10 Things You Should Know about a Results-Only Learning Environment (ROLE)

Scenario

Rhett and Cheri are two instructional designers at Telecom, Inc., a U.S.-based telecommunications company. The two are responsible for designing a variety of management trainings including contingency training in the instance of a telecom union strike.

Last month, Telecom, Inc. experienced a two-week-long telecom union strike. Although all managers had passed the annual, classroom-based contingency training, management was unable to perform as expected during the strike and company operations came to a halt. Telecom's customers were affected and the company's reputation, stock, and profitability were severely impacted.

1. Example

Telecom, Inc. executives have tasked two of their instructional designers, Rhett and Cheri, with redesigning the union strike contingency training and requiring all management to pass the new training ASAP. It is imperative that management is able to keep the company operational even in times of a union strike.

To date, much of the management training Rhett and Cheri have designed has been classroom-based or self-paced e-learning. Recently, Rhett and Cheri learned about Results-Only Learning Environments (ROLE). They have been looking at ways to incorporate ROLE methods into management training at Telecom, Inc., and feel that the new contingency training for management is a great place to start since its focus is on results -- something management must demonstrate to executives to affirm that there will be no future repeat of last month's operational failures.

For our Telecom, Inc. strike contingency management training, we will initially provide our management teams with a set of key skills that need in the event of a strike. Strike contingency teams consist of several groups that have been assigned specific skills training. We are going to focus on the training needs of our "residential services" strike contingency group. The residential services contingency group needs to know how to perform home phone line installations and maintenance. We will provide our group with an outline of the specific residential services skills they need and they will have access to training resources and hands-on training labs. The contingency group will be responsible for researching their specific job tasks so that they can demonstrate competency in performing specific skills.

2. Definition

*A ROLE is a Results Only Learning Environment. Results-only learning is a system of education that uses project-based learning and evaluates students' mastery of learning outcomes, based strictly on the results, rather than the methods used to get to the results* (Barnes, 2011, para. 1).

ROLE methods are also reflected in ROWE, (the Results-Only Work Environment). This work environment, originally defined by Cali Ressler and Jody Thompson while working for Best Buy Corporation, focuses on employees' performance and results in the workplace rather than tenure, the means to results, face time, or attendance. Outcomes drive activities rather than vice versa (Ressler & Suleman, 2011; Achievers, 2011b).
3. Advantages

“The timeliness and quality of the delivered results is what validates employees’ contributions to the company, and...results are the expectation” (Achievers, 2011c). In the case of training Telecom employees, this translates to managers needing to perform, rather than simply receiving a passing grade on contingency training that they cannot later replicate on the job. “[Results-only environments] focus on the results that improve business as opposed to patting effort on the back” (Achievers, 2011a). This allows employers, such as Telecom, Inc., to engage top performers who will no longer get the same tenure-based “service” awards as everyone else (Achievers, 2011b). Classroom management issues during training disappear when utilizing a results-only environment. According to Barnes (2011), students are too busy engaging in learning activities to be disruptive in this type of environment, allowing teachers and trainers to stop concerning themselves with rules and consequences and to direct focus to actual teaching. This would work well in a corporate setting like Telecom’s, as managers have multiple roles and tasks, and attending contingency training may be just one of the many things they are responsible for at a given time.

Placing value on results allows this environment to work in a variety of settings, industries, and organizations since results and outcomes are the focus of all learning and work activities. Companies who move to a [results-only] environment immediately notice a difference in the workplace because employees are being stimulated beyond base needs. Traditionally, about 5% of employees will not step up to the plate. [Leaders should take] action on poor results and know that these individuals would not be performing in a non-ROWE environment as well” (Achievers, 2011a). Returning to the Telecom scenario, if management still does not perform after the new contingency training, it is possible that these managers will continue poor performance, yet it is an advantage for Telecom to be able to identify these managers to ensure people are in the right positions in the organization.

According to the Achievers (2011b) and Ressler & Suleman (2011), additional advantages of results-only environments include:

- Allowing employees to focus on activities to achieve goals rather than perform tasks that are irrelevant to goals
- Allowing all employees to contribute freely and motivate each other
- Giving employees autonomy and focusing on accountability rather than employee monitoring
- Trainers and leaders focus on outcomes (results) instead of the daily tasks, (e.g., meetings, monitoring employee work time, ensuring people are doing their jobs, etc.) instead of activities that drive results
- Accomplishing more and driving results without having to increase employee headcount (as noted in the Best Buy case; see Evidence of effectiveness section below)
- Alignment with what motivates employees, such as making meaningful progress (see image below)

![What motivates today's employees?](Ressler & Suleman, 2011, slide 7)
4. Limitations

Stewart (2009) outlines that it takes both time and effort to move from a traditional environment to a results-driven one. This must be considered when planning to implement a results-only environment, as it is not something that can be accomplished quickly or overnight.

Learners, employees, and employers can be apprehensive in changing from a traditional environment that has been around for decades, so demonstrating the value of this environment may prove to be a challenging task (Achievers, 2011a). Cheri and Rhett should prepare for this as they determine how to present a results-only environment at Telecom. In addition, learners and employees – rather than teachers and trainers – are accountable for learners’/employees’ learning and performance (Stewart, 2009). This may seem intimidating to learners who must now take on the role of scheduling their own time and ensuring results are achieved, rather than simply being rewarded for “showing up” or “trying.” Telecom managers may appear hesitant to this environment with so many other management-related tasks in the current role.

In order for a results-only environment to work, learners need to be motivated and constant feedback is important. If a poor motivator or coach is in place, or if the instructional designer or trainer cannot find a means to motivate learners and appropriately guide them, a results-only environment may be less effective or ineffective (Achievers, 2011a, 2011b). Cheri and Rhett must ensure that proper feedback and motivation is in place going into the training and work with Telecom trainers to ensure training will be appropriately facilitated in this type of environment.

The focus is on results to drive activities rather than the activities alone, and monitoring how people achieve results seems to be of less concern than in a traditional environment. It should be noted, however, that a results-only environment does not necessarily translate to removing all relevance from the means of achievement. Still, some worry that learners and employees will take short cuts or achieve results in an unethical way. Achievers (2011b) argues that these learners/employees would be performing unethically whether or not they are in a results-only environment. This is something to consider as companies like Telecom still strive to have their employees and learners respect organizational values and the culture while driving results.

