

Algebra 1—An Open Course: Pilot Profile and Case Study

New Resources for New Approaches

Algebra 1 – An Open Course is a flexible, comprehensive, learner-centered program that integrates a broad range of pedagogical approaches. It is designed to open the door to mathematical concepts for all students, and to give teachers new tools to address the challenges of math instruction. It is part of the National Repository of Online Courses (NROC), a collection of media-rich, adaptable, and affordable curricular content resources. This case study is one in a series that highlights a number of the new approaches to mathematics education made possible with these resources.

Montana Digital Academy

BACKGROUND

Montana Digital Academy (MTDA) is a state virtual school that works with districts across the state to expand educational options by offering a mix of core and elective online supplemental courses. MTDA uses all or part of 11 different courses from the NROC library, including large enrollment, original credit courses such as Algebra 1, US History, and American Government, as well as Advanced Placement Program® (AP®) courses such as AP Calculus and AP US History.

THE PILOT PROJECT

MTDA administrators and teachers were excited to pilot *Algebra 1 – An Open Course* because the course aligned well with traditional algebra courses taught in Montana high schools, as well as with the Montana Common Core Standards for Mathematical Practice and Content. A husband and wife each volunteered to teach one section of the pilot course in each semester of school year 2011-12, and created a transformational learning experience for their students. The NROC content lends itself to individualization, allowing the teachers to meet a wide variety of student needs. MTDA online teachers also teach in traditional classrooms in local districts, and find the lines between their online and brick-and-mortar classrooms blurring as they exchange resources and strengthen their teaching strategies.



MONTANA DIGITAL ACADEMY

PROGRAM STATISTICS

- **School Enrollment:** Estimated 5,700 course enrollments in 2011-12
- **LMS and LOR:** Moodle
- <http://montanadigitalacademy.org>
- **Contact:** Jason Neiffer, Curriculum Director

PILOT DETAILS

- **Number of Students:** Pilot: 49 students in two fall 2011 sections; 43 students in two spring 2012 sections
- **Teacher Experience:** Teachers have one to two years of online experience
- **Course Type:** Fully online, supplemental
- **Terms in Use:** *Algebra 1* piloted for the full 2011-12 school year

INSTRUCTIONAL APPLICATIONS

Course Customization
Flexible Structure
Asynchronous Content Delivery
Individualization
Online Teacher-Led

The students in the *Algebra 1* pilot classes were primarily 8th graders; some were high school students. Most of the students were taking algebra for the first time, and had a variety of reasons for selecting an online algebra course: some students lived in remote areas where access to a high-quality algebra course was limited, some were homeschooled, some were homebound with serious illnesses, some were stay-at-home mothers, some were in juvenile detention, and a few had a past history of struggling in traditional classroom settings.

MTDA OVERVIEW

Montana Digital Academy (MTDA) opened in fall 2010 and is one of the newest state virtual schools in the country. It provides online supplemental courses to 81% of the state's 162 school districts. MTDA had an estimated 5,700 course enrollments (one student enrolled in one semester-long course) in 2011-12. MTDA offers both original credit and credit recovery courses; small districts often focus on original credit classes and larger districts use a higher percentage of credit recovery courses. Bob Currie, Executive Director of MTDA, was aware of the NROC online course library from his previous experience as the Director of Michigan Virtual School. "I had a great experience as an NROC member previously in Michigan. Upon arriving at MTDA, we had to move so quickly to launch a new state virtual school that becoming an NROC member was a natural choice. We could utilize several of the NROC foundation courses [e.g., algebra, US History, American Government], which gave our teachers and course developers a leg up in the development process."

MTDA classes are taught exclusively by Montana teachers employed by their local districts who participate in an 18-hour training course in online instructional techniques. MTDA reimburses districts for the cost of the teacher's time, while providing district teachers with professional development to improve local understanding of and skills in online learning. Teachers typically teach one online class for MTDA, with the remainder of their time spent instructing classes at their brick-and-mortar school.

WHY NROC?

Piloting NROC's *Algebra 1 - An Open Course* was a logical progression for MTDA because it used the algebra course from the original NROC library when launching the school. "After using the NROC library for several years, a number of NROC members asked for a new algebra course as an area of need," said Bob Currie. "NROC listened and moved ahead with investing significant funding to develop a richer, more engaging, and effective course. We anticipated that the updated version would meet the needs of a wider variety of student learning styles."

