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Literacy: Buzz Word on the Back Burner

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Literacy: Buzz Word on the Back Burner

Abstract

This paper reviews 12 published articles written on the importance of literacy in mathematics and the best practices to utilize inside the math classroom. The paper focuses on the definition of literacy of Orr, Kukner, and Timmons (2014), a definition that adapts literacy from reading and writing to the inclusion of problem solving, critical thinking, and the interaction with materials. The study conducted beyond the review of the literature was aimed at identifying the need for literacy across all content areas. The results of the findings show that as an educational community we show awareness of the deficit, but have not identified ways in which we may improve upon those deficits.

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Abstract

This paper reviews 12 published articles written on the importance of literacy in mathematics and the best practices to utilize inside the math classroom. The paper focuses on the definition of literacy of Orr, Kukner, and Timmons (2014), a definition that adapts literacy from reading and writing to the inclusion of problem solving, critical thinking, and the interaction with materials. The study conducted beyond the review of the literature was aimed at identifying the need for literacy across all content areas. The results of the findings show that as an educational community we show awareness of the deficit, but have not identified ways in which we may improve upon those deficits.

Keywords: Content specific literacy, literacy in math, literacy

Literacy: Buzz Word on the Back Burner

When thinking about education today there are many topics that stand out. Recently, there has been one such topic that has dominated the conversation, the development of literacy across all content areas. With the implementation of Common Core, a set of curricula based on rigorous literacy and mathematics based skills, there is no doubt why this has become one of the most talked about topics in recent educational history. One major focus of this initiative is making a connection between literacy and mathematics.

Before it is possible to begin to make connections between literacy and mathematics, clarity is often required on what literacy is. Literacy is the skills of reading and writing, however in the modern technological era there are many other intricacies to literacy that do not garner as much attention. Literacy according to Orr, Kukner, and Timmons (2014) has become much more than reading and writing:

Literacy today is understood in broader terms and as one of the ways by which individuals relate with others in particular contexts in order to communicate, critically solve problems, develop knowledge, and fully interact in society. This broader definition acknowledges the multiple possibilities and situations in which individuals engage in relation to particular contextual requirements. (p. 92)

This definition clearly shows that literacy is not a stagnant set of skills, but one that is ever changing and evolving to become more effective. Literacy can be infused into a multitude of content areas.

The infusion of literacy development among the content areas is one of the ways that will allow students and individuals to interact with information in a variety of ways and contexts. This interaction and connection with information in various modes will foster more

interdisciplinary learning and thus with allow for connections among the various curricula in schools (Casey, 2013). According to Schell (1982) there are two reasons literacy in the content areas and mathematics specifically are important, first to further improve literacy skills and second to help a student connect with and understand a topic or concept.

Too often in education the issues for comprehension and understanding of the language of the area of learning is a barrier to the learning of the particular individual. Alt, Arizmendi and Beal (2014) state, “There is clear evidence that children with early diagnosed language impairment are at risk for later academic difficulties” (p. 221). This evidence points to literacy difficulties having similar adverse effects on understanding and connecting with key concepts in various content areas. One area of particular evidence of this correlation between literacy and content is mathematics.

Mathematics is a content area rich in vocabulary, abstract concepts and literacy-based learning. Mathematics allows an individual to interact with a number of literacy practices in a variety of contexts like graphs, definitions, concepts, and thought processes. This allows for critical problem solving which has become part of the evolving definition of literacy. Relevancy of literacy in mathematics can be shown through the final portion of Orr et al.’s (2014) definition of literacy. By allowing individuals to engage with mathematical concepts in a variety of contexts and situations literacy becomes an integral part of mathematics.

However, linguistic understanding can often become part of the problem in mathematics understanding as well. Words commonly used in mathematics have other meanings in everyday language as well; words such as product, face, volume, and plot have very different usages outside of math (Adams, 2003). One specific example that exemplifies the possible confusion for students extremely well is the word plane; in mathematical contexts the word plane refers to a

surface, while in everyday contexts the same word with the identical spelling means an airplane. There are also many words in mathematics that are homophones with words used in the English language that could create barriers for learning; examples of such words are plane (plain), one (won), whole (hole), and cent (scent or sent) (Adams, 2003). These linguistic similarities can cause difficulty understanding key concepts and ideas within mathematics. The context surrounding the language in mathematics is critical for success in this content area. Mathematics creates relationships between words and symbols and it is also a language of order and context.

