Instructional Design Proposal

Grade 7 Math Unit on Fractions, Decimals and Percent's

Front-end Analysis

Chris Bennington

University of Saskatchewan

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Abstract

The purpose of this instructional design proposal is to propose ways to enhance the delivery of the Saskatchewan Grade 7 math curriculum's unit of Fractions, Decimals and Percent's. This Proposal will discuss in detail the needs for enhancement, the learner analysis and the context analysis. Following the need a detailed proposal will explain the proposed enhancements to the program along with the evaluation methods that will be used to document student learning and improvement.

Keywords: Instructional Design, Math, Grade 7, Fractions, Decimals, Percent.

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Introduction

In Saskatchewan, teachers are required to follow the Saskatchewan curriculum in the planning and delivery of teaching. This curriculum can be found on the Saskatchewan Ministry of Education website: https://www.curriculum.gov.sk.ca/webapps/moe-curriculum-BBLEARN/subjecthome?lang=en&subj=mathematics&level=7. For the purposes of this proposal we will be looking specifically at the outcome N7.4 – Expand and demonstrate an understanding of percent to include fractional percent between 1% and 100 %. Under this outcome it is expected that students will be able to express a percent as a fraction or a decimal. In the Saskatchewan Rivers School Division grade 7 math teachers utilize the Math Makes Sense 7 textbook offered through Pearson: http://www.mathmakessense.ca/books.html. This textbook covers the curriculum well and is designed with critical thinking and problem solving strategies. While we use the Math Make Sense textbook developed by Pearson as the core of our divisions teaching practice, through years of use I have discovered limitations with the way the textbook is designed and how math concepts are taught and many teachers end up redesigning and tweaking their instruction files to better meet the learning needs of their students. As will be explained in further detail later, it has been documented that a certain percentage of students struggle with understanding these concepts and have expressed difficulty with utilizing the textbook in order understand. The purpose of this instructional design proposal in to identify the need and develop learning strategies that infuse technology in which this unit can be improved in order to enhance student learning.

Part A: Needs Assessment

There is a need to improve grade 7 math scores within our division on the division's yearly Math assessments. In the unit of Fractions, Decimals and Percent students have experienced difficulty converting from fraction, to decimals and percent and understanding how to solve problems involving them. While teachers are provided with a Math Makes Sense textbook and a teacher resource to instruct this unit, difficulties have been found in the students understanding of the language the textbook uses and the lack of sufficient practice in order to master the concept. Students are frustrated with a text that they have a hard time understanding. Teachers are challenged with the textbook's focus on word problems and lack of practice in one skill to mastery.

There are a number of key stakeholders who should be involved in the development of instructional goals for this proposal. They include, grade 7 teachers, a focus group of grade 7 students, school administrators, educational support staff, and members of the school division's senior administrative team (i.e. superintendents). To get these people involved, formal group discussions with grade 7 math teachers can be held to collect their thoughts on the goals for the project. Surveys could be sent out to former grade 7 students to get their impressions on this specific math unit. Focus groups could be held with current grade 7 students to determine successes and ways to improve instructional delivery. Meetings with educational support staff will help to identify key strategies that can assist struggling students. Finally discussions with senior school division staff on the relevance of this project and its impact it can have on achievement will help to gain support and provide an avenue to see this project distributed on a division wide basis.

In order to validate the need for a grade 7 math improvement I will access the school division's data records on the past 5 years of results in on the grade 7 assessment for outcome N7.4. I will tabulate the results and determine the percentage of students who are approaching or below grade level (this is a level 2 or 1 on the 4 point scale used in our division grading protocol) in this area. With these statistics in hand I will identify the need for improvement and set a goal of a 20% improvement in the number of students who are at or above grade level after taking this proposed instructional design enhancement.

This lack of understanding can be solved through instruction. I believe that providing teachers with a better designed unit that carefully explains how to solve fractions, decimals and percent, provides sufficient practice to master the concepts, reduces the current volume of word problems and provides an attractive, engaging, technology infused and student relevant instructional program will lead to vast improvements in student achievement.

Technology has been shown to help improve overall learning in various studies. David Andrade states that "Technology can be used to improve teaching and learning and help our students be successful… However, technology can be a "force multiplier" for the teacher. Instead of the teacher being the only source of help in a classroom, students can access web sites, online tutorials, and more to assist them. The full article is located here: How Technology can improve Education.

