Formative Assessment, Education and Gaming, and InQuizitive

Formative Assessment Works
A great deal of research supports the general idea and effectiveness of formative assessment—"quizzing to learn" (Roediger and Karpicke, 2006; Pennebaker, Gosling, & Ferrell 2013). Many systems, including InQuizitive, have been designed to help instructors realize gains from formative assessment in their classrooms.

Formative assessment differs from summative assessment in that the goal is not primarily to evaluate student knowledge, but to build knowledge and help students identify their strengths and weaknesses. Neither formative nor summative assessment is better than the other. They are complementary tools that can and should be used in tandem.

Developed by a cognitive psychologist
InQuizitive was developed through a partnership between a cognitive psychologist with years of research experience and W. W. Norton, a leading content provider in higher education publishing. Thus InQuizitive provides a combination of functionality based on proven cognitive psychological principles and authoritative content that students and instructors can trust.

Learning from Gaming
Formative assessment can only be effective if students are motivated to actually complete the formative activities. Every instructor knows the difference between a classroom of students who are engaged with the material being taught and a group of students who would rather be anywhere other than the classroom. Indeed, one recent one study showed that student interest was actually more highly correlated with information retention than was student ability (Naceur and Schiefele, 2005).

InQuizitive uses research-proven gaming techniques to encourage student engagement. Both the sheer size of the gaming industry ($66 billion in revenue for 2013) and research initiatives at premier universities that promote the use of gaming techniques [MIT—(http://education.mit.edu/), Penn State—(http://gaming.psu.edu), and Stanford—(http://news.stanford.edu/news/2013/march/games-education-tool-030113.html)] speak to the promise gaming holds for learning.

One aspect of InQuizitive that has been informed by successful gaming practices is the user interface, which is designed to be clean and visually engaging and incorporates sound effects and visual cues that signal to students when they’ve completed tasks and achieved goals (Prensky, 2001). InQuizitive also incorporates motivating gaming techniques such as “leveling up”, constant score tracking, and intermittent score bonuses.
Research also indicates that engagement is heavily affected by the extent to which an activity leads to feelings of competence and autonomy in the player (Rigby and Ryan, 2007):

• Activities engender feelings of competence by “pushing” users just enough—challenging them without overwhelming them. Thus InQuizitive's question selection algorithm, like the algorithms in other adaptive systems, is constantly evaluating the student’s current level of knowledge and attempts to deliver questions at or slightly above that level.

But no matter how effective an algorithm is at choosing “just the right question” for every student in every situation, in a formative assessment situation students are often not going to know the correct answers. To be maximally effective, the system needs to turn even such failures into positive learning experiences (Gee, 2009). This is an area where InQuizitive shines: InQuizitive’s question delivery mechanism goes beyond other systems in guiding students to generate the correct answer themselves on every question, even when the student didn’t initially get the question right. As Rigby and Ryan put it, “Feeling effective energizes us and motivates further action, while feeling ineffective decreases motivation and brings a negative psychological impact.” When students have to give up on a question, they’re de-motivated; by always leading them to the correct answer, InQuizitive turns every question—even ones where students originally failed—into a positive, motivating, learning experience.

• “Autonomy” means giving users the freedom and ability to create the experiences they want for themselves (Klopfer, Osterweil, & Salen, 2009). In an educational system such as InQuizitive we can’t give students complete control (there are specific concepts that they must master in each activity), but InQuizitive does strive to give students control over certain aspects of their activity experience. For example, before answering each question, students can set their confidence level to determine the stakes for that question, and after reaching their Target Score, students can decide which Learning Objectives to test themselves on if they wish to continue using InQuizitive for review purposes.

**Question types**

A wide variety of question types and a focus on conceptual questions require students to think deeply about the content they’re trying to learn while working in InQuizitive. Cognitive psychological research going back to the early 1970’s (Craik and Lockhart, 1972) has repeatedly shown that generating the answer to a question yourself, as is required InQuizitive’s interactive questions, leads to much better retention of how to answer the question than does simply recognizing the answer in simplistic multiple-choice questions. More recently, brain imaging studies (Kapur et al, 1994) confirm that different parts of the brains are activated when you do “shallow” tasks as opposed to “deep” tasks.

A related cognitive psychology construct is called transfer-appropriate processing (Morris, Bransford, & Franks, 1977): the better the match between how you process information when you learn it and what you’re trying to do with the information when asked to retrieve it, the better you’ll be at retrieving and using the information in the end. Therefore, giving students a variety of experiences with the information during learning—as with the multiple interactive question types in InQuizitive—will better prepare students to use that information in a variety of contexts in more advanced classes as well as later in life.

**Feedback during the learning process**

Research shows that formative quizzing is only as good as the feedback students get while completing formative quizzing activities (McTighe and O’Connor, 2005). In InQuizitive, every time a student drags a label to an answer field, clicks a choice, or types in a letter, they receive instant feedback on whether they’re on the right or wrong track towards answering the question, and if they’re on the wrong track, they get specific instruction on why they’re mistaken.
References