In order to be successful in mathematics it is paramount that one can read mathematics. Reading mathematics is not as simple as reading and comprehending a sentence. While reading a certain mathematical equation, the mathematical equivalent to a sentence, one will not always begin by performing operations in the way they were written or spoken because of the order in which operations may be done. Adams (2003) exemplifies this in her work as such, “Consider this simple exercise: $3 \times (5 + 2) = ?$ One might read it initially from left to right, but the nature of the exercise requires that the operations must be performed from right to left, that is, $5 + 2$ must be completed first” (p. 794). This strange order without context of order of operations (parentheses, exponents, multiply/divide, add/subtract) makes very little sense and is what often troubles learners that have literacy difficulties.

While there are many ways in which reading mathematics is fundamentally different from reading a book, Capraro and Joffrion (2006) believe that there are many parallels between the two. They state that the need to understand meanings of words and the ability to infer what other vocabulary may mean within the context of a mathematical definition are skills that belong to both disciplines (Capraro & Joffrion, 2006). While Capraro and Joffrion (2006) do point out the similarities between the two disciplines, they also state, “mathematics students must possess

conceptual understanding so that once the words have mathematical meanings they can accurately translate those words into mathematical symbols” (p. 150). The connections between literacy difficulties and understanding math do not stop there. Often individuals have difficulty writing or reading mathematical concepts in multiple forms of representation (Adams, 2003).

Forms of mathematical representation may include visual drawings, graphs, sentences, or contextualizing answers. These representations are extremely difficult for students with content literacy deficiencies because of their abstract nature and the inability to read mathematics. Not only are mathematical representations like graphs and timelines present in mathematical content, but they are present in other subject areas such as science, social studies, or English as well. Without the skills and teaching of content specific literacy, such as what do the coordinates on each axis of the graph mean, individuals will have difficulty making meaning of graphs, and other mathematical representations across the content areas. Since literacy is important in all areas of content, each content area teacher is responsible for a role in the literacy development of each child they teach (Orr et al., 2014).

Literacy development in mathematics and other content areas will lead to further success for all learners in all content areas. Content specific vocabulary can relate directly with another content’s vocabulary. Prefixes, suffixes and roots of words that may be used and identified to allow the learner to understand concepts that were troublesome or unknown prior to learning the meaning (Schell, 1982). These content specific vocabulary terms may allow for connections between two seemingly unrelated topics and create a deeper understanding for the individual learner. However, this may also create confusion due to similarities between words and concepts in different contents.

There are many ways to combat content confusion in mathematics, the first is to focus on mathematics as a language, a language that is used to decode and determine a concept or questions purpose (Adams, 2003). The use of this mathematical language allows learners to hear as well as visualize the concept, so rather than having individuals simply show or write an answer, have them explain or verbalize this answer and promote the mathematical language in classrooms. Also encourage the use of mathematical symbols such as graphs and timelines in other contents across your school.

The encouragement of mathematical language is essential to the improvement in not only literacy fluency in mathematics, but achievement as well. Just like any other discipline of school mathematics has a very specific language of communication that should be encouraged just as it is in all the other content areas (Firmender, Gavin, & McCoach, 2014). The more this linguistic discourse is used, the greater the results for the student will be. The discourse allows for relationships to be formed between the language and the content being provided.

Much of mathematics is relationships between words and symbols, or words and numerals, or even words and answers. According to Adams (2003), “students need to be made aware that they should attend to the relationship between, words, numerals, and symbols” (p. 793). What she means by this is that rather than mindlessly reading a problem such as a word problem, one should pay particular attention to the mathematics specific vocabulary within the context of the question. For example the two statements “four less than ten” is not the same statement as “four is less than ten” within the context of the two statements the insertion of the word “is” evolves the problem from a subtraction question to an inequality statement. The language must be matched up to its corresponding symbols, as the question requires close reading and decoding strategies often related to literacy.