5. Role of the teacher

To enable a results-only environment, Achievers (2011a, 2011c) and Ressler & Suleman (2011) recommend focusing on results and appropriate activities to achieve the results. Effort and participation are not end goals and learners/employees — including managers at Telecom — who do not demonstrate results should be addressed. Micromanaging trainers should change their focus to motivational activities and move from a traditional teacher-student relationship to a partnership in achieving results. This translates to Telecom trainers partnering with managers to facilitate the contingency learning, rather than lecturing on how to handle union strikes in the future.

According to Barnes (2011), to facilitate a ROLE, trainers (teachers) should also:

- eliminate worksheets, homework, and classroom rules and consequences;
- replace traditional grades with narrative feedback (see Assessment Methods section) and allow learners to evaluate themselves and their performance;
- avoid lectures and promote a workshop setting with discovery activities aided by brief instructional videos and activities;
- avoid requiring learners to pass a test to demonstrate their understanding of the content, and use assessments only as diagnostic tools; and
- leverage projects should as a means for learners to demonstrate their understanding of the content and concepts.

At Telecom, suggestions from Barnes translates to managers collaborating to learn and apply contingency training in future situations. This is heavily activity-based, and guided by trainers.

Stewart (2009) outlines that in a ROWE (ROLE), trainers (teachers) should not restrict times, locations, or activities for their learners. Learners are free to participate in the learning events that are beneficial to them and trainers should not require participation in anything that is inefficient or wastes learners’ time. This will work well for managers at Telecom since they will be free to handle their learning and other tasks in priority order, rather than prolonging potentially urgent issues to attend contingency training. Trainers are responsible for motivation and should motivate learners to show results, monitor progress, provide assistance/guidance (scaffolding), and then reward those results. (See Assessment Methods section.)

6. Role of the student

ROLE is a "student-centered" methodology, therefore, the student is takes on a significant responsibility for learning. Students in a student-centered environment are actively engaged in initiating discussions (Hmelo-Silver and Barrows, 2006). Given that the learning follows a project-based learning (PBL) approach, students work in groups to research what they need for their learning task while the instructor provides oversight and feedback. As Ertmer and Simmons (p. 41, 2006) note: “Because students are introduced to the problem before they have learned the required content knowledge, they work together to identify their learning needs and to locate relevant information to address those needs. Throughout the process, the teacher monitors and guides students’ progress by overseeing the management of small student groups, keeping students focused on important content, and providing ongoing formative feedback”.

In our scenario, students are not spoon-fed monotonous slide presentations and web tutorials for learning their job skills. Students will determine how to demonstrate their learning. The students are given information about the specific skills they will need to know in the event of a strike and they are responsible utilizing available resources to learn their job tasks. Each student must demonstrate the specific skills competencies assigned to their contingency group. Students will work as a team to research the skills and they will engage in role play activities to help validate their skills. The students are empowered to perform their own research and they are encouraged to stage mock "strike" events where they step in and perform residential services tasks for Telecom, Inc.
7. Assessment methods

ROLE approaches assessment much differently from the traditional testing and grading methods that most of us are used to. ROLE has no specifically assigned:

- Tests
- Homework
- Worksheets
- Grades (in the traditional sense)

Instructors implementing ROLE will use narrative feedback (see video below) to assess on-going progress and conduct final performance reviews (Barnes, 2011). Narrative feedback occurs throughout the training cycle and takes the place of traditional grading. Depending upon the instructional environment, feedback may be provided to students in different ways, such as:

- Private student web sites
- Discussion forums
- Online grade books
- One-on-one discussions (“sidebars”)

Students also provide a self-evaluation where they meet with the instructor and suggest a grade that they feel they deserve. While this will approach may fly in the face of common sense, students have been shown to realistically self-evaluate (Barnes, 2011). The on-going feedback that students receive helps to reduce surprises because students have a good gauge of how they are doing. As Barnes (2011) notes, “A week prior to sitting down for our one-on-one discussions, when we’ll reflect on the quarter and decide on a report card grade, I reminded students that they needed to begin the self-evaluation process”.

See: ResultsOnlyLearning

Our training scenario would have private skills competency tracking web pages for each team member. For narrative feedback, our instructors can add comments to the students web page and students can leave messages and comments for the instructor. This online tool is used both for scaffolding and assessing progress. Students are responsible for initiating a dialog with the instructor and they determine how they will demonstrate competencies. While the instructors will not assign “grades” to the tasks that students demonstrate, ongoing feedback is provided to help students determine how they are doing and where they need to work on their skills.

The following videos from Mark Barnes (2011) provides a good overview of assessment within ROLE:

**How to crush the ABCs with narrative feedback**

YouTube URL: http://www.youtube.com/watch?v=2Rn1pTbC-As

**How teachers can eliminate grades**

YouTube URL: http://www.youtube.com/watch?v=yIY4BzTm5lY

8. Most relevant digital tools

Achievers platform provides tools for recognizing and rewarding employees. Recognizing and rewarding results is an important part of ROWE and ROLE. Achievers would be most applicable for the corporate environment. This video provides an overview of how Achieve works: http://www.youtube.com/watch?v=p3QjcSLl1eo

Diigo is a collaborative research tool that can be used to highlight, bookmark, tag and share web content. Teachers can set up Diigo sites for their classrooms and students may contribute research content to the site. The video below, Mark Barnes (2011) instructs his students to sign up for Diigo and shows them how they will be using the tool to aggregate, bookmark and tag websites that they will be using for research. Research is a critical part of PBL and this tool is very cool, collaborative way student groups can pull their research content together and to catalog it for their projects.

**How to use Diigo groups**

Facebook can be used to facilitate PBL group interaction in a ROLE classroom. Jan Pierce provided a guest blog post on Mark Barnes’ (2011) blog site and offered a number of suggestions for using Facebook with ROLE. See: resultsonlylearning.blogspot.com

Given that on-going feedback is a critical part of ROLE, relevant online tools would include any web applications that provide student web pages, threaded discussion forums and online grade book capabilities. A number of Learning Management Systems (LMS) are available that provide functionality for student projects and on-going feedback. One commonly used open-source LMS is Moodle. Moodle was designed with social-constructionist principles in mind and provides an online grade book, discussion forums, blogs, wikis and a number of other capabilities for facilitating a ROLE classroom. This brief video provides an overview of Moodle:

Moodle Presentation [Version 2.1, HD]

YouTube URL: http://www.youtube.com/watch?v=I4mmMeMDMic

If you want to geek-out and learn more about Moodle, this presentation by the founder/creator, Martin Dougaimas, provides an interesting overview and some insight into where the LMS is headed:

Moodle Keynote July 2011

Our strike contingency training scenario would benefit from using Moodle for organizing internal research material, providing group discussions, facilitating on-going narrative feedback, and providing online grade book capabilities. Achievers could be used for recognizing and rewarding our employees that are exhibiting key skills competencies.
9. Evidence of effectiveness (from the research literature)

Given that ROLE is a relatively new instructional methodology, empirical research findings are scant. Mark Barnes (2011) provides a strong testimonial concerning the effectiveness of ROLE in his language arts class, however, research needs to be conducted to objectively determine whether the efficacy of ROLE. Research should provide findings that determine:

- How students scores in a ROLE classroom compare with "traditional" classrooms
- How performance in a ROLE classroom compares with other pedagogies, such as problem-based learning, project-based learning, inquiry learning, authentic instruction, etc.
- The issues and challenges associated with implementing a ROLE classroom. Given that ROLE uses project-based learning (PBL), it could be assumed that ROLE would, at a minimum, entail some of the same challenges associated with PBL (Ertmer and Simons, 2006).
- Which types of learners and learning tasks are most suitable for ROLE. For instance, is it feasible to expect that ROLE would work for lower elementary grades?

While peer-reviewed research on ROLE is nonexistent, we can review studies on PBL and ROWE and draw some inferences.

Project- and problem-based learning (PBL) have been studied for a number of years and, while successful implementation requires careful planning and preparation, the results indicate that students in PBL programs score higher on standardized tests than students receiving traditional instruction (Geier et al., 2008).

Implementing a results-only environment at Best Buy Corporation decreased turnover rates by as much as 90%, saved $2.2 million in two years, increased average productivity by 41%, and "expanded individual and team capacity" (Ressler & Suleman, 2011, slides 19-20; Achievers, 2011b). This demonstrates that the Best Buy organization was able to accomplish more and drive results without having to increase headcount -- an advantage of a results-only environment.

10. Supplemental reading list (for those who would like to know more)

ROLE is an emerging pedagogical trend and we do not have much in the way of peer-reviewed articles or books. Given that ROLE is an offshoot of ROWE (Results-Only Work Environment), we have included some references below for you to learn more about ROWE. ROLE implements similar ROWE techniques in learning environments instead of work environments.

Ressler, C., & Thompson, J. (2011). Why work sucks and how to fix it: The results-only revolution. New York, NY: Penguin Group. We have included an excerpt from the book:

Why Work Sucks Intro and Chapter 1 - SlideShare Page Link

Mark Barnes is a teacher and ROLE thought leader. Anyone interested in implementing ROLE should bookmark the links below:

Mark’s blog site: http://resultsonlylearning.blogspot.com/
Mark’s classroom site where you can see how ROLE is being implemented in a real classroom: http://www.barnesclass.com/

If you like watching movies, enjoy the following ROLE videos:

Results-Only Learning Environment PechaKucha Style
YouTube URL: http://www.youtube.com/watch?v=zhGbaI1WRCA

Results Only Learning Environment (ROLE)
YouTube URL: http://www.youtube.com/watch?v=Ob5tBRFqJU

This slideshow from Mark’s classroom site provides an overview of ROLE:
ROLE Slideshow (Click the slides to advance the presentation)

References:


Table of Content

10 Things You Should Know about Authentic Instruction

1. Example
   With the high winds of the last couple of days, Mr. Smith proposes a question to his Physics class. "What scenario and conditions could put a Benton County windmill in danger of toppling over?" This is an open-ended PBL assignment, allowing students to make a case and present it in any way they like.

2. Definition
   Authentic instruction is a model for high-quality instruction developed by Fred Newmann (1993). It lists five major components of the teaching process:
   
   1. Higher-order thinking. Higher-order thinking requires students to "manipulate information and ideas in ways that transform their meaning and implications, such as when students combine facts and ideas in order to synthesize, generalize, explain, hypothesize, or arrive at some conclusion or interpretation." When students engage in higher-order thinking, they must solve problems and develop new meanings for themselves. There is an element of uncertainty and unpredictability in the process.
   2. Depth of knowledge. Depth of knowledge means that students deal with the significant concepts or central ideas of a discipline. Students use knowledge to understand arguments, solve problems, or construct explanations.
   3. Connectedness to the world beyond the classroom. This third feature of authentic instruction connects the classroom to some "real world public problem" or personal experiences that the student can relate to.
   4. Substantive conversation. This feature involves considerable discussion and interaction about the ideas of a topic that develop and build on ideas presented by others in the conversation. It involves the sharing of ideas and multiple exchanges in which students and other participants develop shared understanding of a theme or topic.
   5. Social support for student achievement. This last feature involves the development of "high expectations, respect, and inclusion of all students in the learning process." Social support is more than token acknowledgement or praise for participation. It occurs when teachers convey high expectations for all students and encourage all students to participate in the learning experience.

3. Advantages
   Students have better depth of knowledge of different topics of learning. Also, they are engaged in the learning and it connect to the world beyond the classroom. Having meaning to the learner has been shown to increase learning.

4. Limitations
   Limitations would be that this process can be hard for students. They would need to be trained on how to explained their and answers with support. Also, some find it hard to work in groups. It is also a very exhausting process for the teacher. Planning is essential for this type of instruction. Many concepts and standards do not easily lend themselves to real-world situations.
5. Role of the teacher
Teachers will need to create an environment that is multidisciplinary. They will also need to create lessons that have real world relevance, ill-defined questions, and sustained investigation. They need to allow the students to reflect.

6. Role of the student
The role of the student would be to be an active participant in learning. The student will need to communicate, give ideas, work in groups, and think about how they may use these items in the real world. The student must also offer insight and feedback to the teacher, in order for them to understand what has meaning to them, and help craft further authentic instruction.

7. Assessment methods
Assessment is not merely summative in authentic activities but is woven seamlessly into the major task in a manner that reflects real-world evaluation processes. This could be by having polished products and/or papers. The process is often more important than the product in authentic instruction, since that is where the learning takes place. In fact, it is possible to have real learning occur in a lesson that might once be considered a "failure."

Getting Real With Authentic Assessment - Betsy Whitely
YouTube URL: http://www.youtube.com/watch?v=leuN0gdQBZa

8. Most relevant digital tools
Technological support for today’s authentic learning environments commonly includes:
- High-speed Internet connectivity for provision of multimedia information, including dynamic data and practical visualizations complex phenomena and access to remote instrumentation in conjunction with expert advice.
- Asynchronous and synchronous communication and social networking tools for the support of teamwork, including collaborative online investigation, resource sharing, and knowledge construction.
- Intelligent tutoring systems, virtual laboratories, and feedback mechanisms that capture rich information about student performance and help students transfer their learning to new situations.
- Mobile devices for accessing and inputting data during field-based investigations.