 In recent CBC article titled "How math education in Ontario is dividing educators." Teresa Murray stated "Something needs to be done about fractions," she said, citing them as an example. "The way fractions are being done in Ontario, it's being skimmed over, the topics are left too late, there's not enough time for practise … and the students just aren't getting it." The full article is available here: CBC News article on Current Math Challenges. I believe that a

balance between the inquiry method of learning and adequate practice of basic skills

(multiplication, adding fractions) needs to occur to improve success.

The goal of this proposal is that through instructional design of an online interactive

supplement to the Math Makes Sense textbook, I believe that we can better meet the needs of

both teachers and students in math while helping to design crucial technology skills in grade 7

students. Their needs and wants are listed in the chart below.

	Wants	Needs
Client – Teachers	Want to ensure that the students learn how to effectively convert fractions to decimals and percents. Also want to see students be able to solve word problems that involve fractions decimals percents.	Needs to be a one-stop resource that can be used in the classroom, on computers, Smartboards and online at the students discretion (anywhere, anytime, any place). Needs to be easy to use.
End-User – Students	They want an engaging unit that captures their attention, is relevant to them and interesting. They want to see the relevance of what they are learning to the real-world. They want it to be taught as simply as possible to help them maximize success and understanding. (i.e. step-by-step with lots of practice to master)	Needs to be fun. Needs to be current. Needs to be relevant to their lives. Needs to be simple.

As an Instructional Designer the following is a list of assumptions I am required to make

in understanding the scope of this project.

	Assumption	Reasoning (Why do you think this?)
#1	*Who are the stakeholders?* Teachers, Students, Division staff and parents.	Teachers want to see their students succeed and want resources that best help them achieve this goal. Students want to do well in school and learn skills that they can use in real-life. School division staff want to see high success rates on division

		assessments that show the high quality of their division's teaching staff to the public and other stakeholders. Parent's want their children to receive the best education possible and see their children succeed.
#2	*Why do you think the client has hired you?*	The school division has searched for an Instructional Designer cause there is a need to see improvement in students understanding of Fractions, Decimals and Percent. They have hired me given my familiarity with the school division's assessment and recording protocols, my 9 years of experience in teaching the grade 7 curriculum, my familiarity with the current textbook being utilized and the issues surrounding it, and most importantly my understanding of instructional design, technology and distance education through my training in the University of Saskatchewan's Masters of Educational Technology and Design Program.
#3	*Who will determine success or failure?*	The success or failure of this project ultimately lies wit the instructional designer who develops the new unit. It will be determined primarily be the results of the students on the division's assessment of this particular unit. While there is a possible variance from teacher to teacher in the delivery of this new unit (the human element), this will be minimized by providing a detailed, step by step unit guide and resources that give all teachers (regardless of experience, age and mathematical understanding) the best opportunity to succeed.
#4	*How will you deal with conflicts between the client and the end user needs?*	The only perceived conflict I see is that the client will want a comprehensive unit that effectively reaches the outcome expected in the curriculum. The students on the other hand want the easiest way to learn the material and if they don't need to know it they can't be bothered. The easiest way to deal with this conflict is by ensuring proper communication with the students as to what exactly they need to learn and also ensuring that teachers understand the students needs for interesting, relevant and easy-to-

		learn content. This can be achieved through collaboration with teachers once a month on the status of the project (i.e. email, focus group) and pilot groups. Ultimately the client and the end user have the same goal; they both want the end user to succeed.

Part B: Learner Analysis

The learners are between the ages of eleven and twelve years old and come with a wide range of mathematical ability. In the past decade of teaching I have found that when teaching this unit students have a hard time conceptualizing fractions and making it relevant to themselves. They also experience difficulty with fractions and understanding that the larger the more numbers in a decimal does not necessarily mean the larger the actual number (0.2 is larger than 0.14568). Also students are beginning to have trouble with percent and there usage given educations shift to a 4 point rubric grading scale and no longer using percentages in grading, therefor other ways to make this relevant need to be examined. Then finally being able to quickly move from fractions to decimal and percent equivalences is an area that many students struggle with.

