vocabulary building, calculators, and unit conversion tools (e.g., miles to kilometers)

Interest: Motivation is impacted by the learner's level of interest and attention in the activity. To maintain the student's interest, an online learning environment should employ various methods to avoid the sense of boredom from students. Student interest is crucial to the learning process because it fosters a desire for more information.

PLATO Application:
Content is presented using text, graphics, animations, and audio to provide clear and engaging instruction for the learner. All content includes navigational options that make learning self-paced and allow the learner to repeat or review previously viewed material. Tutorials elicit frequent responses from the learner to enhance student engagement and confirm understanding of the content. Rich media interactions like visual timelines and clickable diagrams provide engaging instructional material.

Feedback: Students need to have consistent and authentic feedback. Positive and creative feedback that is linked to a student's work will build relevance for the learning.

PLATO Application:
As students progress through instruction within the PLATO Learning Environment, they receive informative feedback that informs them of their successes and progress. Student feedback provided by the PLATO system is tied to a specific student's performance level rather than simple milestones or scores on assignments. Additionally, the PLATO Learning Environment provides several communication tools to connect students with teachers as well as other users. These tools include a message board, discussion board, and email.

Success: An online learning system should provide students with feelings of accomplishment and satisfaction with their learning experience, otherwise motivation will not be sustained through the learning process.

PLATO Application:
PLATO Courses administered through PLE provide students with powerful opportunities for success such as scaffolding and guided practice. The system offers scaffolded instruction which provides step by step guidance while teaching a process or concept, as well as the use of on-screen characters who mentor the learner.

Individualizing Learning for Each Student

A range of instructional design theories have as one of their goals the outcome of individualized learning. For example, Scandura's Structural Learning Theory (Scandura 1973 and Scandura 1976), Collins & Steven's Cognitive Theory of Inquiry Teaching (Collins and Stevens 1982; Collins and Stevens 1983), and Merrill's Component Display Theory (Merrill 1983), all have certain factors in common when it comes to tailoring instruction to each individual in a group or class. The commonality lies in the presence of these three elements:

- Some approach that breaks the content to be taught into a structure that includes goals or objectives (they don't all use those terms, but the concepts are similar)
- Regular opportunities to assess each learner in terms of whether they have mastered a particular goal or set of goals
- Prescribing content specific to the individual learner that includes only material for the goals they have not yet mastered

Some prefer to describe this approach as personalized learning, as the coursework and learning can be done in collaboration with others, not just as an individual. The important aspect is that the instruction follows a path that meets the individual needs of a learner, regardless of the instructional method used (group work, discussion, projects, tutorials, etc.). In *Disrupting Class*, the authors base much of their advocacy for innovation in education around a tension between "customization of learning" and the standardized model of school institutions. In their analysis, they state, "The proper use of technology as a platform for learning offers a chance to modularize the system and thereby customize learning."

For many years, PLATO Learning has used a mastery-based model to build the content at the heart of the courses and curriculum delivered on the PLATO system. That instructional model shares three basic elements from the approaches described above.

- PLATO online courses break the content into goals and objectives. Each learning module is built at a single objective level and provides an opportunity to practice the material being taught.
- Students are asked to demonstrate mastery of that objective through a mastery test or project. If mastery is not achieved, the material can be repeated and a new assessment of that objective can be taken to demonstrate mastery.
- PLATO online courses include unit-level pretests of the objectives covered within that unit. If mastery is demonstrated on any objective in that unit, the learner is exempted from the lesson that teaches that objective. In this way, learning is customized for the needs of that individual student.

Multiple Intelligences and Learning Styles

In his 1983 groundbreaking work, *Frames of Mind: The Theory of Multiple Intelligences*, Howard Gardner broke from previous theories around a single, quantifiable intelligence measured through a standard IQ test. Initially, Gardner divided intelligence into seven distinct categories, then refined his theories and added an eighth intelligence, the naturalist, in his subsequent research, *Intelligences Reframed: Multiple Intelligences for the 21st Century* (1997).