9. Evidence of effectiveness (from the research literature)
Evidence for positive achievement effects of teaching for thinking is provided in diverse sources such as Brown and Palinscar (1989), Carpenter and Fennema (1992), Knapp et al. (1992), and Resnick (1987). However, no significant body of research to date has clarified key dimensions of instruction that produce authentic forms of student achievement as defined here.(Authentic Instruction (1))

10. Supplemental reading list (for those who would like to know more)
Authentic Instruction - http://www.ncrel.org/sdrs/areas/issues/educators/leadership/le4auth.htm

Activating Background Knowledge & Using Authentic Materials
YouTube URL: http://www.youtube.com/watch?v=ZRxzaY0vocE

Table of Content

10 Things You Should Know about Case-based Learning

Scenario
Designers Jason and Lisa are tasked to create a learning activity to instruct 8th grade students at Ermer Middle School on how to identify reliable online sources for the purposes of doing research. The learning activity is to be entirely online except for the introduction of the material by the teacher.
Case-Based Learning (CBL) is a form of Problem-Based Learning (PBL) and has been used widely in Law Schools and Engineering programs for decades (if not centuries…). Basically, CBL is a strategy in which learners are given cases (see Carroll and Borge (2007): “Case studies, or cases, are descriptions of a specific activity, event, or problem, drawn from the real world of professional practice” (p. 34)).

2. Definition

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1. Example

- In a computer lab, the students are given a list of basic terms that will help them evaluate online sources and their definitions.
- The students are then given a rubric on how to evaluate an online source. The students then watch a short video about a student who didn’t know how to evaluate an online resource.
- Article Scenario: The student is writing a research paper on Martin Luther King, Jr. and finds many websites about him. One of the websites is a front for the KKK and the student, not realizing who the author is, what the purpose is of the site, who the intended audience is, and hasn’t verified the content, uses the material in his paper. Not only does the student fail the assignment, but he gets himself into some hot water with teacher and his classmates.
- Video Scenario: The student, who finds cases online, uses a case that is found in a Wiki page. However, this page has not been properly cited. The student uses this page, despite the failure of the author to cite the original article properly. The student will fail in this case, because the author has not been properly cited. This will also subject the student to possible plagiarism penalties set by the school because of the lack of proper citation.
- The students are then given a rubric to help them understand how to analyze the Author, Audience, Purpose, and Content.
- The students are prompted by the computer program to click on a series of links that will direct them to reliable and unreliable online sources.
- After each page, the students are asked questions about the source in terms of author, audience, purpose, and content. The program provides feedback and will offer additional examples if the student is not applying the correct analysis.

2. Definition

Case-Based Learning (CBL) is a form of Problem-Based Learning (PBL) and has been used widely in Law Schools and Engineering programs for decades (if not centuries…). Basically, CBL is a strategy in which learners are given cases (see Carroll and Borge (2007): “Case studies, or cases, are descriptions of a specific activity, event, or problem, drawn from the real world of professional practice” (p. 34)).

3. Advantages

Learners use authentic situations, events, and materials to construct their own ideas and knowledge. According to Savery (2006): “Cases may be used to assess student learning after instruction or as a practice exercise to prepare learners for a more authentic application of the skillset knowledge gained by working on the case.” Learners also build a proficient knowledge base for the subject in which they are researching for possible future projects.

4. Limitations

The students are not doing their own research for their own paper. The plan is that through doing CBL, the students are asked to “design a route from two interchanges to alleviate traffic at a third interchange.” The students may need more instruction. The limitations will come when the students do their own research papers.

5. Role of the Teacher

Teacher establishes the activity, offers directions, is available to answer questions, but is not involved in an active teaching role until assessment and feedback are required. Teachers are also required to offer guidance to students who have difficulty in seeking answers if the subject is on a more difficult research topic, or if the realm of the subject is unknown, broad, or not found throughtraditional case methods.

6. Role of the Student

Learners are active participants in analyzing, applying knowledge, and evaluating the sources and problem solving. Learners are also responsible for reporting and informing teacher of any difficulties that arise from finding and/or applying knowledge.

7. Assessment methods

The computer program will monitor students’ progress, but the grade is only to help the teacher establish which students may need more instruction. The assessment will come when the students do their own research papers.

Note: There is not one suggested assessment method for CBI. Teachers are free to use any type of assessment including testing, essay assignments, portfolios, etc. CBI can fit in any current assessment structure.

8. Most relevant digital tools

The students will be using the school’s computer lab and internet. The designers will be constructing the interactive lesson using Camtasia for the video and using the existing BBI program at the school to create the lessons with the links and the questions. (The lessons will be set up as a test so that feedback can be provided, but it will not be listed as a test.) *CBI does not have to use technology. Reiser & Dempsey (2012) cite their own example of CBI. Students are asked to “design a route from two interchanges to alleviate traffic at a third interchange... the students were given topographic maps, real estate maps, aerial maps, and soil maps” (p. 67) to use.
Case-Based Learning uses the study of cases to create a problem-based active learning environment. According to Prensky (2010), case studies are useful tools for analysis that can be done with or without technology. They are basically a description of a real situation, typically with a problem or a question at the end, regarding the best thing to do. Case studies can be created on paper, or dedicated technology tools can be used to create them in a systematic way that allows users to arrive at the proper conclusions in an iterative fashion (p. 116).

Resier and Dempsey (2012) recommend CBL as the building blocks of PBL and a very effective model.

Driscoll (2005) and Resier and Dempsey (2012) refer to the research of the Cognition and Technology Group at Vanderbilt (CTGV) in which they’ve been able to show successful learning through the use of video-based scenarios to instruct students and engage them in problem-solving. CTGV refers to their program as Anchored Instruction under the situated learning theory; however, based on the seven definitions of Case-Based Learning according to Resier and Dempsey (2012), CTGV’s model applies.

Lee and Choi (2008) did a study of the effectiveness of using case-based instruction for early childhood teachers in training, and they found that watching the video scenarios was very effective for helping emerging teachers become prepared for the classroom.

In general, there is a lot of research on case-based instruction for Engineering students as it appears it helps in application of the principals. I’ve list quite a few studies on this subject below. There is a fair amount of research occurring at Purdue’s engineering department as well (see Yadav – and on his Purdue site, he has about 10 studies listed that are specific to CBL).

In a 2011 study (Aylin & Omer), 11th grade students were studied to see if case-based instruction (CBI) could be effective to positively change student belief and attitudes towards the study of Chemistry. The study showed that, indeed, using CBI can greatly improve students attitudes toward their own learning experiences in Chemistry.

