



Using Technology in Math

Recently, when I mentioned the word technology to a group of educators, I heard some interesting comments. Comments ranged from, “I love using virtual manipulatives with my smartboard.”, to “Math is math, in the end, students still have to know how to add, subtract, multiply and divide without the use of calculators.” It’s true, I know many educators who love technology in their math classrooms, and others who have a love hate relationship with it.

Technology can make it easy to track students’ abilities and help a teacher manage groups, scores, and grades. Online lesson plan websites allow teachers to search thousands of lessons within minutes. One can’t deny the fact that by having a simple Elmo, or document camera in your classroom, a teacher has the capability to have students explain their reasoning and how they obtained an answer. While the benefits of technology could make a list at least as long as this article, I want to take up the rest of my article space revealing an incredible success that happened in my classroom as I embarked on a journey to embrace Common Core Math Practice Standard 1 with my students; make sense of problems and persevere in solving them.

There is no doubt, getting my students to persevere, think critically, and make sense of problems is an uphill strenuous battle every year. I try to block from my memory the many times I hear, “I can’t do it!”, “I don’t get it.” “So, do I just add (subtract, multiply, divide) these?” Each year I have an actual funeral for the words “I can’t” and bury them on the school playground,

and building students’ perseverance is a task I pour hours into.

Two months ago, I was knee deep in the trenches of place value and providing opportunities for my students to problem solve with multistep problems using large numbers. I had designed many lessons around these two Common Core clusters;

Use place value understanding and properties of operations to perform multi-digit arithmetic.

Use the four operations with whole numbers to solve problems.

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MONTANA MATHEMATICS

To say I was frustrated with my students willingness to charge through a problem, keep going, not quit, or to persevere is an understatement. As my students twisted their tongues reading large numbers, and looked to me for answers to problems, I knew I had to create “the lesson.” It had to be great, big, memorable, and fun. I had to get my students engaged and motivated to push through problems.

As I was brainstorming ideas in how to turn a corner and get my students back on track towards perseverance, I decided to create a lesson in which I would video my school secretary giving students a problem to solve that was pertinent to her job as a school secretary. I wanted something that would engage my students in solving multistep word problems posed with whole numbers and having whole-number answers in order to work on Common Core Standard 4.OA.A.3. So, I scripted a rich mathematical task for students to work on incorporating my secretary. Students would work to solve how many supply items teachers used the previous year by getting information about how many pieces of paper teachers used, how many less envelopes used than paper, and then how many less markers used than envelopes.

I eagerly played the video for my students, all the while wrestling with the concern of how to get my kids to persevere through this problem, and other math problems. Then, something amazing happened during this video lesson. My students were engaged and they were motivated to solve this problem. This problem challenged them. They were erasing and asking questions of each other. When I questioned their work or thinking, they couldn't wait to correct errors and discover how many items were used. They. Were. Persevering!

I sat back and watched my students wrestle with large numbers. I watched them use piece after piece of paper to correct their errors. I watched them watch the clock and listened as they pleaded for more time with this problem. I listened to them communicate with each other and explain their reasoning and thinking. I questioned their results and guided and supported their thinking. It was during this time I realized how important my video was.

I've always been a technology promoter, but had never stopped to think about how powerful a video could be for student learning. The 21st Century learner is incredibly visually literate, and I must grasp this literacy to change and innovate mathematics education moving forward. Storytelling is human nature. By providing a video problem in a story form, my students were willing, motivated, and entrenched in solving a problem. Math Practice Standard 1 was happening in my classroom, without prompting from me.

Another thing that happened after this lesson, besides a newfound motivation from my students, is that my students were stopping by the secretary's desk and asking her about this problem. I heard students say things like, “Did we help you out?” “Do you think that much paper will be used again this year?” “How many envelopes have been used so far?” They were conversing and taking a genuine interest in their school community. Math wasn't just part of math class, but math was happening everywhere, all over the school.

Since this initial lesson, I have videoed a school food service worker, as well as our school nurse. Each lesson has produced the same response from my students. They persevere through a

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MCTM President's Message

Happy Holidays!

