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Collaborative Inquiry for Knowledge Building among Children in Clinical Courses at the Master's Level at an American College in New York State: A Descriptive Case Study

Abstract: In this article, I describe how I teach graduate students who are in-service teachers in our master's literacy program on how to facilitate inquiry-based learning among school children. This type of learning concentrates on students' curiosity, asking questions, and investigating problems in collaboration. The teacher in such learning is more of a facilitator working towards helping children in becoming more independent learners. In my role as a teacher educator and coach I have used several resources to develop my own practice of teaching inquiry learning since 2015. I describe how I structure my graduate students' tutoring for inquiry and how I teach the ways of utilizing literacy teaching strategies and routines, such as shared reading and accountable talk, in order to facilitate children's knowledge building and their increasing independence in collaborative work. I also describe how my research interests that concentrate around investigating innovative inquiry-based learning spaces has informed this teaching.

Keywords: inquiry-based learning, teacher education, knowledge building

Introduction

In order to support students' disciplinary language and literacy development in the light of new learning frameworks for teaching sci-

ence, the Next Generation Science Standards,[1] and social studies, the C3 Framework for Social Studies,[2] in the USA, substantial changes in instruction are necessary.[3] Researchers have identified aspects of content literacy, such as argumentation, science talk, and a necessity of making sense out of multiple resources,[4] that are essential to the information age. In addition, readers, including young students, need to build knowledge by integrating multiple forms of inquiry and sense making, such as personal experiences, experiments, reading various sources including online ones, and interacting with peers and experts.[5]

Moreover, in the education field, a vast amount of research and publication devoted to inquiry learning and teaching have provided many ideas and resources to help educators implement inquiry-based learning and teaching. Phyllis Whitin and David Whitin[6] describe how cultivating children's curious minds can lead to asking questions and solving scientific problems, thus resulting in a yearlong study of birds. They also stress the role of communities, such as a classroom community and children's families and experts. Heidi Mills[7] in her book *Learning for real*, showcases how relatively unchallenging it is to introduce inquiry to young children in the form of exploration of something children are curious about during the morning school time. The book also features many activities in which teachers and children work collaboratively, such as reconstructing the skeleton of a dead bat. Stephanie Harvey and Anne Goudvis[8] in their book *Strategies that work: Teaching comprehension for engagement, understanding, and building knowledge,*

[1] Next Generation Science Standards Lead States: *Next Generation Science Standards: For states, by states*. National Academies Press, Washington, DC 2013.

[2] National Council for the Social Studies: *Social studies for the next generation: Purposes, practices, and implications of the college, career, and civic life (C3): Framework for social studies state standards*. Silver Spring, MD 2013.

[3] T.S. Wright, A.W. Gotwals: "Supporting kindergartners' science talk in the context of an integrated science and disciplinary literacy curriculum." *The Elementary School Journal* 2017, no. 117, pp. 513–537. https://doi.org/10.1086/690273

[4] M.A. Britt, J.-F. Rouet, J. L.G. Braasch: "Documents as entities." In: *Reading – From words to multiple texts*. Eds. M.A. Britt, S.R. Goldman, J.-F. Rouet. Routledge/Taylor & Francis Group, New York, NY 2013, pp. 160–179.

[5] T.S. Wright, A.W. Gotwals: "Supporting kindergartners' science talk..."

[6] P. Whitin, D. J. Whitin: *Inquiry at the window: Pursuing the wonders of learners*. Heinemann, Portsmouth, NH 1997.

[7] H. Mills: *Learning for real: Teaching content and literacy across the curriculum*. Heinemann, Portsmouth, NH 2014.

[8] S. Harvey, A. Goudvis: *Strategies that work: Teaching comprehension for engagement, understanding, and building knowledge, Grades K-8*. Stenhouse, Portland, ME 2017.

Grades K-8, feature examples of classroom inquiries from elementary to middle grades levels across many different content areas, not just science, as well as provide thirty lessons that can help educators in teaching every aspect of inquiry. In their recent book, *21 century skills development through inquiry-based learning,* Chu et al.[9] present innovative instructional activities in order to support inquiry learning and teaching, such as team-based teaching, social constructivist game design and play, and using social media such as wikis.