The following list is a summary of the eight intelligences:

- **Verbal-Linguistic**—the ability to manipulate words in a variety of ways, including speaking, writing poetry or prose, and story telling
- **Logical-Mathematical**—the ability to think and express ideas in logical, rational terms, establish patterns, and find cause-and-effect relationships. The Logical-Mathematical intelligence is the basis for the hard sciences and fields of mathematics
- **Spatial**—the ability to be highly attuned to the visual world, perceive visual detail, and create pictures
- **Musical—**the ability to appreciate, understand, and produce melody and rhythm
- **Bodily-Kinesthetic**—the ability to manipulate one's own body to express ideas and emotion (dance) or to overcome challenges or competition (sports)
- **Interpersonal**—the ability to interact well socially, to collaborate, and to work within a team
- **Intrapersonal**—the ability to access and understand one's own feelings and emotions
- **Naturalist**—the ability to be highly attuned with the natural world, plants, animals, and natural outdoor settings

Learning Styles

Early theory on learning style is based on the work of Carl Jung's (*Psychological Types* 1923) conceptualization of human psychological types as either perception (how we absorb information) or judgment (how we process information). Jung states that we can absorb information in two ways, either concretely through sensing or abstractly through intuition. Also, we can process information in two ways, either through the logic of thinking or subjectivity of feeling.

Building on the early work of Jung and later researchers, like Isabel Myers, who developed the Myers-Briggs Type Indicator, researchers Harvey Silver and J. Robert Hanson (*Learning Styles and Strategies* 1998) developed a formal learning style model characterized by four basic learning styles:

- **Sensing-Thinking (Mastery)**—characterized by the ability to remember, order, organize, and plan; learns best through hands-on experience, practice, and demonstration
- **Intuitive-Thinking (Understanding)—**characterized by the ability to analyze, examine, make connections, and explain; learns best through lectures, tutorials, reading, logical discussion, or debates
- **Intuitive-Feeling (Self Expressive)**—characterized by the ability to generate ideas, imagine, think metaphorically, express, and create; learns best through open-ended activities or discussions, as well as creative and artistic activities
- **Sensing-Feeling (Interpersonal)**—characterized by the ability to empathize, respond, express feelings, and build trust and rapport; learns best through group activities, personal encounters, role playing, and collaborative projects.

Multiple Intelligences, Learning Styles, and PLATO Online Learning

The PLATO instructional design process leverages the extensive research base behind multiple intelligences and learning styles to create a rich learning environment that appeals to the unique traits of different learners. For example, practice activities provide the opportunity for learners to solve a variety of problems and demonstrate their skills. They appeal to sensing-thinking (mastery) and logical-mathematical learners. Video enhances and supports learning and provides connections to the real world. This element appeals to spatial and intuitive-thinking (understanding) learners. The table below lists and defines the key components of PLATO online instruction and notes the learning style or intelligence that each component supports.

PLATO Online Instructional Component	Description	Learning Style or Intelligence
Tutorial	Tutorials introduce concepts, present critical information and facts and provide explicit t step-by-step instruction on terminal and enabling objectives.	Intuitive-Thinking (Understanding) Verbal-Linguistic
Practice	Practice activities provide a variety of problems that are based on both abstract concepts and real-world scenarios and allow learners to check their understanding and demonstrate their skills.	Sensing-Thinking (Mastery) Logical-Mathematical
Application	Application activities provide the opportunity for students to take learning from one context and apply it to a variety of problems or scenarios.	Intuitive-Feeling (Self Expressive)
Exploration	Explorations are constructivist inquiry-based activities that allow a learner to take control of their learning experience by providing guided research activities with demonstration of learning.	Intuitive-Feeling (Self Expressive) Verbal-Linguistic Logical-Mathematical
Culminating Activity	Culminating activities provide opportunity for learners to demonstrate that they can synthesize knowledge and understanding to solve problems or formulate logical thesis.	Sensing-Feeling (Interpersonal) Verbal-Linguistic Logical-Mathematical
Project-based Assignments	Project based assignments provide the opportunity for learners to apply learning on concepts and skills to real world problems.	Sensing-Feeling (Interpersonal) Verbal-Linguistic Logical-Mathematical
Mastery Tests	Mastery Tests are groups of five to ten assessment questions designed to measure specific learning on terminal and enabling objectives.	Sensing-Thinking (Mastery)
Graphic Imagery	Learning experiences are often supported through graphic imagery that provides support for instructional concepts and connections to the real-world.	Spatial
Interactions	Learning experiences are supported through a variety of technology-based interactions that allow students to apply learning, as well as practice and check their understanding of concepts. Examples include multiple choice, drag and drop matching, fill-in-the-blank and many other interactivity types.	Sensing-Thinking (Mastery) Bodily-Kinesthetic
Video	Learning experiences are often supported through video that enhances and supports instructional concepts and provides connections to real-world scenarios.	Spatial Intuitive-Thinking (Understanding)
Simulations	Simulations provide learning experiences that mimic real world problems, systems, or scenarios and give the learner the opportunity to explore, learn and test their knowledge without real world consequences.	Sensing-Thinking (Mastery) Bodily-Kinesthetic
Online Discussions	Online discussions provide a virtual environment where students can interact with their teacher and peers to explore, discuss and debate specific topics relevant to learning.	Sensing-Feeling (Interpersonal) Verbal-Linguistic Interpersonal Intrapersonal

The New Role of 21st Century Educators: Differentiated Learning Using Online Solutions

As technology changes so does the way we communicate, access information, establish communities, live, and work. Technology is also changing the way students learn and is changing the role of 21st century educators.