Life is busy these days for all of us, but I hope you have found some time to slow down and appreciate the family and friends in your life. One of MCTM's major tasks the past few months has been to re-vamp the Math/Science Leadership Conference with a lot of help from OPI and the School Administrators of Montana organization. I'm certain we would not have pulled Leadership Conference off this year without their help and support. This year the Leadership Conference will have two strands - one for administrators/teacher leaders and one for teachers! Our keynote speaker will be Janelle Johnson from the Equity Assistance Center at [Metropolitan State University of Denver](http://www.metu.edu/), and she will be presenting to the entire audience on Problem Based Learning. After lunch, the audience will break into 2 sections and Janelle will continue to work with administrators on what to look for in a STEM classroom, while teachers will listen to Jeff Crews and Dean Phillips, co-founders of [Beyond the Chalk](http://www.beyondthechalk.com/), who will be presenting Problem-Based Learning: Challenging teachers and students to solve real-world problems by using technology as a tool to help collect and analyze data, research, and share information to transform learning! In addition, we will have panels to learn about funding STEM projects and talking about what Career and College Readiness is! I am so excited for this year's conference - and hope to see you there. If you come as a team of 3 or more (with 1 administrators), each participant will receive a \$25 discount on their registration cost!

MCTM has also been busy creating new Professional Development Academies (PDAs) to be presented this summer! The PDA's this

summer will focus on the content standards and how to implement them into a classroom using the curriculum material that is available to individual teachers. During the workshop, participants will examine several different tasks to decide if they are rigorous tasks and how to change them, if necessary. I believe this PDA will be a must for teachers who are in small districts with limited curriculum support! We will once again have a K-5 PDA, 6 - 8 PDA and 9-12 PDA to meet the needs of teachers. Go to tinyurl.com/leadership2014 to register! And don't forget - MCTM has scholarships to help cover the cost of the PDA (see page 10).

The Mathematical Practices PDA is still available to school districts and consortiums, as well. If you are interested in this PDA, please contact [Hilary Risser](mailto:hilary.risser@mctm.org).

Need money for your classroom? Don't forget about the MCTM Small Classroom Grants available. Receive up to \$300 (we'll give away 5) for math supplies that will help you to implement the Common Core Math Standards. [Apply here!](http://mctm.org/grants)

Congratulations to Bente Winston of Missoula for winning the Dean Preble Award! Bente was nominated by Jim Hirstein. Also, congratulations to Allison Troxel and Georgia Cobbs for receiving the Karen Longhart Memorial Scholarships.

I hope you have a restful and rejuvenating holiday break!

Angel Zickefoose
MCTM President

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Complete lesson plans are available at www.montanamath.org

Middle School Lesson Plans

Understanding Graphs

Submitted by Jennifer Brackney

Through an examination of various graphs, students will describe functional relationships of real-life mathematical situations, describing them through graphic representations and verbal models. This 8th grade lesson meets the Montana State Common Core Standard 8.F.B.5

High School Lesson Plan

Fundamental Theorem of Variation

by Laura Ascheman

Explore the Fundamental Theorem of Variation using a small group setting of Algebra II students. Students will explore how multiplying the independent variable by a constant affects direct and inverse variations.



HELP WANTED - 2014 MEA-MFT Educator's Conference

We need your help. Mandy Berens and Lisa Wood have been co-chairs for the MEA-MFT Annual conference for 2 years now! Their last year will be next year in Missoula. MCTM is seeking volunteers to become the conference chairs after Missoula. Starting in 2015, the conferences will be in Billings, Helena, Missoula and then Billings. If you (and a friend) are interested, please let one of us know. We would like you to start shadowing them next year, so that you have an idea of the process - and then take over in 2015.

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MCTM Small Classroom Grants

Do you want \$300 for your classroom to spend on mathematics instruction?

Are you an MCTM member?

Are you willing to write a newsletter article to share what you did with your grant money?

If you answered yes to the above questions –then you can apply for the MCTM Small Classroom Grant!

MCTM will be giving \$300 per region for winning grant applications.

Still interested? Go to <http://bit.ly/Qm7Qih> to apply.

Applications are due by January 1st, so don't delay!

Winners will be announced in March.