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**Table of Content**

**10 Things You Should Know about Challenge-based Learning**

Scenario: Tesseract School is an independent, private school located in Phoenix, Arizona. Having served the K-8 population since 1988, Tesseract opened its high school in 2007. Based on student interest surveys, the school plans to incorporate a robotics program into its high school curriculum next year. Students in grades 9-12 can elect to take a full-credit course in robotics.

The administration at Tesseract is committed to supporting the robotics program by funding a half-time teaching position and making an initial capital investment of $5,000. As part of their coursework, the students will be challenged to find additional funding sources to support the program and the costs of competition participation.

The purple inserts throughout indicate the hypothetical development of a challenge based learning experience using this scenario.

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**1. Example**

Challenge based learning is framed by a Big Idea, an Essential Question, and a Challenge. Descriptions of these components were copied from http://challengebasedlearning.org/pages/about-cbl

Big Idea: “The big idea is a broad concept that can be explored in multiple ways, is engaging, and has importance to students, and the larger society. Examples of big ideas are Resilience, Separation, Creativity, Health, Sustainability, and Democracy.”

Essential Question: “By design, the big idea allows for the generation of a wide variety of essential questions that reflect the interests of the students and the needs of their community. Each group will narrow their thoughts to one essential question.”

Challenge: “From the essential question, a concise challenge is articulated that asks the learners to create a specific solution that will result in concrete, meaningful action.”

Our Big Idea: Finding and Securing Additional Resources for the Tesseract Robotics Program

Our Essential Question: How can we enhance resources and then effectively allocate them for a sustainable robotics program?

Our Challenge: Secure additional funding for the robotics program through Community, Foundation, Corporate, and University outreach.
2. Definition
Students undertake a real-life challenge; they identify a question, conduct necessary research, develop solutions or courses of action, and implement at least one solution. "By giving students the opportunity to focus on a challenge of global significance, yet apply themselves to developing local solutions, challenge-based learning creates a space where students can direct their own research into real-world matters and think critically about how to apply what they learn." (Johnson, Smith, Smithy & Varon, 2009, p. 7)

"Challenge Based Learning is collaborative and hands-on, asking students to work with other students, their teachers, and experts in their communities and around the world to develop deeper knowledge of the subjects students are studying, accept and solve challenges, take action, share their experience, and enter into a global discussion about important issues." Retrieved from http://challengebasedlearning.org/pages/about-cbl

Challenge Based Learning - Process Design

Big Idea

Essential Question
The Challenge

Guiding Questions - Guiding Activities - Guiding resources

Solution - Action

Assessment

Publication: student examples

3. Advantages
- Incorporates the best aspects of problem based learning, project-based learning, and contextual teaching and learning while focusing on real problems faced in the real world... Challenge-based learning brings relevance to classwork... By giving students the opportunity to focus on a challenge of global significance, yet apply themselves to developing local solutions, challenge-based learning creates a space where students can direct their own research into real-world matters and think critically about how to apply what they learn." (Johnson, et al., 2009)

For our students at Tesseract, bringing a sustainable robotics program to the school through a collaborative effort will help students understand how this STEM discipline can allow them to compete with their global counterparts while learning to appreciate the processes, collaboration, and hard work it takes in building local capacity.

4. Limitations
Challenge based learning is limited by the prevailing perception of the teacher’s role in the classroom as an information dispenser and is difficult to implement in a standardized test-driven setting since it develops skills better assessed by different methods. Teachers may struggle with identifying appropriate "Big Ideas" which they can then implement as a challenge that aligns with standards, content, and curriculum mandates.

Since the robotics teacher will be a new hire, Tesseract will include criteria in the hiring process that the teacher be open to the different teaching style required. The school will also provide the robotics teacher and the related support staff training on the challenge based learning model. In order to measure the development of their thinking and application skills, the students will be given the College Work and Readiness Assessment (CWRA), an internet based assessment that measures how students apply what they have learned in real life situations. The Tesseract administration will support challenge based learning by holding a professional development workshop dedicated to brainstorming Big Ideas and synthesizing them to local, state, and common core standards.

5. Role of the teacher
The teacher’s role is to engage the students on formulating questions about challenge and keeping them focused on the creating. "The changed nature of the teacher’s job is described in the pilot study: "In challenge-based learning, as in problem-based learning, the teacher’s primary role shifts from dispensing information to guiding the construction of knowledge by his or her students around an initially ill-defined problem." (Johnson et al., 2009, p. 7-8)

In this case, the teacher could help the students focus on existing sources of school and technology funding, such as donations, grants, and participation fees. The students would also be encouraged to develop new sources of funding - the sky is the limit. A prompting guide by the teacher may be, “Let’s create a wiki and list all of the types of groups and entities that may be possible sources of funding for our robotics effort?”
6. Role of the student

After the identification of the challenge, the students are essentially the drivers of the process; they...

(Johnson et al., 2009, p. 2) The students work in groups to complete the following tasks: "...refine the problem, develop research questions, investigate the topic using a wide variety of primary source material, and work out a variety of possible solutions before identifying the most reasonable one." (Johnson et al, 2009, p. 8) The students seek to generate the guiding questions that represent the knowledge they need to discover in order to meet the challenge.

In Challenge Learning and our example, the students are truly in charge of the direction of how the project unfolds through their formulation of the guiding questions along with their discussions on how they will assess their progress and what metrics to put in place to do so.

7. Assessment methods

Assessment will be guided by self-reporting mechanisms and solution presentations. "The teacher and the teams discuss what they will use as a measure of their success and adopt, adapt, or develop project rubrics to gauge the success of their workflow and solution." (White paper, 2011, p. 4)

Free tool to help teachers create quality rubrics http://rubistar.4teachers.org/

* Assessment can and should be conducted throughout the challenge process. The results of the formal and informal assessments confirm learning and inform decision making as the learners move towards the implementation of their solution. During the evaluation stage both process and product can be assessed." Retrieved 3/9/2012 from http://www.challengebasedlearning.org/pages/about-dbl

In our example, the assessment pieces would be designed by students in collaboration with the teacher to gauge the effectiveness of the resource raising campaign and the processes used by the students to achieve the goals.