These decoding and close reading strategies are skills that are often practiced in a literacy lab or in an English classroom. However, as evidenced by the above example, effective reading and decoding strategies benefit students in more than one class, they enable learners to develop skills in other contents that are necessary to be successful. In a 2013 study conducted by Massey and Riley they identify mathematical texts as “multisemiotic; that is, they use natural language and symbolic language” (p. 577). This study examines the way that mathematics teachers read mathematical texts and what types of literacy strategies they use in order to decode and understand the texts (Massey & Riley, 2013). One particular member of the study by Massey and Riley (2013) began thinking that reading was not occurring during mathematical practices, however after months of work and self-reflection he states:

I am learning that reading DOES take place in math. I wasn't even sure reading was happening at all when you first posed the question several months ago. But I see now that just by going over the words and introduction of the math lesson the kids are reading (or at least I am guiding them through a few pages in the text). (p. 580)

This shift in thinking allowed for a greater reflection into the reading and literacy strategies that he was utilizing to understand the content. This study shows that the educator used three specific patterns of thinking most often when reading mathematical texts; they are visualization, connecting to the known and the question ‘what is this in math?’ (Massey & Riley, 2013).

While using the visualization strategy Massey and Riley (2013) correlate this to two comprehension strategies often found in literature about best literacy practices; those two strategies are visualization to create mental representations of text and prediction of image before solving a problem from prior knowledge and text structure. These visualization strategies are effective ways of checking or predicting the outcomes in a mathematical context. Connecting to

the known often requires the literacy practices of making connections to other relevant information and problems/text, clarifying and determining importance (Massey & Riley, 2013). Connections are useful in order to allow individuals the opportunity to truly understand and comprehend a task thoroughly. The question ‘what is this in math?’ correlates to the literacy strategies of using text structure and key words, asking questions of the text, and connecting the vocabulary to known concepts and ideas and/or distinguishing the vocabulary from nonmathematical understandings (Massey & Riley, 2013). Questioning and using strategies to connect vocabulary to concepts is key to effective mathematical practices. However there are more strategies and practices that can lead to a furthered mathematical comprehension and literacy for learners.

Links between theory and practice are the crux of mathematical procedures, so similarly there must be a link between mathematical concept and comprehension/literacy. The practices by which an educator links these two is essential to the development of not only mathematics skills, but literacy skills as well. According to Adams and Pegg (2012) there are two effective ways in which to utilize and enact such strategies, rehearsal and reorganization. Adams and Pegg (2012) write that, “In the Rehearsal pattern, teachers primarily use literacy strategies to revisit and rehearse content” (p. 154) and “In the Reorganization pattern, teachers enact literacy strategies with a goal of supporting students in developing deeper conceptual understanding” (p. 154). The implementation of both rehearsal and reorganization patterns within the classroom were found to be effective when the use of the literacy implementation was centered on the student learning objectives (Adams & Pegg, 2012). While the way a strategy is implemented and used can be important, the truly important pieces to this puzzle are the strategies themselves.

One such literacy strategy that has been found to be extremely effective is the Frayer Model. This model is very useful in mathematics education because of its setup and ease of use. The setup is very simple, there are four boxes formed around a central topic, these boxes are labeled definition, examples, non-examples, and characteristics, this enables students to interact with the concept on a more individual level (Adams & Pegg, 2012). During a lesson or after a concept has been taught, this strategy allows the learner to define or explain the given concept in their own words as well as provide personal input into their learning of the concept and allowing for connections between prior knowledge and concepts to be formed (Adams & Pegg, 2012). The Frayer Model is not the only literacy strategy however that enhances the learning of content specific vocabulary in mathematics.

The Verbal Visual Word Association (VVWA) is another example of a strategy that can be implemented in order to enhance the learning of content specific vocabulary and concepts in mathematics. The VVWA is a strategy very similar to the Frayer Model in that it has four sections that are used to describe a vocabulary term or concept. However, these sections are not the same, the four sections of the VVWA are the vocabulary term, a visual representation, a definition and a personal association or characteristic for the term (Adams & Pegg, 2012). This model works particularly well when the term being described can easily be given a visual representation, which makes this strategy extremely effective for Geometry terms, given the concrete visual aids it provides. These models are great for learning vocabulary and understanding of words through connections to prior knowledge. Other strategies, such as thinking aloud, that may be used during direct instruction can be enhanced due to the rich vocabulary that the Frayer Model and the VVWA lead to.