MCTM Membership Form

| | | |
|-------------------------------------|----------------------------------|---|
| <input type="checkbox"/> New Member | <input type="checkbox"/> Renewal | Annual Dues (January - December) |
| Grade Level: Check all that apply | | <input type="checkbox"/> Regular (1 year) \$20 |
| <input type="checkbox"/> Elem | <input type="checkbox"/> MS | <input type="checkbox"/> Regular (2 years) \$30 |
| <input type="checkbox"/> HS | <input type="checkbox"/> College | <input type="checkbox"/> Regular (10 years) \$150 |
| Name: _____ | | <input type="checkbox"/> Life Time \$200 |
| Address: _____ | | <input type="checkbox"/> Student \$10 |
| _____ | | <input type="checkbox"/> Retired Educator Free |
| Phone #: _____ | | <input type="checkbox"/> MCTM and MSTA \$40 |
| E-mail: _____ | | |

Send form to:

David Erickson, MCTM Membership Chair

david.erickson@mso.umt.edu

Department of Curriculum and Instruction

The University of Montana

32 Campus Drive

Missoula, MT 59812

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NCTM Representative's Report

The benefits of membership in the [National Council of Teachers of Mathematics](#) (NCTM) are numerous. With membership comes a journal of your choice, reduced rates at regional and national conferences, reduced prices on publications, electronic access to information/publications of NCTM back into the 1980s, and, best of all, the opportunity to support our local affiliate, [MCTM](#). Your participation in NCTM allows us as an organization benefits too, including reduced registration fees for the Leaders Conference each summer where we send a pair of board members to learn about continued leadership for our council, and a rebate of \$3 on each year of membership renewal if you use the [online renewal form](#) and check the box next to the affiliate member MCTM.

The immediate savings to members on purchases of all NCTM publications and gear include a 30% reduced price on purchases made online before [December 8](#), so act quickly. Use the code HD13a when checking out. These make for good holiday gifts. Other one week promotions will follow this month.

New this winter are four [concurrent institutes](#) in Orlando on February 14-15, 2014 to help implement the Common Core State Standards. These are around grade level bands, pK-5, 6-8, 9-12, and school leaders. The location certainly appeals to those from the northern states during winter. Register before December 13 and save \$40.

There are five journal options for members:

Elementary School Teachers: [Teaching Children Mathematics](#)

Middle and High School Teachers: [Mathematics Teaching in the Middle School](#)

High School Teachers: [Mathematics Teacher](#)

College/University: [Journal for Research in Mathematics Education](#)

Teacher Educators: [Mathematics Teacher Educator](#)

The [2014 NCTM Annual Meeting & Exposition, Big Ideas in the Big Easy!](#) scheduled for April 9-12, 2014 in New Orleans is another professional development opportunity I won't pass up. Hope to see many of you in New Orleans that week. And, our Montana Council of Teachers of Mathematics has teacher [scholarships](#) to help fund attendance. Check these out and submit regardless of deadlines – we want to support teacher professional development.

Enjoy your holidays and NCTM.

David Erickson, NCTM Representative, david.erickson@mso.umt.edu

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News from OPI Math Curriculum Specialist

STEM: Imagine the Future Recap

On October 16, STEM: Imagine the Future, drew just under 250 educators, businesses, students, and STEM providers from across the state to the Museum of the Rockies to learn and share how STEM enhances college and career readiness for Montana students.

The event featured 32 exhibitors that provided information on STEM resources, practices and means of engagement. PK-12 educators experienced exciting ways to integrate Science, Technology, Mathematics and Engineering into their classrooms in a variety of ways including robotics, ways to engage girls in STEM and blending science with art.

The evening ended with an Ignite Session for forum participants - a series of inspiring five minute talks from STEM leaders that only added to the energy and enthusiasm of the evening. Montana PBS filmed the Ignite session and will be releasing the video within the next few months that will be shared when it's available. You can experience KECI NBC Montana's coverage of the forum at <http://www.nbcmontana.com/news/educators-gather-in-bozeman-to-learn-more-about-stem/-/14594602/22480588/-/f7exv6z/-/index.html> Big Idea

Thank you, MCTM, for having a membership table at the STEM event.



If you are taking time during the holidays to read a holiday mystery or romance, consider a professional reading like *Mind Set* by Carol Dweck, or the resources on The OPI Mathematics Wiki <http://opi.mt.gov/groups/mathed/>.

However, most important is taking time for family and friends. Enjoy your holidays.