Several studies have also researched student literacy practices in knowledge building communities and showcased substantial benefits of inquiry-based learning. Zhang et al.[10] investigated how students engaged in writing and reading during knowledge building in science and social studies. These reading practices demonstrate such new features as reading for advancing the knowledge of children's classroom community; reading for continual problem finding and solving; reading embedded in ongoing knowledge building discourse; and connecting student knowledge with knowledge built by others in the larger world. In a more recent study, Hong et al.[11] found that children who learned in knowledge-building inquiries outperformed children receiving traditional instruction in an assessment of reading. Students engaged in inquiry also incorporated rich visual and graphic representations in their online discourse.[12]

Taking the benefits of inquiry-based learning into consideration as well as the new frameworks of teaching content subject areas to children, I devote an entire literacy clinical course in the spring semester to teaching inquiry. In this course, I teach my master's students how to utilize instructional routines they already learned in their literacy master's program and how to couple them with new routines in or-

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[9] S.K.W. Chu, R.B. Reynolds, N. J. Tavares, M. Notari, C.W.Y. Lee: *21st century skills development through inquiry-based learning from theory to practice*. Springer International Publishing 2021.

[10] J. Zhang, H.-Y. Hong, M. Scardamalia, C. Teo, E. Morley: "Sustaining knowledge building as a principle-based innovation at an elementary school." *Journal of the Learning Sciences* 2011, no. 20(2), pp. 262–307. https://doi.org/10.1080/10508406.2011.528317

[11] H.-Y. Hong, L. Ma, P.-Y. Lin, K. Yuan-Hsuan Lee: "Advancing third graders' reading comprehension through collaborative Knowledge Building: A comparative study in Taiwan." *Computer & Education*, no. 157, p. 103962. https://doi.org/10.1016/j.compedu.2020.103962

[12] Y. Gan, HY. Hong, B. Chen, M. Scardamalia: "Knowledge building: Idea-centered drawing and writing to advance community knowledge." *Educational Technology Research and Development* 2021, no. 69, pp. 2423–2449.

der to implement inquiry-based learning in both our inquiry clinical course and in their classrooms.

Inquiry is a method of learning which involves the exploration of the surrounding world, asking questions, making discoveries and conducting experiments to arrive at new understanding of scientific processes. As such, inquiry is driven by one's curiosity when someone notices something surprising that stimulates curiosity to find an answer to it. Then, through the process of observing and often through experimenting as well, the person gathers data and checks other resources to see what others discovered about the phenomenon.[13]

At the University at Oneonta, one of New York state colleges, after earning bachelor's degrees in education from four-year educational institutions, our master's students can study literacy in our fully online master's literacy programs to work towards obtaining a degree that allows them to work in three areas of teaching. They can become classroom teachers with expertise pertaining to reading and writing instruction. They can also become literacy specialists who remediate children's reading and writing skills and help them in becoming critical consumers of information accessible in ever evolving social and technological networks. In this capacity, our graduate students can also help other teachers in using reading and writing to effectively teach other subjects. Or, down the road, after they gain more teaching experience, they can decide to become literacy coaches who work with teachers to help them sharpen their teaching skills. In addition to this scope of competence, our graduates also learn how students can build knowledge as they inquire about topics of interest using various literacy routines and strategies and how building knowledge and literacy intersect and support each other.

In my teaching how to teach inquiry as a way of learning that allows children increasingly become independent thinkers who connect what they learn across multiple sources in collaboration with their peers, I consider several aspects and resources, as well as my own research. First, I need to cultivate the inquiry mind and inquiry identity as a teaching stance in my graduate students who take the inquiry course.[14] Then, I engage them in the journey to familiarize themselves with a certain structure of facilitating inquiry-based learning whose goal is to use the existing literacy routines and strategies to aid in

[13] *What is inquiry?* Institute for Inquiry. https://www.exploratorium.edu/education/ifi/inquiry [retrieved: 29.11.2022].

[14] B. Vokatis, J. Zhang: "The professional identity of three innovative teachers engaging in sustained knowledge building using technology." *Frontline Learning Research* 2016, no. 4(1), pp. 58–77. https://doi.org/10.14786/flr.v4i1.223

learning how to do the research in order to build knowledge on a researched topic. As children read and write to synthesize information from multiple resources, teachers need to learn how to use a variety of reading and writing routines and strategies to help children in digesting a variety of materials and build knowledge through their research. In addition, I incorporate existing literature on inquiry-based learning.