Jason Neiffer, MTDA Curriculum Director, noted that he liked being able to remix by adding, subtracting, and customizing content to create a course that is ideal for MTDA's students. "In addition to flexibility, having the algebra course and our other NROC courses in our Moodle environment allows us to gather and track data we probably would not access otherwise. Having the content at the learning object level helps us develop our own repository of content to utilize however our teachers deem fit."

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- Jason Neiffer,

This quickly growing state virtual school must keep a close eye on its budget. "When looking at course assets to license or purchase, our top priority was scalability. We expected rapid growth at MTDA and the open

educational resource (OER) approach taken by NROC allows us to scale without significantly increasing licensing fees," said Mr. Neiffer. "That allows MTDA to focus on training online teachers and making courses better."

FLEXIBLE COURSE DESIGN

MTDA imported *Algebra 1 - An Open Course* and other NROC online courses into its own Moodle application, which gave the course developers and teachers control over course development, teacher training, and data collection. All NROC courses are available in Moodle "shells" created by other NROC members and shared among members of the NROC Network.¹

Robyn Nuttall was the obvious choice to lead the change from the older NROC Algebra course to the all-new *Algebra 1 - An Open Course* as she has 12 years of teaching experience, two of which were online with Idaho Digital Learning, the state virtual school of Idaho. She is now a K-12 Mathematics Instructional Coach in Missoula Public Schools, and teaches one section of algebra for MTDA. "Robyn has the passion to make a course accessible and student-oriented," noted Mr. Neiffer. Mrs. Nuttall slightly rearranged the content of the *Algebra 1* courseware, added some supplemental material, and created a course calendar. "The ability to modify content is extremely important. It gives teachers and staff ownership," said Mr. Currie.

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- Bob Currie,
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"The online course lends itself to individualization; I don't have to work to individualize it for each student because they can learn at their own pace," said Mrs. Nuttall. The classes used the Topic Text² from the NROC content, making it easy for students to access the text from home or to print if they prefer. Students used the Worked Examples, which are step-by-step worked problems using original videos created by Sal Khan of Khan Academy.

Mrs. Nuttall and Mr. Nuttall found it easy to customize the course by adding other open educational resources and low-cost content. Responding to a request from the teachers, MTDA purchased access to a provider of online simulations, and the teachers incorporated Illuminations (free resources from the National Council of Teachers of Mathematics).

The teachers used a variety of assessment strategies to determine student understanding. Each Topic began with a pre-assessment, or Warm-up. Then students self-assessed their learning with the Practice problems, and submitted the Topic Review (a short formative assessment at the end of each Topic) for a grade. Each student needed to achieve at least a 70% on the Review in order to access the next Topic.

¹ The NROC Network, <http://www.NROCnetwork.org/>, is an online community of teachers, technologists, and curriculum designers

² The Topic Text feature is an integrated textbook that provides comprehensive coverage of topics with additional explanations, manipulatives, and examples written specifically to coordinate to the courseware. The Topic Text pages may be printed per topic, or as a complete textbook for off-line studying and note-taking.

THE STUDENT EXPERIENCE

Most of the students in the *Algebra 1 – An Open Course* pilot had not taken online courses before, so the class began with an orientation to online learning. The self-paced *Algebra 1* course allowed some students to cover a full unit on a weekend, or study for 45 minutes each day in a computer lab at their high school. Students needed to work through the various learning tools in each Topic and complete the Review; those who passed the Review were allowed to move on to the next Topic, but those who struggled with particular areas of content had access to additional tools and assignments. If a student achieved less than 70% on any particular assignment, the teacher intervened and offered additional activities for review and practice.

“Students are developing learner strategies to figure out material they don’t understand.”
- Robyn Nuttall,
Math Teacher

All students took a course pre-assessment in the first week of class to determine their skill level. If the results showed that a student struggled with a particular concept, the teacher sent review materials to help the student get up to speed. If the student scored very poorly on the course pre-assessment the teacher worked with a Site Facilitator—usually a teacher or counselor at the student’s brick-and-mortar high school—to evaluate whether the student was ready for an online course, and what interventions would be necessary to keep the student in the course. The Site Facilitator acted as a liaison between the student and MTDA, assisting with enrollment and supporting students throughout their online course.