Submitted by Jean Howard

Montana Council Teachers of Mathematics Annual Board Meeting October 17, 2013

The annual MCTM Meeting was held in Bozeman this year and Angel Zickefoose presiding as the president. The meeting was highlighted by the presentation of the MCTM awards, Dean Preble awarded to Bente Winston, Karen Longhart awarded to Alison Troxel and Georgia Cobbs. Nominations were taken for the upcoming board elections and will come out in the spring newsletter along with bio information. Information from MCTM continues to be updated on the website. If you have anything for the good of the group, please contact the web master, Tony Riehl, to have it added to the site. The MCTM Math Contests will be held around the state in March. If you are interested in participating, please get ahold of your Regional Contest Director, whose contact information is on the website.

Submitted by Jennifer Brackney, Secretary

Montana Council Teachers of Mathematics Board Meeting Update October 16, 2013 Bozeman, MT

The board met on October 16, 2013 in Bozeman, Montana. We are excited to announce that your membership dues and donations can now be made online through PayPal. If you have not yet renewed your membership this will be convenient and easy way to do so! We also discussed the upcoming Leadership Conference that will take place in Bozeman in January. MCTM is continuing to work with OPI as we promote the implementation of the Montana Common Core State Standards. Through OPI and MCTM there will be upcoming PDA opportunities to support school districts and individual teachers in this endeavor. Please check out the website, www.montanamath.org, for information on the Leadership Conference, PDA opportunities as well as other opportunities around the state as they become available. Our next board meeting will be held, January 23rd in Bozeman, Montana.



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Scholarships for Teachers

The deadline for teacher scholarships is quickly approaching. Please seriously considering applying for one of the scholarships available this fall. The Karen Longhart Scholarship application is due October 12; two scholarships for PD over the course of this next year worth \$500 each are available. Choose a PD activity and submit your application.

Additionally, there are scholarships for teachers of mathematics for \$400 to attend out of state conferences and \$200 for in state math conferences; these applications are due November 30th for the upcoming academic year.

The [application form](#) and guidelines for this year's scholarships can be found in this newsletter as well as on our webpage. Please consider your own professional development and the support MCTM could provide you. We welcome applications any time before the deadlines.

Submitted by [David Erickson](#), MCTM Scholarship Committee Chair

Karen Longhart Scholarship for Professional Development

This scholarship is intended for active teachers involved in Mathematics Education, Grades K-12. The intent of the Scholarship is to help teachers attend professional development activities dedicated to the appropriate level of mathematics for their teaching. Karen was very active in both MCTM and NCTM. These two organizations provide many excellent workshops involved in professional development. There are other programs that also provide excellent professional development.

A minimum of 5 years teaching is required in order to qualify for these funds.

Two \$500 scholarships will be issued each year.

Send Application to arrive before October 12 electronically to david.erickson@umontana.edu or snail mail:

David Erickson
MCTM Scholarship Committee
Department of Curriculum and Instruction
The University of Montana
32 Campus Drive
Missoula MT 59812

MCTM Teacher Scholarship

Teachers wishing to attend math conferences may be eligible for some financial assistance from MCTM in the form of \$400 scholarships for out of state math conferences and \$200 for in state math conferences.

Any teacher who is an MCTM member is eligible to receive the scholarship except for current MCTM board members or if the MCTM member received an MCTM scholarship in the previous year. The scholarship chairman may allocate up to \$2000 per calendar year. Applications are due November 30. The recipient must write an article for the newsletter on a useful idea acquired at the conference. This article must be mailed to the Chairperson of the Scholarship Committee within thirty calendar days of the final day of the conference. The chair will then submit the article to the editor of the newsletter and will authorize the MCTM treasurer to issue a check to the scholarship recipient.

The following is the procedure for obtaining an MCTM scholarship:

- 1) The application for the scholarship must be submitted to the Chairperson (David Erickson) by November 30. An individual is only eligible to receive one scholarship per calendar year.
- 2) Applicants cannot apply for a scholarship if they were awarded one the previous year.
- 3) The chairperson will notify applicants if they have been awarded the scholarship.
- 4) The recipient must attend the conference.
- 5) After the conference, the recipient must write an article for the MCTM newsletter on at least one useful idea obtained at the conference. This article should be e-mailed to the scholarship chair (David Erickson) within thirty days of the end of the conference. The chair will submit this article to the editor of the MCTM newsletter and will authorize the MCTM treasurer to issue a check to the scholarship recipient.