A recent analysis of online learning from the U.S. Department of Education took a look at several key questions concerning its effectiveness:

1. How does the effectiveness of online learning compare with that of face-to-face instruction?
2. Does supplementing face-to-face instruction with online instruction enhance learning?
3. What practices are associated with more effective online learning?
4. What conditions influence the effectiveness of online learning?

Some important findings from the 2009 U.S. Department of Education study *Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies* include the following:

- Students who took all or part of their class online performed better, on average, than those taking the same course through traditional face-to-face instruction.
- Instruction combining online and face-to-face elements had a larger advantage relative to purely face-to-face instruction than did purely online instruction.
- Studies in which learners in the online condition spent more time on task than students in the face-to-face condition found a greater benefit for online learning.
- The effectiveness of online learning approaches appears quite broad across different content and learner types.
- Elements such as video or online quizzes do not appear to influence the amount that students learn in online classes.
- Online learning can be enhanced by giving learners control of their interactions with media and prompting learner reflection.
- Providing guidance for learning for groups of students appears less successful than does using such mechanisms with individual learners.

While the U.S. Department of Education's meta-analysis indicates that the effectiveness of various approaches to online learning appears quite broad across different content and learner types, an INACOL report focused specifically on the benefits of online learning for at-risk and credit recovery students. Findings from INACOL's report, *An Exploration of At-Risk Learners and Online Education*, suggest that online learning supports increased motivation, student engagement, and achievement success for at-risk students due in large part to the flexibility and self-paced nature of online delivery programs.

Adapting PLATO Learning's Model for Different Settings

As described above, PLATO Learning's instructional model provides the flexibility to adapt online courses for settings ranging from credit recovery to first-time credit and AP*.

Credit Recovery

PLATO Learning's historical strength in credit-recovery settings comes from the delivery of courses with rigorous curriculum and instructional design. Following are the primary features of PLATO Learning's approach to credit recovery.

- Curriculum is centered on individual objectives in a scope and sequence built to address national and high-quality state standards.
- Courses are correlated to individual state standards.
- Unit pretests identify content that students are struggling with, which allows for customized instruction.
- Interactive and engaging content is accessible in a self-paced setting.
- A mastery model confirms that learners understand each objective before they move on to additional material.
- Each semester-long course consists of 60 to 75 hours of instruction.
- Tools are available for customizing PLATO-structured courses into a focused, brief overview of a semester of materials.

First-Time Credit

PLATO online courses are regularly used by schools and districts to offer courses with rigorous curriculum and instructional design for first-time credit. Following are the primary features of PLATO Learning's approach to first-time credit.

- Curriculum is centered on individual objectives in a scope and sequence built to address national and high-quality state standards.
- Courses are correlated to individual state standards.
- Unit pretests identify content that students are struggling with, which allows for customized instruction.
- Interactive and engaging content is accessible in a self-paced setting.
- A mastery model confirms that learners understand each objective before they move on to additional material.
- Each semester-long course consists of 75 to 90 hours of instruction.
- Optional discussions and culminating activities extend instruction as needed.
- Tools are available for customizing PLATO-structured courses to supplement lessons with local activities, other online resources, or modules from other PLATO courses.

AP* Courses

PLATO Learning is introducing innovative courses with rigorous curriculum and instructional design for use in AP* settings. Following are the primary features of PLATO Learning's approach to AP*.

- Curriculum is centered on individual objectives in a scope-and-sequence built to meet College Board expectations.
- Syllabi are provided that document the course design for ready submission to the College Board for local course approval.
- Courses are correlated to individual state standards.
- Pretest results can be overridden to ensure that students review all material relevant to the curriculum.
- Interactive and engaging content is accessible in a self-paced setting.

- A mastery model confirms that learners understand each objective before they move on to additional material.
- Each semester-long course consists of 120 to 150 hours of instruction.
- Unit-level discussions and culminating activities deepen learning and extend understanding of rich curriculum.
- Assessments and activities are modeled on College Board exam formats to prepare students for AP* exams.
- College Board lab experiences are integrated into science courses in a hybrid online/in-person model.
- Interactive elements present material in novel forms and confirm deeper learner understanding of the objective.
- Tools are available for customizing PLATO-structured courses to supplement lessons with local activities, other online resources, or modules from other PLATO courses.