Mrs. Nuttall reported that students’ favorite tools in *Algebra 1 – An Open Course* were the Worked Examples and the Practice Problems.³ Students appreciated the Worked Examples because they offer clear explanations for challenging math concepts; they also liked being able to pause and rewind the videos for extra review. The Practice Problems are a form of self-assessment with immediate feedback that allow the students go back and review a concept if they missed a question, and then try again before submitting the final Topic Review for a grade. The Practice problems provide nine different assessment types (e.g., multiple choice, matching, plotting, graphing, answer entry) and are adaptive to provide appropriate-level problems based on the student’s performance.

The teachers also used online resources for one-on-one intervention when a student struggled with a particular concept. They found that creating screencasts⁴ allowed them to target instruction. “Because we are in an online format and can’t actually get out the manipulatives we need to find a way we can pictorially represent those manipulatives,” said Mrs. Nuttall. The Site Facilitator received weekly progress reports from MTDA; if a student hadn’t logged in and wasn’t responding to the online teacher, the Site Facilitator could intervene. Mrs. Nuttall believes students learn to be more independent in the online environment. She noted, “Students develop learner strategies to figure out what they don’t understand: they review course material, or try additional activities.”

EARLY FEEDBACK AND RESULTS

Mrs. Nuttall found that the Topic Text (the NROC textbook integrated into the course) and Worked Examples were particularly useful tools. Mr. Nuttall thought the Practice problems offered very good practice for the students, and that the graded portion of the Review was very useful. Mrs. Nuttall noted that in “an online

³ To view samples of the Worked Examples, Practice Problems, Presentations, and other pedagogical features of *Algebra 1: An Open Course*, please visit <http://www.NROCmath.org>.

⁴ The Nuttalls found it very easy to use Jing to create screencasts for their students.

classroom it is all about how much students learned—if they fail they are failing to understand, not failing to do the work. A grade truly reflects what they know, not how hard they work."

Students responded well to the dynamic of choice: they chose how long to spend in a particular topic and had flexibility in how and when they did their learning. This flexibility motivated them to work harder. Also, students liked that the Practice and Review gave them immediate feedback before trying another problem.

Comparative data for the *Algebra 1* pilot is being compiled and will be published on the www.NROCmath.org web site.

LOOKING BEYOND THE ALGEBRA 1 PILOT

Both Mrs. Nuttall and Mr. Nuttall report that they are using the teaching strategies developed through their online experiences in their traditional classrooms. Mrs. Nuttall is a learning coach who works with other teachers in her district, and recommends some of the intervention strategies she has used with online students when coaching other teachers. She also is able to glean best practices from those teachers and adapt them for her online courses. Mr. Nuttall is using Khan Academy videos in his traditional classroom as well as the Worked Examples in *Algebra 1 – An Open Course* as a review tool for students. They both use the screencasts they create to help struggling online students in their traditional classrooms as well.

The Nuttalls work together to solve the challenges they face as they master a new teaching methodology; they share resources and brainstorm ways to best support their students. They are involved with the NROC Network and also participate in a NROC Network LinkedIn group for teachers who use NROC resources.

"The future holds a lot of promise for OER resources and models like NROC," said Currie. "The thing that impresses me is that NROC is listening to the members and what we need for our students. Having content at the learning object level helps us develop our own repository of content to use as the need arises. The model NROC has established gives us inspiration on how to work with OER and broaden our catalog with open resources."

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ABOUT NROC AND THE MONTEREY INSTITUTE FOR TECHNOLOGY AND EDUCATION

NROC is a project of the Monterey Institute for Technology and Education (MITE), an educational non-profit organization committed to improving access to high-quality education for everyone. With funding from The William and Flora Hewlett Foundation and The Bill and Melinda Gates Foundation, the National Repository of Online Courses (NROC) project is designed to develop and distribute high-quality online content to a world-wide audience. Sustained by institutional members of the NROC Network, NROC is an Open Educational Resource (OER), part of a movement fueled by the belief that everyone is entitled to an education, regardless of their financial or social circumstances.

For additional information on *Algebra 1 – An Open Course* please visit <http://www.NROCmath.org>, or email membership@montereyinstitute.org.