Send the application and completed newsletter article to:

David Erickson
MCTM Scholarship Committee
Department of Curriculum and Instruction
The University of Montana
32 Campus Drive
Missoula MT 59812

Or preferably
david.erickson@umontana.edu

MCTM Early Career Scholarship

MCTM is offering an “Early Career” scholarship worth \$500. This scholarship will be given to one K-12 Montana teacher each year to attend either the K-6 or the 7-12 MCTM Professional Development Academy (PDA) during the summer. This scholarship may not be used for any other convention or conference.

To be eligible for this scholarship you must:

- 1) have taught math in Montana for at least one (1) year and not more than five (5).
- 2) be contracted to teach math this coming year in Montana.
- 3) be a current member of MCTM

You must also fill at least one of the following criteria:

- 1) an elementary teacher who teaches at least one section of math during the day or
- 2) a secondary teacher who teaches at least 3 sections of math each day or
- 4) special education teacher who has at least one period of math each day or
- 5) a Title 1 math teacher who teaches at least 2 periods of math each day

The deadline for a completed and submitted application is May 1 of the year of the PDA.

In the event that the original winner is unable to attend, an alternate will be chosen.

To receive the \$500, you must:

- 1) complete the PDA,
- 2) write and submit an article about the PDA to David Erickson (scholarship committee chair) for the MCTM newsletter. This article must be submitted within one month of the completion of the PDA and
- 3) enclose a letter, written by the facilitator of the PDA, indicating that you have successfully completed the PDA.

Send applications and the newsletter article to:

David Erickson
MCTM Scholarship Committee
Department of Curriculum and Instruction
The University of Montana
32 Campus Drive
Missoula MT 59812
Or preferably
david.erickson@umontana.edu

MCTM Scholarship Application Form

(Information on each scholarship can be found on the MCTM webpage under [Scholarships/Awards](#))

Circle appropriate choice:

Karen Longhart Scholarship: October 12

Teacher Scholarship: November 30

Early Career Scholarship: May 1

Name _____

e-mail address _____

Mailing address _____

City _____ Zip _____ Phone _____

School name _____

School address _____

City _____ Zip _____

Grade level(s) taught _____ Years of Teaching _____

Subjects taught _____

Are you a member of MCTM? _____

What conference, workshop, PDA, or class are you interested in attending?

Location _____ Dates _____

What are your objectives for attending this conference/workshop/class?

How will you use/share this information? (all recipients will also share via an MCTM newsletter article due to the scholarship chairman within one month of attending the conference.)

All applicants should enclose a letter from an immediate supervisor/principal verifying teaching success/support during the current year of the application, a written essay that adequately addresses your philosophy of mathematics education and reasons why you are an appropriate recipient.

Submit completed application to David Erickson's email: david.erickson@umontana.edu

Math Science Leadership Conference 2014

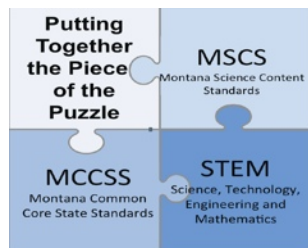
Building a Better Future for Montana's Children

When: January 24th and 25th, 2014

Where: Comfort Inn, Bozeman, MT

Costs: \$125 for MSTA or MCTM Members or \$155 for non-members (includes a 2 year membership to MSTA or MCTM – your choice)

Registration: <http://tinyurl.com/leadership2014>



opi.mt.gov

Conference for Administrators, Teacher Leaders, and Teachers

Keynote Speakers:

Janelle Johnson, Department of Teaching, Learning, and Sociocultural Studies at Metropolitan State University of Denver

- Problem-Based Learning in a STEM classroom
- What to look for in a Common Core STEM classroom with an Administrator and teacher leader focus

Jeff Crews and Dean Phillips, co-founders of Beyond the Chalk

- Problem-Based Learning: Challenging teachers and students to solve real-world problems by using technology

Other Sessions:

- Montana Partnerships with Regions for Excellence in STEM (MPRES) Toolkit
- STEM Planning at the District Level
- Place-Based and Informal Learning Projects,
- Funding Your STEM Projects
- What Does Career and College Ready Mean?
- Scientific Exploration Tools

PORTFOLIOS IN THE MATHEMATICS CURRICULUM

Portfolios might well be an excellent approach for pupils and mathematics teachers to share the former's achievement with parents, as well as with other interested, responsible persons. Here, parents may observe and evaluate pupil progress authentically. Parents then may view learner achievement directly from pupil products, not from test scores. Questions arise and answers given in assessing the products. The valid concerns of parents might become a part of the portfolio.