Characteristics	Data from project study	Design implications
Cognitive:	Students will have been exposed to fractions, decimals and percent's in previous grades. The extent of familiarity and level of comfort towards these concepts varies from individual to individual. Students also tend to be within Piaget's Identity vs. Identity Confusion stage – characterized by the students figuring out one	Students will require step-by-step instruction in both the concepts and how to utilize the technology in the course. Need to plan both lessons on how to utilize the online course and how to work through the lessons and activities. They also need support and encouragement at every step of the journey.

	self as an adult and at times unsure of themselves and their abilities.	
	Problem solving tends to be at the developmental age with 11 to 12 years old with some students still at the beginning stage, especially with word problems.	Progressively leveling the types of problem solving questions from simple to more complex in the lessons will allow students to gain confidence and allow for adaptations.
	Students at this age enjoy hands on learning activities and it appears to be one of the best ways to process new learning. At this age most students have familiarity with using computers and are at the developmental age where they can work by themselves.	This unit should utilize hands-on activities in most lessons to help students grasp the concepts. Games and activities on the computer will help meet this need. Students may need some mini-lessons in computer usage and etiquette at the start of the unit to reinforce their computer skills.
Physiological:	The students, aged 11 to 12 are of good health and have normal sensory perception for students of this age.	Media designed should be rich in format (visual, auditory, and allow for a variety of sensory inputs for each concept.
	Variations in perception (glasses), hearing (possible loss) and other physiological and mental abilities levels may be present.	Adaptations may need to be present in order to assist special needs of certain students.
Affective:	Students at this age are naturally drawn to learning tasks that are rich media and hands on learning. An emphasis on games and fun learning tasks helps to motivate them to learn. They also enjoy tangible rewards and seek to understand how they can use new knowledge in the real world. Only a few students at this age can internalize rewards and many still enjoy tangible external rewards. Students can have a natural anxiety to learning new Math concepts based on their experience in previous grades.	Design an online unit that incorporates games and rewards (i.e. badges, tokens, certificates) for achievement of math concepts. Utilize rich media to teach the lessons and interactive games to help them practice the concepts. Students will enjoy utilizing technology for learning, therefore students should have the opportunity in this unit to utilize laptops and online resources.

Social:	Students at this age tend to thrive in relationships to peers and conversations. Many have a respect for authority but also like to test limits and challenge authority as part of their adolescence. Students both enjoy cooperating with others and healthy competition in structured environments but require lots of support.	Opportunities for students to converse in the lessons and discuss their learning should be encouraged. This could be a think/pair/share using a shared google document or other social media platform for the class (google hangout, blog, google classroom). Challenges to authority can be minimized by having the student have input in their overall evaluation and giving them choice through creative freedom with a final unit project that displays their understanding of Fractions, Decimals and Percent.

Part C: Context analysis

The following chart lists the contextual issues that I foresee specifically to this project.

	Observations/ assumptions	Implications for design
Physical context/environment *- hardware, existing curricula, facilities, etc.*	The class is equipped with a Smartboard. There is a class iPad and it's possible to book enough iPads for a 1 iPad to 2 student ratio. There are enough Chromebooks for a 1 to 1 usage, and access to laptops if required. Students have access to the Math Makes sense textbook both in hard copy and digital copy. All students have their own Google Drive account provided by the school division.	A rich media environment is possible and students have the ability to utilize 1 to 1 technology. Design of the instructional unit should take in to account the use of technology to design a blended classroom of instruction and the ability for students to do asynchronous work.
Use context (who will use the materials and how will they make use of them) *- which classes, people, end users, teachers,*	Grade 7 students will utilize the content designed and Grade 7 teachers will utilize the online unit to help them teach the concept of fractions, decimals and percent. Parents may also assist students at home with accessing supporting resources online	Unit needs to be designed with the end-user in mind. Their interests, cognitive ability and developmental stage need to be taken into account to make the unit both attractive and facilitate ease-of-use. Teachers will enjoy a comprehensive unit that covers all

parents, students, etc.	outside of school time.	the material and is easy to instruct.
Socio-political dynamics of the learning environment - community, school, organization, government, philosophies, taboos, etc.	The school I work for is a small urban school within the city of Prince Albert. It is located in an area of town with a lower social / economic status and sees a large influx of students from reserves and other northern communities who move into the city. The school has a large level of cultural diversity with First Nations / Metis students making up at least 60% of the school population.	Media should be designed to incorporate indigenous ways of learning and use examples that tie into First Nation and Metis ways of life. Diversity is also the key and lessons should show a rich variety of examples that allow all students to feel valued and allows them to make social-cultural connections.