8. Most relevant digital tools

Students would benefit from having access to the following:
- One-on-one laptop with internet access
- Multimedia presentation tools (Powerpoint, podcasts, etc.)
- Collaboration Tools For Writing, Blogging, Sharing about Challenge
  Edmodo: http://www.edmodo.com/
  Wikispaces for Educators: http://www.wikispaces.com/content/teacher
- Project collaboration sites that are challenge and project based with opportunities to team with others around the world.
  The Globe Program-Connecting the Next Generation of Scientists: http://www.globe.gov/
  iEARN-Learning With the World, Not Just About It...: http://iearn.org/
  Siemens-We Can Change the World Challenge: www.WeCanChange.com
  Discovery Education/3M-Young Scientist Challenge: www.YoungScientistChallenge.com

In our example the students could check these sites to see if there might be other classes trying to also create a Robotics program and look to leverage knowledge resources with them.

9. Evidence of effectiveness

(From the research literature)

Based on a pilot study done by Apple, challenge-based learning can be effective as indicated by self-reporting of the students and the assessment from the teachers:

- 97% of the students found the experience worthwhile
- 80% of the students reported they "...made a difference in their schools or communities by addressing their challenge.”
- 100% of the teachers indicated that "the students exceeded their expectations.”
- All but one of the teachers reported that the students learned the required materials.

(Johnson et al, 2009, p. 14-15)

In Apple's follow-up study designed to replicate the results of the pilot study and to explore the use of challenge based learning in a wider context, the following results were reported by teachers in the CBL Implementation Project Report:

- My students mastered the expected material 79% Overall engagement of my students increased during the project 75% (p. 9)

Students reported similar success with this method. “Over three-quarters of students, across every age group, felt that they had learned more than expected, were part of solving a big problem, and worked harder than they normally do.” (Johnson & Adams, 2011, p. 9)

As outlined in the publication section of the definition, the students will complete an evaluation of their fundraising effectiveness by developing an annual fundraising plan for the robotics program. They will include which methods they tried, what worked (or did not), and what they want to try next year with a timeline. The students will also rate the effectiveness of their challenge in teaching them 21st century skills. The teacher will complete a similar evaluation identifying which skills were demonstrated. Hopefully, the robotics program will also receive some funding!

10. Supplemental reading list

(for those who would like to know more)


10 Things You Should Know about Experiential Learning Model

1. Make learning come to life.
One way to effectively implement ELM in a public school setting is through Science Curriculum Kits. Depending on budget and time availability, schools can choose from 1-4 themed kits that would be used to teach science curriculum throughout the school year. Each kit is designed to be student-centered, providing hands-on experience with the themed unit of study. It would include training information for teachers: being a facilitator, building prior knowledge and skills needed to succeed in the ELM environment, and lesson guides. Kits would also contain a majority of the supplies needed to carry out the project. As this curriculum grows from year to year, inclusion of previous user experience and reviews/reflections can also be included.
An example of an ELM-based Science learning kit that could be used in an elementary school is Community Gardening. Students not only learn about plants and how to grow them, but also how work together cooperatively, all while experiencing food (something that is part of their everyday life) in a meaningful way. Take a look at Burton Valley Elementary School as their students engage in gardening and learn a little along the way!

2. ELM Defined: Learn from direct experience.
Rooted in research and writing conducted by David A. Kolb, ELM is "the process of making meaning from direct experience" (Experiential, n.d.). Kolb outlines a cycle of learning that moves through states of understanding: (1) concrete experience followed by (2) observation and experience followed by (3) forming abstract concepts followed by (4) testing in new situations (Smith, 2001). ELM presents the opportunity for teachers to facilitate learning opportunities throughout the cycle, creating meaningful learning.

3. Advantage: ELM is a benefit to the reality students will face beyond elementary school years.
- Investigating real world problems to learn about a topic helps make learning meaningful.
- Supports research in learning theory (situated cognition, Ausubel's Meaningful Learning & Schema Theory, Constructivism, Keller's ARCS model of motivation)
- "Feed a man a fish, he will eat for the day. Teach a man to fish, he will feed himself and his family." Substitute "how to discover" for "how to fish" and you capture the essence of experiential learning.
- Fundamentals like math facts or grammar are placed in contexts that show their value.
- Students are invested in the learning because the "learning" is on the way to the goal which has real world context and value.

4. Limitations: ELM alone will not meet all of the learners needs.
- May not easily translate into facts that allow for a student to pass a "standardized" test.
- Requires a lot of resources and support from the school and the teacher to be implemented, at least initially
- Limited instruction leaves room for inaccurate/incomplete learning which may be difficult to overcome.
- Primarily westernized and has not been studied in culturally diverse conditions.
- Effects of societal factors (gender, social status, authority, etc.) could undermine the intended means and outcomes.

5. Teachers facilitate student-centered learning.
- To set up and provide the resources and projects
- Present guiding questions.
- To assist, coach, and provide criteria for success.

6. Students become responsible for their own learning.
- To be a willing and actively engaged learner.
- Think critically about experiences.
- Reflect, analyze, and synthesize learning.
- “Take responsibility in the experience and feel in control of their learning” (Stanchfield, 2010).

7. Assessment methods are process focused rather than outcome based (Kolb, 1984).
- Journals
- Research Projects
- Learning Portfolios
- After Action Reviews (AARs)/Debriefing (Prensky, 2010, p. 112)
8. Technology that simulates or facilitates the transfer of student experiences while promoting critical thinking, reflection of learning, and use of skills in a variety of settings.

- Presentation builders such as Splainers, YouTube, PowerPoint, etc
- Digital camera and tools such as Paint or Photoshop, other program to create visual record
- Wikipedia, Google and other research sites relevant to the project.
- GoVenture
- Virtual Internships
- Toolwire.com
- Simulations and interactive games

9. Empirical evidence via case studies shows increase student motivation and active learning in a variety of settings.

- PersonalizingExperientialLrng.pdf - This article is interesting because it gives real world examples of embedding experiential learning into classrooms and also talks about processing student AND teacher reactions to such experiences. It also puts it in context with learning theory which is always good when you have to justify trying these methods.
- ExplLearningStudentTeachers.pdf - A very topical article that takes a look at student teachers. Through implementing key components of Kolb's experiential learning model, teachers benefited from the same type of learning we intend to use with students.
- Project Wild Case Study Evaluation - “Findings suggested that Project WILD is capable of meeting goals set by state science standards, and when used as a supplement to the curriculum provides a strong method of teaching environmental science” (Powell, 1996).