Thinking aloud is a practice that many mathematics educators use currently in order to model the process of teaching mathematical concepts through modeling. Thinking Aloud as described by Davis and Brown (2013) is “the verbalization of the thoughts and processes that are typical of the teachers’ internal processing of discipline-related material in a way that allows students to observe the methods of thinking and knowing” (p. 177). This strategy gives the learner the benefit of not only visually following the process of a specific mathematical discipline, but the verbalization of the discipline as well. The verbalization allows the dialogue between educators and their students to be primarily focused on the mathematical concepts and enrichment of vocabulary needed to be successful (Davis & Brown, 2013). Students may also utilize thinking aloud to create a way in which conversation and group work can be led and discussed. Practices by which educators teach literacy in mathematics can also be extended to different teaching models such as the Reciprocal Teaching approach.

The Reciprocal Teaching approach created an extension “from the traditional four reading strategies used in literacy contexts to include other cognitive strategies” (Meyer, 2014). The use of this pedagogical approach creates a relationship between the context and concepts of mathematics. This connection according to Meyer (2014) allows the educator to release a portion of the responsibility and accountability for learning onto the student. However, the literacy aspect of teaching is not limited to the educator’s teaching style, but also the way a learner conveys thoughts and ideas as well.

One strategy in which learners can convey their thoughts, ideas, and understandings in mathematics is through authentic writing about a concept or topic. Ming (2012) identifies ways in which to utilize authentic writing in the mathematics discipline, he writes that students may “write paragraphs to explain procedures or solutions to a problem” or “write poetry to describe a

concept” (p. 215). Through this writing the understanding, contextualization of understanding and the literacy of mathematics work together to create a comprehensible and coherent explanation for given processes and concepts. The ideas of quick writes for reflective purposes can also be used to show reflection and concept mastery (Ming, 2012). Writing forms are not simply limited to writing exercises in class and during the school day, but can be extended to social medias and more technological means.

According to Casey (2013) social media can be an extremely effective and collaborative method by which learners can help one another and share ideas in a safe way that is communicated through a non face-to-face interface. She claims, “through the integration of social and participatory media, I connected students to a variety of real-world mathematics examples, online and provided opportunities for students to share the ideas of how math could relate to them” (Casey, 2013, p. 69). In other words through her formatting and use of social media her students connected and communicated further about the topic, which enhanced literacy benefits for those students in the mathematics classroom.

Even with the recent shift to enable educators a larger abundance of resources that are provided in our educational workplaces, such as professional development and literacy specialists, mathematics educators find that many of the resources provided fall short of helpful to their plight. According to Siebert and Draper (2008) “many literacy messages fail to resonate with mathematics educators because they neglect, deemphasize, or misrepresent the nature and content of the discipline of mathematics” (p. 231). This feeling of misrepresentation causes many in the mathematics field to overlook the importance of literacy instruction within the mathematics classroom. There are three major categories of messages that are problematic among the literature provided about literacy about mathematics according to Siebert and Draper

(2008). These three are “(a) messages that neglected disciplinary influences, (b) messages that deemphasized or minimized disciplinary influences, and (c) messages that misrepresented the discipline of mathematics” (Siebert & Draper, 2008, p. 235). In a vast majority of the literature that is provided for professionals in the mathematics education field this is the case. This widespread miscommunication of proper and effective literacy strategies in mathematics education is leading to an increase of neglect for literacy instruction in one of the major content areas of today’s education.

This neglect is one of the driving factors behind the lack of understanding of complex or in some situations basic mathematical concepts. A lack of understanding creates further gaps in learning within the subject. With a concerted effort and focus by the educational community on literacy in mathematics, students will gain greater understanding and success in mathematics.

Introduction

Around education there is an abundance of buzz words that have found their way into many of the conversations surrounding the field. One such word that has become increasingly popular is literacy. Literacy has been marked as one of the key cogs of understanding for all learners regardless of the subject or age level. While literacy has become popular amongst policy makers and education departments throughout the United States, this topic has not quite taken the front seat it deserves inside of some secondary classrooms. For example, often when secondary educators hear the word literacy they think of the Humanities. While it may be true that these subjects (English and social studies) lend themselves easily to the teaching of literacy practices, literacy is also an imperative tool to learn in the Math and Science classrooms.