A plethora of mathematics products may become a part of the portfolio. They represent efforts, motivation, and pupil purposes in ongoing lessons and units of study. Here, the pupil is actively engaged in choosing what to include in a portfolio. He/she is not a passive recipient, but evaluates, learns, grows and develops in the process. Too frequently, pupils merely respond to test items given on the local, state, and national levels. From test results, the pupil passively views a percentile, grade equivalent, or per cent given for correct answers given. In doing a portfolio, the pupil selects representative inclusions. It is flexible and open ended in terms of its development (See Kasinath, 2009).

Philosophy of Portfolio Development

Constructivism, as a psychology of learning, emphasizes that the pupil is in charge of his/her learning activities. As an active learner, the pupils sequences his/her own experiences. The mathematics teacher is a facilitator and guide, not a lecturer. He/she observes and assists pupils to learn by discovery. The mathematics teacher sets the stage in introducing new subject matter. New learnings are developed by pupils in moving from the known to the unknown. If a learner needs help on a new process in mathematics, the teacher raises questions which lead pupils to the correct response. Telling is not teaching, but scaffolding based on background information guides each pupil to achieve more optimally. Thus, the pupil develops his/her own knowledge within a learning sequence (Ediger, 2010).

Constructivism emphasizes the uniqueness of the learner with his/her own background knowledge and culture. Responsibility for achieving in mathematics resides within the pupil. The teacher encourages each pupil to achieve in mathematics, but motivation is intrinsic and comes from within the learner. Teaching is facilitating learning and there is a dynamic interaction among the learning activity, the mathematics teacher, and the pupil.

For example, within an ongoing unit of study pertaining to place value, properties of four basic operations, fractions, decimals, regrouping and renaming, estimation, statistics and probability, as well as fundamental learnings in algebra and geometry, the pupil together with the facilitator, and curriculum interact; they are not separate entities (See Wolk, 2008).

Testing is very frequently used to ascertain pupil achievement in mathematics. Here, the learner is a somewhat passive individual, responding to multiple choice test items.

Portfolio develop emphasizes the learner being actively involved in choosing entries from daily work completed within lessons and units of study. A random sampling is chosen by the pupil with teacher facilitation. A Table of Contents brings order to these dated entries and makes it easier for parents, teachers, and other responsible individuals to peruse and evaluate mathematical learnings developed by a pupil. The following are examples of what may become a part of a mathematics portfolio:

- * daily work completed in ongoing lessons and units of study.
- * line, bar, and circle graphs as well as charts made such as a narrative which tells the history of number and its uses, a tabulation chart which indicates growth and comparisons in population figures of selected countries integrated with the social studies, an organizational chart indicating structure and order in base ten numeration, and pictured graphs in chart form, among others.
- * objects constructed such as a place value chart, a fact finder, beanstalks to show sets of different values, and a fraction/decimal chart

-
- * games developed such as addition, subtraction, and multiplication bingo.
 - * electronic photos of constructed items such as geoboards and tangrams,
 - * drawings of geometrical models, attribute blocks, as well as other manipulative materials.
 - * recordings of pupils involved in small group discussions (Ediger, 2005).

The above are examples of what might constitute a portfolio of pupil work and products. Active pupil involvement necessitates the choosing of contents for the portfolio. He/she owns the portfolio and shares its selection of entries with the facilitator/teacher. The portfolio, too, provides a basis for doing parent/teacher conferences. Here, the learner may play a leadership role in discussing achievement within the conference. What has been accomplished and what is left to learn is diagnostic as well as remedial and promotes developmental learnings.

Somewhat opposite of constructivism and portfolio development is behaviorism. Behaviorism stresses the following:

- * establishing measurable objectives for pupils to attain in mathematics.
- * aligning learning opportunities with the stated objectives.
- * teaching toward pupils attaining these objectives (Ediger, 2003).