10. Get informed! This TOP 10 lists only the basics. For effective implementation on ELM, check out these great reads:

- Interesting site about Experiential Learning Cycles with great references.
- InfEd offers a concise overview of Kolb's work, as well as some controversial issues about ELM.
- http://www.youtube.com/watch?v=ITAMM-Z0_vMWatch Video Classroom in the Woods DVD (Sample Clip) Duration: (3:56) 
  
  User: thomasjelpel - Added: 2/23/11  
  YouTube URL: http://www.youtube.com/watch?v=ITAMM-Z0_vM

- Deeper look at learning cycles according to Kolb's ELM model.
- Experiential Learning: Bringing Knowledge to Life - This white paper in Experiential Learning is a great read but hop down to page 6 for the meat and potatoes.
- This article takes a look at experiential entrepreneurship in the classroom.

References:


Table of Content

10 Things You Should Know about Inquiry Based Model

Scenario: Wes and Casie are 8th grade U.S. History teachers in a local middle school. They each instruct three classes of twenty students. Jointly, they have decided to push their curriculum and their students in a new direction, one that is more capable of reaching the interests and abilities of their students.

1. Example

Wes and Casie have decided to design a research project based on U.S. Presidents. Jointly, they decided to make use of inquiry-based learning. The goal is to assess the improve student engagement and learning outcomes by using inquiry-based learning. They will be looking for information attained, retained, and applied.

As a Chinese proverb says: “Tell me and I forget, show me and I may remember, involve me and I’ll understand.”
2. Definition

“Inquiry is something that students do, not something that is done to them.”

Inquiry and the National Science Education Standards. Inquiry-based learning “is giving students guiding questions and letting them work on their own, individually or in groups, to answer them (followed by discussion and summation)” (Prenskey, 2010, pg 39). Inquiry is an approach to learning that involves a process of exploring the natural or material world, that leads to asking questions and making discoveries in the search for new understandings.

3. Advantages

There are several advantages to inquiry-based learning:
* Developing analytical and synthesizing skills
* Drawing well thought out conclusions and utilizing problem solving skills
* Flexible and adaptable for cross-curriculum learning
* Build self-esteem in students and creates partnering life-skills
* Can be utilized in most age groups
* Development of habits of mind that can last a lifetime and guide learning and creative thinking.

4. Limitations

Limitations to inquiry-based learning could be:
* Content overload (students are overwhelmed with facts and information and do not process it correctly)
* The instructor may fail to detect problems or misconceptions.
* Requires more planning, preparation, and responsiveness from educators
* Educators must be skilled in helping students learn the art of asking a good question.
* Requires more class time
* May be less able to meet the goals of standardized testing.

5. Role of the teacher

* Facilitator of learning
* Guide discussions, learning
* Provide a variety of outlets, research materials, and media resources
* Demonstrate how to access and utilize new tools or materials
* Asks open-ended questions to encourage investigations, observations, and thinking

In our scenario, Wes and Casie would allow students select a partner and possibly aid in the selection. They would provide an outline and rubric for the students. This outline would be a guide for students as they start their learning on U.S. Presidents. Wes and Casie would also provide, within the outline, a series of open-ended questions to create interest, encourage engagement, and ensure students are brainstorming and researching important information. An example of an open-ended question would be: "How do we know Abraham Lincoln was a family man?" The rubric given, would help guide and drive the learning. As instructors, they will provide and assist students with using materials and digital tools. Essentially, they step out of the direct instruction model and into a role of mentorship.

6. Role of the student

* Active learner
* Problem solver
* Independent learner
* Increased responsibility

In our scenario, students will become independent, self-motivated learners. They will seek out important facts of the U.S. President they are assigned by using a variety of methods and resources. They will discuss, design, and deliver relevant presentations of their findings.

7. Assessment methods

Assessing student achievement with inquiry-based learning can be difficult. One of the best ways to assess student learning from inquiry learning is through a narrative assessment. This narrative becomes an important report for the student and the teacher. A narrative assessment provides a way for students to demonstrate not only what they know but also how it relates to their other knowledge, their ways of viewing the world, and the ways they assess and analyze ideas. Other ways to assess student achievement is through the degree in which students have developed the content knowledge and how the processing skills have developed.

In our scenario, Wes and Casie will be using anecdotal records and presentation information to assess the competency of the topic. This, along with their guidance throughout the research process, will ensure student achievement.

8. Most relevant digital tools

* Computer and Internet access
* Access to research catalogs
* Skype or a similar tool to connect with other people to ask questions

9. Evidence of effectiveness (from the research literature)

In the findings of Geier et. al. a multiple year implementation of inquiry-based learning showed significant, consistent growth with student performance after exposure to at least one unit (8-10 weeks).

In the following table and chart the LeTUS group is the group that used inquiry-based learning.


10. Supplemental resource list (for those who would like to know more)


Jeffrey Wilhelm on: Inquiry-based learning

TED_NYED - Dan Meyer - 03/06/10

Inquiry Based Learning
# 10 Things You Should Know about Problem-based Learning

**Scenario:** Tim and Sandra own their own learning design company, T & S Information Design. They are working with a new client to teach problem-based learning (PBL) to a large pharmaceutical company in southern Indiana. Their target audience is the HR Global Group. Most of the members in this group have at least one master’s degree. This first problem-based learning meeting is employee retention, and Tim and Sandra will use this first encounter to serve as tutors to the PBL process. The client has already provided roles and responsibilities to all participants. During this activity, learners will:

1. Read a case scenario on employee retention.
2. Determine any problem(s) definition.
3. Analyze problem by brainstorming.
4. Arrange all input for clear structure of problem.
5. Discuss knowledge gaps (what participants need to know ~ current v. ideal) gaps.
6. Define individual learning goals.
7. Discuss findings from individual resources.

**1. Example**

Of the 12 clients in the problem-based learning demonstration, each one was asked to select from a stack of index cards containing the following roles: chairperson, note taker or secretary, board writer, facilitator, and regular participants, which leaves 8 roles for clients as participants.

The client’s problem deals with employee retention and the great expense that comes with recruiting. This will become the problem definition. Members will brainstorm to come to consensus with a clear structure of the problem. From there, they will see where they need to be as opposed to where they are currently.

The gap is where the main focus will be during the discussion. This will also include other topics to identify the gaps completely.

As a group, members will define goals and objectives whereby each member will seek out new knowledge from interviews, database searchers, etc. Once all new knowledge has been acquired, members will meet again to discuss their findings.

It should be noted that this is a highly iterative process and a solution could take several iterations (Kolodner et al., 2009, p. 511).

**2. Definition**

*Problem-based learning* [is] a cognitive apprenticeship that focuses on learning from problem-solving experience and promotes learning of content and practices at the same time* (Kolodner, et al., 2009, p. 497). Techniques can include: structured discussion, debate, reflective practitioner, role play, discussion chain (Stepich, Ermer, & Lane, 2001, p. 57).