In my study I interviewed five secondary teachers (of various subject areas) from a suburban school district outside of Rochester, NY on the importance of literacy in their specific

classrooms. The five teachers I interviewed have experience cumulating in nearly 75 years of teaching, in multiple subject areas. The subject areas of those interviewed include Special Education, Mathematics, Social Studies and Science.

I received permission from all participants in this study. My role in this study was to interview educators and find out what methods of literacy (if any) are used in their classrooms daily and if they feel their district has done enough to support them and provide them opportunities for professional growth and development in the area of content specific literacy. I did this by connecting with colleagues and emailing them a series of thirteen questions in order to ask the individuals questions about their own classrooms. I then took their answers and compared them in order to identify differences and commonalities in their answers.

I am currently certified in Mathematics Secondary Education, grades 5-12. I am presently enrolled in a program working towards earning a Master's of Science in Special Education. While I am working towards this certification, I am also employed as a general education math teacher at the school where I conducted my interviews.

Context

This case study is being conducted through a series of interviews with teaching professionals in a large suburban school district just outside of Rochester, NY. The participants are colleagues, but many of them work in different capacities and school buildings throughout the district. The teachers whom I have interviewed were educators from the district in which I teach and the five that responded were interested and willing to answer all of the questions I asked them. The educators that responded to my inquiries about their classrooms were very interested in this study and provided me with a great deal of information about the topic of

content specific literacy. The students that these educators work with are from a predominantly middle class area and the population of the school very closely resembles that population.

Participants

In order to provide anonymity to those who have chosen to participate in this study I will refer to them as Participant #1, Participant #2, Participant #3, Participant #4 and Participant #5. Participant #1 is a New York State master teacher that teaches math grades 10-12. Participant #2 is the head of the math department of the building in which he teaches; he teaches ninth grade math. Participant #3 is a ninth grade special education teacher, who pushes into a Global History class, with over 20 years of teaching experience. Participant #4 is a social studies teacher, grades 10-12, with credentials to teach Syracuse University Project Advance (SUPA) courses. Participant #5 is a dual certification Science and Special Education teacher who teaches Earth Science.

Method

This study was conducted primarily to identify the true importance of content specific literacy in the educational classroom. Secondly, this study provides a look into the development and growth opportunities that are provided to educators within the topic of content specific literacy. Literacy is a truly wonderful part of education but as a field we must identify and develop the way it is implemented in all classrooms. In order to gather information I sent out thirteen interview questions to various educators of the recipients I received responses from five participants who are exceptionally qualified educators.

In order to create a non-biased interview I created a series of questions that all built upon one common thread, the influence of literacy on a students' success. However, many educators have very different ideas of success and how to achieve that success for students. In order to

account for this I asked each professional to outline their version of success before proceeding to their interviews. After the participants determined how they identify student success they answer a series of questions on the importance of reading, writing, problem solving, interaction with materials, and critical thinking to the defined success they have provided.

After they have identified the importance of each of these parts of literacy I asked each individual to define literacy in their own words. Then I gave them a definition of literacy that was created by Orr, Kukner, and Timmons (2014) and asked the participants to respond to the definition with any parts they had overlooked or were surprised with when reading the definition. Next, I asked each individual to identify the importance of literacy and what literacy practices they utilize in their classrooms regularly. Lastly I asked each participant to identify if their district offered training in content specific literacy and if they believed trainings in the area of content specific literacy would benefit educators and students alike.

Results

When looking at the data that was received there were many common themes that occurred throughout the thirteen questions. I have broken down the results of each of the questions 1-13 below and the commonalities that presented themselves.

Question #1 – How do you define student success?

In this question there were a variety of answers provided by the participants however there were two main themes that presented themselves throughout the respondents' answers. Each of the participants stated that the way they measure a students' success is the continued growth and improvement in areas of education, whether it is study habits, academic achievement, organization or confidence. Participants #1 and #2 also stated that student engagement is another primary goal to student success. As you can see the two main themes to defining student success

were goal oriented student growth and student engagement in the school community and classrooms.

Question #2 – Explain the importance of reading to your students’ success.