The following Interference / Success factors may disrupt / support the development of this design.

Interference factors:
What could place constraints on design? 1. The grade 7 curriculum provides the natural framework of this unit and places constraints on the design of the unit. 2. The instructional time for math classes must also be taken into account, ensuring a proper amount of time for teaching and practice is incorporated into each lesson. 3. Finally the availability of technology (given that in the school Chromebooks and laptops are loaned out, also student access to this outside school) may provide constraints and ways to work around the lack of computers, Chromebooks and iPads from time to time need to be considered. 4. Teachers who feel uncomfortable using technology within their classroom. 5. Lack of access to laptops, Chromebooks, iPads or other technology used to access the online unit resource.
What might interfere with delivery? 1. Difficulties with logging on to an online course could pose difficulty and ultimately make this sort of learning difficult. It may be worth to design a supplementary Smartboard unit that does not utilize the Internet as a back up in case of technological failure. 2. Let's also consider if there is a power outage. Providing ways for instruction to happen without electricity should be incorporated. 3. Approval of the school division to distribute this resource to all grade 7 teachers in the

division. Their approval is crucial to the overall validity of this project.

What might interfere with instructional strategies?

1. Student lack of interest could lead to difficulties in delivering instruction and cause distractions in the class. I believe that if the unit is designed with rich media in mind that the instances of this should be minimized, but teachers need to have proper classroom management practices in place to control student and deal with ones that get out of control. Ideas for proper classroom management when utilizing online courses can supplement the teacher's guide that goes along with the unit.
2. Lack of comfort and understanding of how to use technology present – workshops for teachers and the ability to help students learn need to be present.
3. Some students will need other supports and instructional strategies to be able to achieve the same level of success as others.

Factors contributing to success:

How might personnel aid the project?

Support for the project will come from the school division office and specifically the Technology Coach – Stacey Monnet, within our school division. She will assist with the technological side of this project.

I would consult with professor Marguerite Koole and other professors within the University of Saskatchewan's ETAD program for the instructional design aspects and ensure the project is sound.

At the school level I expect support from my schools administration for the piloting of this project and financial assistance that can be allocated from the school budget.

I also believe that students will support this project by being pilot testers and providing their feedback on how to improve the final project.

How might existing resources aid the project?

Support will also come from the Ministry of Education's website for approved online resources that can support the curriculum.

Our division's Teacher Resource Centre can provide ideas for additional resources.

Also a comprehensive search of other school divisions online math program's can provide further ideas and best practices for designing an online math unit.

Our schools and classrooms do have the technological hardware to support delivery

and a comprehensive analysis of all grade 7 classroom technology inventory can be completed through a simple survey tool at the start of the project to identify any technological gaps and work to mitigate this problem ahead of project roll-out on a division wide scale.

How might current strategies/procedures aid the project?

Current strategies that can aid the project are an understanding of the constructivist approach to learning – that students construct their understanding of the world around them on what they already know. Constructivists believe that meaning or understanding is achieved by assimilating information, relating it to our existing knowledge, and cognitively processing it (in other words, thinking or reflecting on new information), (Bates, 2017) Utilizing the inquiry based learning to help students with problem solving in Math once they have mastered the basic skills. Students likely be familiar with using Windows operating systems, Chromebooks and Google Drive ahead of time.

I still want to know:

1. Will students have enough technological skills and knowledge to apply their skills to utilizing this online unit without feeling overwhelmed? Will the teacher also feel comfortable utilizing the online resource?

2. What will be the final timeframe required to effectively teach this unit online? Some basic idea will be from the textbook and how long it takes to cover each lesson, but only through the pilot will I get an idea of the final timeframe.

3. Will teachers and administrators be reluctant to utilizing an online resource or being open to students possibly using their own devices to log onto content in school and outside?