*“Ask specific questions and limit the number” asked at any given time* (Ibid., p. 63).

*“PBL ... is a continuous, ongoing approach to learning”* (Kolodner et al., 2009, p. 506).

*“As defined by Dr. Howard Barrows and Ann Kelson of Southern Illinois University School of Medicine, ...the curriculum consists of carefully selected and designed problems that demand from the learner acquisition of critical knowledge, problem solving proficiency, self-directed learning strategies, and team participation skills... resolving problems or meetings challenges that are encountered in life and career.”* (www.neiu.edu)

**3. Advantages**

Problem solving helps develop cognitive areas of the mind. Presenting learners with increasingly complex problems to be solved will help develop them mentally. Working on a problem with a group builds collaboration skills, fosters creativity and learning. Problem-based learning puts control in the hands of the learners as they are presented with a problem to solve. The learners must take it upon themselves to seek out the knowledge necessary to solve their problem, rather than have a teacher give them knowledge which may or may not appear to be useful to them. The learning they undertake has a clear and known purpose - to help them solve their problem.
4. Limitation

Can take a while for “problem-solving skills to develop” (Ibid., p. 65); using cases for problem-solving can be a daunting task. Learners are often required to work in a group, so teamwork skills are a necessity. This can be problematic for larger groups, or groups with members who are not cohesive. Learners must often agree on a solution. Early in the learning process, problem-based learning can be less effective than other forms of instruction due to the learners’ probable lack of the needed knowledge to solve the problem.

5. Role of the teacher

Coach; guide; partner; questioner; facilitate discussions; orchestrator of knowledge making. It is not the instructor’s job here to tell the students what to do - rather, it is the instructor’s job to be available to offer advice, to help students ask the right questions in solving their problem, and support them in their solution. "Ask specific questions and limit the number" asked at any given time (Ibid., p. 63).

6. Role of the student


7. Assessment methods

Use of case studies; “expert-like responses” (Ibid., p. 55); “Qualitative analysis methods” (Ibid., p. 56).

8. Most relevant digital tools

Discussion boards; blogs; wikis; RSS feeds; social bookmarking services; any Web 2.0.

9. Evidence of effectiveness (from the research literature)

Supports new professionals in the field (Stepich, Ertmer, & Lane, 2001).

10. Supplemental reading list (for those who would like to know more)


Table of Content

10 Things You Should Know about Project-based Learning

1. Example/Scenario: Create a project, in teams, that addresses the issue of videoing others with the use of a cell phone and posting it on YouTube without their knowledge. Within your project you need to address the negative implications of this act, as well as the internal and external factors of the individual(s) being filmed that should be considered.

The following video is an example of a high school student project team that completed the scenario stated above in a fun, creative, and meaningful manner; http://www.youtube.com/watch?feature=player_embedded&v=kUENVZM0K1E
2. **Definition:** Project-based learning (PBL) is a pedagogy that is student-centered and circular in the way students complete the process. The instructor acts as a facilitator during the project and encourages learning by asking guiding questions. The process that students complete in project-based learning is an "inquiry process structured around complex, authentic questions and carefully designed products and tasks" (pbllonline.org).

The PBL approach instills many beneficial social and academic concepts in students' learning. With the use of this approach, students learn effective time management skills, leadership skills, higher-level thinking skills, creativity, independence and constructivist learning. These skills are all transferable to 21st century learners and their academic success in the future.

3. **Advantages:**
   - Students can self-monitor and self-evaluate throughout the course of the project.
   - The instructor has the flexibility to guide each project and instill necessary 21st century skills to learners.
   - The presentation component of the process allows learners to take ownership of their project and have a sense of pride in their work.
   - Long-lasting learning opportunities are made through the use of this learning pedagogy.
   - Collaborative and inquiry learning creates more meaningful learning experiences.
   - The instructor is able to incorporate several academic standards into one large project that can span several months to an entire school year.
   - Multiple subject areas can be covered with the use of PBL.

4. **Limitations:**
   - The framework of the project needs to be expertly planned in order to achieve successful student results.
   - If students' are not motivated about the project, the outcome may be negative and not substantial to academic progress.
   - Some students may not be able to self-monitor and self-evaluate appropriately.
   - The role of "facilitator" may be difficult for some instructors to accept.
   - The administration may not support a project-based pedagogy being used in the classroom.

5. **Role of the teacher:** The teacher plays a role that is more like a guide than a lecturer. The teacher will visit each group during the phases of their project and ask guiding questions in order to make sure they are on the appropriate track for success. The teacher will allow groups to make mistakes when necessary only to ensure that students learn how to tackle difficult situations and collaborate on finding a solution. The teacher also acts as a mentor and will hold whole group discussions after group work time in order to debrief and discuss significant matters that came up during each work day. The teacher will support a positive learning community and allow students to critique each other's work as well as compliment positive group experiences. The feedback that the teacher provides is crucial to student success and is necessary for the project to continue on the most effective track. The teacher should be exhibiting active listening skills and allowing students to self-reflect throughout the process (http://tricex25.edublogs.org/2010/09/16/the-teachers-role-in-pbl/).

6. **Role of the student:** Students work collaboratively in small groups, holding each other responsible for their own learning. In essence, they become "micro managers" of their own learning. Students complete research on their own, then collaborating with one another in order to scaffold their own learning.

7. **Assessment methods:** The assessment is relative to the learning goal. Therefore, one would want to assess something closely related to the given learning goal. Also, the assessment could be in different forms - formative or summative - by using multiple strategies within the assessment process. "Assessment strategies can include performance tasks, teacher observations, personal communications, standardized testing, and student and teacher developed evaluation rubrics, and others" (http://www.globalschoolnet.org/web/pbl/plan/assess.htm).
8. Most relevant digital tools: In accordance to the 21st Century, the most relevant digital tools include; blogs, wikis, video projects, Microsoft PowerPoint, podcast, Google Earth, Google Docs, other Web 2.0 tools, etc.

9. Evidence of effectiveness: The following website has a wide array of research available for your viewing pleasure. For the most part, once PBL is used properly, the results show greater effectiveness. To the contrary, there is much difficulty changing the cultural paradigm from traditional to PBL.
* [http://www.bie.org/research](http://www.bie.org/research) (from the research literature)

10. Supplemental reading list
http://pblchecklist.4teachers.org/index.shtml
http://www.pbl-online.org
http://www.bie.org/
Reinventing Project-Based Learning: Your Field Guide to Real-World Projects in the Digital Age (Krauss and Conery)
(for those who would like to know more)