Participants explained the importance of reading to their students’ success as a vital role in their learning process. Participant #1 stated that this is a foundational skill to not only support, but to enhance and supplement learning and understanding. Participant #2 talked specifically to the new standards for mathematics requiring students to be able to read more carefully and be able to pull more information out of context to enable success within a question. Participant #3 detailed that reading is a paramount skill that students often struggle to use as a learning tool. Reading is vital to the success of Participant #4 students’ because without the ability to read one cannot accurately gather information or communicate with others. Lastly Participant #5 indicated that reading is imperative in fostering proper thought process within his classroom. From the results that were gathered it is clear that each of the participants view reading as an integral tool for the success of learners.

Question #3 – Explain the importance of writing to your students’ success.

Within the answers to this question there were two commonalities that were seen predominantly. First was communication, Participant #1 stated that writing skills are imperative to articulate thinking and understanding. Participant #2 added that writing is key to be able to communicate with people not only in the classroom, but beyond school years as well. It can be used to show growth and stimulate intrinsic motivation as well, Participant #5 described. The other major importance that was identified was the ability to organize and formulate ideas according to Participants #3 and #4. The participants identified the writing as important to student success because it allows them to communicate, organize and formulate ideas.

Question #4 – Explain the importance of problem solving.

According to the first two participants the importance of problem solving to student success is observed not only inside the classroom, but also as it relates outside of school. Participant #1 identified that problem solving is a skill that transcends across curriculum and life experiences. Similarly Participant #2 acknowledged that problem solving not only helps students to achieve success academically, but that it relates directly to life outside of school. Participant #3 talked of the use of this skill in a Special Education setting and the predominant use of it in Math and Sciences rather than in the Humanities. Problem solving is the one area that Participant #4 has seen the biggest drop in student abilities over the past few years. Participant #5 commented that students must be able to problem solve in order to work through problems and identify acceptable solutions in his classroom. The participant believes that technology and the ability to access information immediately plays a key role in this decline.

Question #5 – Explain the importance of interaction with materials to your students' success.

Interaction with materials such as graphs, books, scientific apparatuses, etc. were found by the participants as important to the learners' development. Participant #1 said that interaction with materials aides in making meaning and the transfer of learning to other contexts. Participant #1 added that multiple modes of materials are important to use, to account for different learning styles that students have. Participant #2 answered that the ability to interact with materials in the classroom provides students with the ability to problem solve and make sense of problems both academically and socially. The utilization with technology in addition to the use of multiple modes of materials has significantly improved the ability of a student to succeed in recent years according to Participant #3. The fourth Participant commented that the interaction with materials forces students to engage in their learning more deeply. Participant #5

felt strongly that the use of materials in his field of Science is imperative because it allows students to demonstrate concepts, to collect data, and further analyze that data found with the use of charts, apparatuses and labs.

Question #6 – Explain the importance of critical thinking to your students' success.

The importance of critical thinking was a question that elicited great responses from each of the participants. The challenging of students to think critically according to Participant #1 not only will help them develop academically, but also to compete in a global society. Participant #2 agreed that critical thinking helps to build the problem solving skills students need in life. Participant #3 added that thinking critically is one of the most effective ways that learners actively engage in learning and it gives them skills to utilize beyond the classroom. Likewise, Participant #4 found the skill to be essential to set students up for success in the future. Participant #5 answered that without challenging students to think critically, students will not maximize their growth, thus stunting their success. The one major commonality this skill offers to student success according to the participants is the ability to be successful in students' futures.

Question #7 – Define literacy.

Literacy is often explained with many different definitions and each person carries a definition that may vary slightly; during the interview each participant was asked to define literacy. Participant #1 defined literacy as how individuals understand and communicate with respect to any given context. Participant #2 responded that literacy was the ability to read, decode, communicate and share information with others. Participant #3 answered literacy is the ability to read, write, speak and listen to gain knowledges from their environment and to express needs and wants to others. Participant #4 wrote that literacy is the ability to decode language. While Participant #5 stated that there are three types of literacy within his definition, general,

specialized and technical. The participant then went on to define general literacy as a student's ability to read and write basic passages. Specialized literacy would be a student's ability to use the learned concepts and vocabulary in their reading and writing. Technical literacy would be a student's ability to use advance reading and writing skills to show mastery of a concept. One common thread that occurred in each definition is some sort of ability to use language and understand it.

Question #8 – Literacy can be defined as "... ways by which individuals relate with others in particular contexts in order to communicate, critically solve problems, develop knowledge, and fully interact in society" (Orr, Kukner, & Timmons, 2014, p. 92). What were you surprised by or may have overlooked given that definition.