PLATO Learning: Expanding on a History of Success in Online Learning

PLATO courses are delivered online primarily in one of three ways:

- **Pure Virtual Model**—In this environment, face-to-face interaction between students and teachers is limited. Teachers assign courses to students using PLATO communications and reporting features to provide instruction, monitor student progress, and communicate directly with students.
- **Blended Model**—In this type of implementation, the course is designed to blend classroom-based instruction with online instruction. Teachers typically deliver course components via a whole class, small group, or individual direct-instruction model, with some components assigned using PLATO online learning solutions. PLATO assignments may include entire courses or specific course components, such as units, assessments, and/or offline activities.|
- **Intervention Model**—Students sometimes use PLATO courses to accelerate learning or engage in remediation. Intervention programs are typically based on specific student learning need and incorporate full courses, strategies, lessons, modules, etc. The teacher often works one on one with students or in small groups to provide targeted instruction.

Evidence of the Effectiveness of PLATO Online Learning

PLATO Learning's extensive experience in supporting improved achievement outcomes includes implementations in rural, suburban, and urban districts. In addition, PLATO programs in schools support targeted interventions, multiuse site implementations, and full-school, district, and statewide programs. In many instances, PLATO is used to extend learning resources, including time and instructor access. Following are some recent program efficacy results in sites that use PLATO courses.

PLATO Success Story

Conway Public Schools, Conway, AR

Conway is an example of PLATO applied across multiple grade levels to support learning enrichment and learning acceleration. PLATO Learning's implementation in the Conway Public Schools serves students in grades K-12 year round through site implementations at all school sites. Conway has been using PLATO since 2006.

Results:

Grades K-5
Since the start of the 2009-2010 school year, more than 290 elementary teachers have received professional development and training to integrate PLATO Learning curriculum in grades K–4. This curriculum provides twice-weekly math and reading instructional enhancement to all elementary students (more than 3,700) on nine campuses. In addition, the district is building custom courses to address Individual Education Plan (IEP) recommendations for special education students in grades K-4.

Grades 6-8
During the 2006–2007 school year, Conway extended the PLATO Learning program to serve students in grades 5–8. As part of this implementation, the district capitalized on its vertical and horizontal alignment to the Arkansas state frameworks and its use of pacing guides to ensure consistency across grade levels and subjects. During a single year of program implementation (2007-2008), 23 percent (427) of students in grades 6–8 demonstrated growth on the Arkansas Benchmark Exam. Between 2007 and 2009, the growth in student achievement between the comparable pretests and posttests ranged from 48 percent to 90 percent, with an average growth of approximately 70 percent in the grade-level subject area tests.

Grades 9-12
At the high school level, Conway embarked upon a multiyear plan in 2006 to improve student achievement on Arkansas state test scores for grades 9–12. During the first three years of the PLATO implementation (2006–2009), a total of 982 high school students participated in the credit recovery program. The credit recovery program has been extended to summer school and curriculum enrichment using custom courses from the PLATO Learning content and courses library. Approximately 11 percent of students in grades 9–12 have participated in the online credit recovery option each year, accessing courses from home or in the district lab at each school site.

Thompson School District, Loveland, Colorado

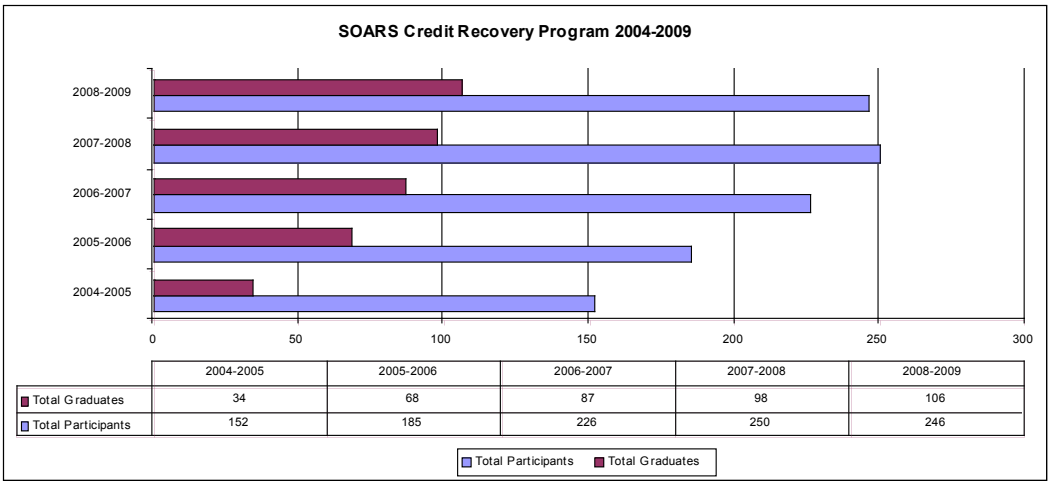
Thompson School District has used PLATO Learning since 2004 to support these initiatives:

- Dropout prevention and retrieval
- Credit recovery
- Response to Intervention (RTI)—personalized assessment and learning program
- Tutoring center

Results

Between 2004 and 2009, the Secondary Options for Achievement Resulting in Success (SOARS) program achieved an average 77 percent success rate for dropout retrieval and prevention. In that same time period, 215 students re-entered school and graduated from Thompson School District via their participation in the SOARS program.

The PLATO Learning program was extended beyond the SOARS center in recent years to include a high school credit recovery program at each of the Thompson School District high schools. The credit-recovery program provides the option for students to complete failed classes beyond the regular school day, between 3:30 p.m. and 9:30 p.m. During the five-year period between 2004 and 2009, a total of 1,059 students participated in the program, including 393 graduates.



	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009
Total Graduates	34	68	87	98	106
Total Participants	152	185	226	250	246

Oceanside Unified School District, Oceanside, California

In Oceanside, students use PLATO courses in a variety of settings:

- Two Academic Acceleration and Recovery Centers (AARCs) at the two comprehensive high schools
- After-School Credit Recovery at the two comprehensive high schools and Ocean Shores Continuation High School
- Enrichment and remediation at the elementary and middle schools
- Summer school program serving 350 students to address graduation requirements
- Home access (testing proctored at home schools)

Results

Within the AARC program, students have completed 5 to 180 credits on average, depending on the circumstances; however, a 30-credit completion rate is the average success for each student enrolled in the program.

The following table represents a summary of the AARC program during the most recent three years:

Oceanside Academic Acceleration and Recovery Centers				
2006-2009				
School Year	**Enrollment**	**Graduates**	**Courses Completed**	**Average Daily Attendance**
2006-2007	224	29	1022	66%
2007-2008	293	79	1500	87%
2008-2009	394	99	2074	86%

Cypress-Fairbanks (Cy-Fair) Independent School District, Houston, Texas

Beginning in the 2008-2009 school year, PLATO was integrated as part of a two-part credit-recovery, secondary-intervention model with school labs and an off-campus center. While Cy-Fair did not have a prior need for a dropout prevention program due to its graduation rate success, the district recognized the need for such a program to help students who were falling behind their classmates as they progressed through high school. From its inception, the program was designed to provide preventive measures, beginning with the high school and expanding to the middle school for succeeding years. Interactive, Inc., an independent evaluation firm, conducted a third-party, quasi-experimental study to examine the results of the PLATO implementation. Additional information regarding the study is available at www.plato.com

Results

- Students earned, on average, teacher-assigned grades that were17 points higher after retaking the same course using PLATO that they had previously failed.
- Of the Cypress-Fairbanks students who failed a course in 2008, and then retook the course in 2009 using PLATO, 84 percent completed and passed the course the second time.
- Limited-English Proficient (LEP) students gained even more than did the other students using PLATO (as indicated by teacher-assigned grades) over the two academic years examined in this analysis.
- When student improvement was disaggregated by ethnicity, gender, and at-risk classification, all the groups improved their average performance year over year. The similarity of the gains across the groups suggests that PLATO is able to equally help all students learn across both semesters of the academic year.

5.0 Conclusions

Online learning is one of the fasting growing trends in education today, with growth in the coming years estimated at approximately 30 percent annually. There are numerous reasons for this explosive growth:

- Online learning can provide students with access to a wealth of information, research, data, media and communication.
- Online learning can provide anytime, anywhere access to learning.
- Online learning can provide an individualized learning experience.
- Online learning can help educators reach broadly diverse student populations including mainstream, credit recovery and advanced students.
- Online learning can help administrators scale quality instruction beyond the walls of each school building.
- Online learning can provide immediate access to critical data and enhance data-driven instruction.
- Online learning can provide flexibility and efficiencies and positively impact budgetary challenges.

The Internet has become more than just a tool; it is a powerful part of our culture and lives. For more than 50 years, PLATO Learning has been a leader in educational technology, driving significant advances that leverage technology to support and enhance the learning process. Today PLATO Learning continues to develop innovations that drive education toward a future where high-quality 21st century teaching and learning is seamlessly integrated within a technology-based learning environment and richly interactive digital curriculum that is relevant to all learners.

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