

SpiralMath.net

Formative Assessment for math classes, grades 3 through 8

How does it work?

Each day, at the beginning of math class, students use a computer or tablet to take a short quiz (five questions); each question assesses a specific standard in the CCSS. The quiz is scored by the remote server which reports each student's performance. For each year level, the server contains 180 quizzes (900 questions).

This automated system addresses the main difficulty with using formative assessment in the classroom: *the large teacher workload*. Traditionally, the teacher must create, score, record and analyze a quiz before gaining the advantages of formative assessment: rapidly evaluating instruction, and identifying students who did not grasp the topic.

Spiral Math offers the teacher — *with no additional work* — graphical reports that...

- show how a class performed on today's quiz, so the teacher can instantly adjust instruction;
- show how a class performed over time on a specific national math standard;
- compare the performance of different classes (for those teaching more than one math class);
- show an individual student's competency and longitudinal growth;
- show which students have poor performance on a specific standard so they can be tutored as a group.

In addition the system will show students their own data, and alert students and parents when standards are not met.

Typically the student is questioned on a standard; questioned again a few days later; again a couple of weeks later...continuing throughout the school year. The system automatically spirals back through the curriculum (hence *Spiral Math*). This deliberate application of the principle of spaced repetition improves retention through the school year and into the following year. The system provides real-time feedback that is separate from larger benchmark assessments.

The quizzes are not graded on the number of correct answers. Students are encouraged to take personal responsibility for monitoring their own skills and improving them.

What does research say about formative assessment?

SpiralMath applies the principle of formative assessment to support learning. It evaluates the pupil while the lesson is still in progress and thus informs the pupil of their understanding, and the teacher if there is need to revise the instruction:

Black and Wiliam (1998) concluded that formative assessment is key to pupil improvement.

Hattie (2009) studied meta-analyses of 138 interventions; "Providing formative evaluation" had an effect size of 0.90.

Willis (2007) The ideal way for students to review new information is to access it repeatedly in the context of subsequent learning activities and skills.

Some investigators (Fuchs & Fuchs 1986) found that formative assessment yielded greater than average gains among disadvantaged students; "helps low achievers more than other students and so reduces the range of achievement while raising achievement overall" (Black & Wiliam 1998).

Additional findings:

The greater the delay, the less likely it is that the feedback will be helpful (McTighe & Tomlinson 2006).

The research on formative assessment is compelling and shows us explicitly how... to improve learning.... (Shepard 2005).

Teachers say they need tools that in real time:

- Compare performance to standards

- Reveal student progress

- Fast and flexible enough to help teachers run their classes.

(Gates Foundation 2015)

Spiral Math program is an outgrowth of the earlier Differentiated Mathematics program

Impact of Mills Differentiated Mathematics Program

Somerset County, Maryland

Before	Proficient/ Advanced
2003 Grade 3	61.0%
2003 Grade 5	43.8%
2004 Grade 4	61.2%

After	Proficient/ Advanced
2010 Grade 3	86.0%
2010 Grade 5	89.1%
2011 Grade 4	90.4%

Morrisville School District, Pennsylvania

Before	Proficient/ Advanced
2005 Grade 5	60.0%
Grade 8	48.0%
Grade 11	19.0%

After	Proficient/ Advanced
2008 Grade 5	78.9%
Grade 8	69.8%
Grade 11	53.4%

2006 Grade 4	65.4%
Grade 6	69.5%
Grade 7	45.9%

2008 Grade 4	87.2%
Grade 6	67.8%
Grade 7	72.2%

Bangor School District, Pennsylvania

Before	Proficient/ Advanced
2002 Grade 5	52.6%
Grade 8	45.0%
Grade 11	40.5%

After	Proficient/ Advanced
2005 Grade 5	71.3%
Grade 8	63.1%
Grade 11	46.1%

Colonial School District, Pennsylvania

Before	Proficient/ Advanced
2003 Grade 11	50.7%

After	Proficient/ Advanced
2009 Grade 11	75.1%

Who is launching SpiralMath?

Joseph Mills - Math education expert; Classroom teacher; Supervisor of Mathematics Harford County, Md; Supervisor of Mathematics State of Delaware; created and managed formative assessment system for schools in Somerset County, Md and others.

Robin Mudge - Science teacher, London; producer of science programming BBC, developed large eLearning projects; Professor, American University, Washington DC.

David Robson - teacher of physics, programming; developed curriculum server for Core Knowledge Foundation. 410-948-2003

Jay McTighe - Co-author of "Understanding By Design" and 13 other books; director of Maryland Assessment Consortium.

Alfred Werner - expert in deploying virtual Internet servers.

What's Next?

SpiralMath seeks to conduct field tests in partnership with several schools that desire to increase the math achievement of their lowest-performing students...

- we can benefit from the teachers' experience and advice;
- we can learn more about student reactions to low-stakes assessments;
- we can learn more about how students engage in self-assessment.

SpiralMath seeks partnership with a university teacher-education department so that...

- we can benefit from the faculty's experience and advice;
- we would like to jointly create an online course covering the theory of formative assessment and operation of the automatic SpiralMath system.

SpiralMath is a product of Formative Assessment & Analytics, LLC
and is a member of the *Towson University Incubator*, Maryland.

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