This multi-faceted definition is much more in depth than most of the responses that were given by the participants. In turn, they were asked to identify the portion(s) of the definition provided they may have overlooked or that surprised them. Participant #1 identified that some of the parts of the given definition may have been left out when responding, but that the excluded parts did not surprise her due to the focus of much of the study in the New York State Master Teacher Program being in the area of content specific literacy. Participant #2, Participant #3 and Participant #5 all concluded that they very much overlooked the problem solving piece of the definition. Participant #4 stated the biggest part that was overlooked when writing the definition was the multi-faceted aspect of the definition. Critical Problem solving seems to be the most commonly overlooked portion of the Orr, Kukner, & Timmons' (2014) definition.

Question #9 – Describe the importance of literacy in your classroom.

It was clear after reading the responses of the participants that literacy is essential in all of their classrooms. Participant #1 evidenced this by stating there are two important types of

literacy used in her classroom. First is textbook literacy, or the ability to understand how to use the math text as a resource. Secondly, participant #1 stated that math literacy is critical in order for student to connect the mathematics to the vocabulary that describes it in order to deeply develop skills and understanding of materials. Participant #2 described that literacy helps to increase the clarity in communication with others which in turn aides in the increase of comprehension. Participant #3 outlined the importance as paramount to the work that is done in Special Education, often literacy impacts self-confidence and self-image of these students. Without literacy, learning is nearly impossible Participant #4 claimed. Participant #5 found literacy to be integral because without literacy it is difficult to understand information, or accomplish a given task. Each of these educators agreed that literacy is not only useful, but essential to student learning within their classrooms.

Question #10 – What types of literacy practices do you utilize on a regular basis in your classroom?

Literacy strategies are used often in classrooms to enable further learning by students in order to ensure their success, the participants were asked to identify ways in which they incorporate literacy in their classrooms. Participant #1 indicated that much of the literacy strategies that are used in the classroom are related to vocabulary and its connection to the processes that they describe within mathematics. Participant #2 identified the use of word walls and introductions to vocabulary prior to processes as strategies used in the classroom. Participant #3 stated that various strategies are utilized in the classroom, including but not limited to explicit vocabulary instruction, visual supports for vocabulary, writing prompts, reading prompts, and visual tools such as graphic organizers among others. The use of social media, reading guides, writing prompts and reading samples from varying perspectives are used

by Participant #4. Participant #5 utilized know, want to know, and learned charts (KWL), word walls, ticket out the doors (TOTD), read alouds and writing activities as literacy strategies within the classroom. The list of strategies that are used by the participants is expansive and identified use of literacy strategies in each individuals teaching.

Question #11 – How often does your district offer training in literacy for your subject area?

This question is written to identify the opportunities that the participants are given to learn more about content specific literacy. Participant #1 commented that she was unaware of professional development or trainings in this area offered by the district, but did mention that she had content literacy training through the New York State Master Teacher Program. Participant #2, Participant #3 and Participant #4 all mentioned that content literacy training and development opportunity is not often provided to them. Participant #5 indicated that most of the development in this area is provided through departmental meetings as well as through work with a literacy coach in a previous position. The major theme that appeared in the participant responses is the lack of professional development offered in the area of content specific literacy.

Question #12 – Do you believe that as an educator you would benefit from content specific literacy trainings in the classroom? How?

Participants were then asked if they believe their teaching would benefit from content specific literacy trainings. Participant #1 expressed that all educators can benefit from it, the participant also identified that there is often a misconception that the focus on literacy should be in the Humanities rather than in all content areas. Participant #2 indicated that if trainings were geared more towards specific content areas it would provide him the ability to use more literacy strategies in the classroom setting. Participant #3 stated that having literacy related training to help support all secondary learners would be a great benefit as an educator. Participant #4

explained that any person who is in contact with students would benefit greatly from training in literacy. Participant #5 acknowledged that he was fortunate to have worked with a literacy coach but also outlined that the opportunity to expand the knowledge and ideas to connect literacy with content would be welcomed. Each of the participants believed that the opportunity to have training in content specific literacy would benefit them as educators.

Question #13 – Do you believe that your students would benefit from you having content specific literacy trainings? How?