A deductive approach is generally used in teaching mathematics. Content moves from the teacher to pupils with the end result being for the latter to achieve behaviorally stated objectives. Testing is a major procedure used to ascertain pupil progress. Pupil results are indicated through precise numerical results such as percentiles and grade equivalents (See Gardner, 1993).

Constructivism, Dewey, Piaget, and Vygotsky

Three highly recognized constructivists are John Dewey, Jean Piaget, and Len Vygotsky. Dewey (1916) emphasized a problem solving curriculum whereby the pupil with teacher guidance would identify a problem within a unit of study. Pupils need to have necessary background information to delve into securing a possible solution. The problem needs adequate delimitation so that it can be solved. There are a plethora of practical problems in mathematics which need to be identified. These require deliberation and thought, not a factual answer. For example, a classroom is securing new carpeting. The problem then pertains to securing the number of square feet or square yards for the covering. Pupils initially might hypothesize how to ascertain the approximate answer. They are actively involved here as they are in sequential steps of solving a problem. The teacher may raise questions as needed to assist pupils in mathematical problem solving. After deliberation, pupils may check their hypothesis of necessary skills to ascertain the answer as well as evaluate the correctness of the answer. There is interaction, here, between the pupil, the teacher, and the curriculum. This might be an individual or small group endeavor.

Jean Piaget (1973) stressed a maturation theory of learning whereby the pupil develops different capabilities of thought as he/she progresses in age and through the grades in school.

There were four stages of pupil development as Piaget's research indicated:

- * sensori- motor, ages birth to eighteen months of age
- * preoperational, eighteen months to seven years
- * concrete operations, seven to eleven years of age
- * formal operations, twelve years and older.

In each of the above named years, pupils change and modify their perceptions. Thus, from birth to eighteen months of age, pupils need to experience concrete objects and items. Learning occurs through viewing, interacting, and observing. In the preoperational stage, the pupil also experiences the concrete, but perceives each by seeing one variable at a time. The stage of concrete operations emphasizes blending the concrete with increasingly more abstract learnings such as physical representations with numbers/numerals. Whereas, the stage of formal operations stresses that pupils can reason through abstract methods in using numbers/numerals in addition, multiplication, subtraction, and division. Reasoning and inventing have become leading approaches in learning as well as critical, creative thinking, and problem solving. Piaget emphasized that individually the pupil arrived at each stage maturationally and was assisted through each stage with adult/teacher guidance.

Vygotsky emphasized that learning was a social situation, not individually based. Thus, within a committee or small group pupils worked together on a project. Members learn from each other when interacting and ideas "bounce off the minds" of participants. The teacher facilitates learning among group members, but does not, by any means, dominate the participation. The small group progresses with active participation and ideas are modified within the committee. By challenging and modifying ideas presented, committee members benefit in developing comprehensive structures (See Vygotsky, 1978).

Commonalities in psychological/philosophical thinking involving John Dewey, Jean Piaget, and Len Vygotsky are the following:

- * the teacher is a facilitator of learning and not a "sage on the stage."
- * pupils own the curriculum with the teacher assisting learner achievement and progress
- * pupils construct knowledge and acquisition does not come from lecture or the teacher indoctrinating with what is correct
- * sequence in achieving resides within the pupil, not the materials of instruction
- * pupils interact among themselves, the materials of instruction, and the teacher. There is interaction not domination. With the thinking of Jean Piaget, however, the pupil develops largely through maturation.

References

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Submitted by Marlow Ediger

Jokes and Quotes

JOKES:

Q: Why is it so hard to drink a glass of water with 8 ice cubes in it?

A: Because it is "too cubed!"

Q: What is a "Bola Bola?"

A: Pair-of-bolas (parabolas)

Q: Why did the polynomial plant wilt?

A: It had imaginary roots.

Q: What do you call a snake after 2 espressos?

A: Hyper-boa.

Q: What African animal will only attack its prey at one point?

A: A Tangen-lion.

Q: Why is a family reunion like an Algebra lesson?

A: It is a function with relations.

QUOTES:

"Geometry is not true, it is advantageous." ~Henri Poincaré

"The man ignorant of mathematics will be increasingly limited in his grasp of the main forces of civilization."

~John Kemeny

Submitted by Marie Boothe



AND



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