Finally participants were asked if they believed that content specific literacy training would benefit their students. Participant #1 indicated that teachers who know and understand the importance of content specific literacy will help student grow in all areas. Participant #2 revealed that any strategies that are learned and implemented within a classroom setting can benefit learners. Training in content specific literacy according to Participant #3 may help to provide students with special needs to compensate for their disability without stigma. Similar to Participant #2, Participant #4 stated that any learning strategies that can be utilized while teaching would absolutely benefit a student. Participant #5 added that the addition of literacy strategies will allow students to tap into a fundamental step in the learning process that can greatly enhance learning.

Analysis

The information provided by the educational professionals that were interviewed provides clear bridges between the research found in a review of the literature on content specific literacy and the belief of educators. The insight provided not only allowed for connections to a greater necessity in literacy in mathematics, but in all content areas alike. Each of the questions

posed from questions one through six were created to identify any disjoint between the responses to those questions and the responses to question number nine.

When asked about the importance of reading and writing to a students' success the responses indicate that both reading and writing are integral to the success of all learners. Perhaps the most interesting part of these responses is the inclusion of only one Humanities educator. Yet, the findings still support that literacy at its most basic form, reading and writing is essential to student success in school. This connects to work done by Capraro and Joffrion (2006) in which they identify the ability to decode vocabulary within Mathematical content as a skill that belongs to both the Math and English content areas respectively. Teachers must focus on their content vocabulary as a language rather than as a supplement to the linguistic abilities a student already possesses. This focus will result in better reading and writing abilities of learners; as the participants identified it can significantly enhance students' ability to decode, communicate, organize and formulate ideas. From this data one can conjecture that the use of literacy practices must be developed not only in the Humanities but also in Math and Science.

The ability read and write directly correlates with the ability to interact with materials within the classroom. The ability to interact with information in various modes fosters more interdisciplinary learning according to Casey (2013). Similarly the participants identified interaction with materials as a way for students to contextualize information and use that information while problem solving. Problem solving creates skills that are life long and useful as students' progress in their future. The connections with problem solving do not stop at reading, writing, and interaction with materials, but rather continue on with critical thinking skills as well. The connection amongst each of the parts of Orr, Kukner, and Timmons' (2014) definition of literacy are astounding.

The most surprising information that can be pulled from the interviews that were conducted is the combination of the essential nature of content specific literacy across all curricula and the lack of teacher development in this particular area. While conducting the study I was pleasantly surprised by the awareness of the necessity of content specific literacy, and the numerous strategies the educators used within their classrooms. However, the identification of a lack of literacy based trainings for subject areas outside of elementary and English education is one that must be addressed. It is my belief that without the advocacy of educators and administrators alike, this issue will once again be swept under the rug.

Conclusion

The results of this study and the review of the literature on content specific literacy shows a clear and defined need for learners to be provided with the literacy tools necessary to succeed in the classroom and beyond. This need, specifically as shown in the literature review is essential in the realm of mathematics. However, after interviewing educators from a variety of fields the need for literacy based instructions is not limited to the Mathematics and English realm, but rather spread to each of the academic disciplines. The simple abilities to read, write, communicate, interact with materials, problem solve and think critically make up the crux of education. Without these abilities our young people will struggle as they move forward in their lives and careers.

The research I have conducted and have collected through the review of literature and interviews can be improved and more must be done to identify the weaknesses of this issue on education today. The study I have conducted for example limits the teacher population to educators in a generally affluent suburb of Rochester. In order to improve this study and create an accurate representation of the true population of educators in the Rochester area and in New

York State more educators must be included in the study beyond the parameters of suburban educators just outside of Rochester. Creating a balance of urban, suburban, and rural educators will create a greater sense of the needs of students and educators alike. This balance will allow the information to be presented to those who are in the administrative positions and will allow for teachers to advocate for their needs.

While the state of the educational world is ever changing and evolving to adapt there are simple fundamental parts that must take precedent. With the push for better education and reform why does the education world focus on the product rather than the process? Why is the focus on creating and passing tests? What is the purpose of an education? The purpose of an education is simple, it is to challenge, to learn, and develop skills that will provide a future of success. The simplest way to ensure the success of all learners as students and as people is to educate them on the fundamental skills of human interaction. The root of all human interaction has, is, and will continue to be literacy.

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