The identity of the inquiry teacher

At the beginning of the inquiry course, I start with sharing an article I co-wrote with my collaborator from the University at Albany, Dr. Zhang, who has been researching innovative inquiry learning spaces in elementary and intermediate school levels for many years, in both Toronto in Canada and in the USA. The purpose of this sharing is to help our graduate students think about the mindset they need to start acquiring in order to be able to teach in ways that allow them to become purposeful facilitators of inquiry-based learning.[15] Simply, in order to cultivate the inquiry mind, teachers need to constantly nurture such a mind themselves and become co-learners in students' inquiries in addition to becoming problem solvers. They also need to engage other teachers in professional community building and work towards an empowering relationship with school principals who support such innovative teaching and learning. Starting the inquiry clinic course with pondering the problem of what identifies teachers who would like to teach in this way allows our graduate students to contemplate their transformation of their thinking.

The basics of scientific inquiry

At the beginning of the course, I ask my students to familiarize themselves with steps of the scientific method, such as asking questions, doing background research, constructing hypotheses, testing the hypotheses in experiments, analyzing data and drawing conclusions, and communicating results.[16] Such a simple overview is necessary in order to establish a common ground in understanding the process through which they will need to lead children. In addition, we also discuss

[15] Ibidem.

[16] *What is a scientific method?* Science Buddies. https://www.sciencebuddies.org/science-fair-projects/science-fair/steps-of-the-scientific-method [retrieved: 29.11.2022].

modifications of these steps in relation to research topics, since topics of our tutored children's choosing will vary. Some topics are scientific in nature, while others pertain to social issues and therefore direct experimentation is not possible.

The choice

When my graduate students meet with their small groups of children for the first time, the main goal is to learn about what fascinates children, what they would like to research. This approach is in line with the definition and practices of inquiry in science.[17] The fascinations children come up with always have a wide scope, from social issues, entrepreneurship, to engineering and beyond. In our literacy clinic, children have proposed some of the most fascinating topics. For instance, some groups were interested in genetics that determined particular features in certain dog breeds. We also had a group of children researching how children can start their own business or a group wanting to find out how to design animal prosthetics.

Inquiry-based teaching structure and routines: shared reading

My graduate students start each inquiry by tutoring hour consisting in engaging children in shared reading.[18] Shared reading is an interactive reading routine in which teacher and students read together. It is a reading routine used especially with younger students. Students join in or share the reading of a book with the teacher while guided and supported by the teacher. The shared reading model often uses oversized books (referred to as big books) with enlarged print and illustrations. During this type of reading the teacher models how proficient readers read, including what reading with fluency and expression sounds like. During shared reading the teacher also models how to comprehend the text and understand vocabulary, text structures, and text features.

While this type of reading plays a big role in younger grades, when modified, it can also substantially support older readers, in grades 3–6, especially in the area of nonfiction texts, students read when they re-

[17] *What is inquiry?* Institute for Inquiry...

[18] D. Fisher, N. Frey, D. Lapp: "Shared readings: Modeling comprehension, vocabulary, text structures, and text features for older readers." *Reading Teacher* 2008, no. 61(7), pp. 548–556. https://doi.org/10.1598/RT.61.7.4

search topics of their interests. For instance, such a routine can support students' navigating through such text structures as compare and contrast, chronological sequence, problem and solution, and cause and effect, etc. But beyond that, shared reading at this level (grades 3–6) can help in introducing and modeling essentially any reading strategy that is critical for the inquiring mind, such as activating background, inferencing, summarizing, predicting, clarifying, questioning, visualizing, monitoring, synthesizing, evaluating, and connecting.[19] Shared reading helps in checking children's understanding of these reading and inquiry strategies and gives children more responsibility to continue using the strategy/inquiry skill on their own as they finish reading the text more independently and try to use the strategy and skill also on their own throughout their research. Simply, shared reading is considered to be the most effective way of modeling how to process a text.[20]

Every time I teach my graduate students how to conduct shared reading, I suggest that they follow a certain structure. It is important to note that in shared reading for intermediate grade levels (3–6), the teacher reads first and models how to use a certain inquiry strategy to access information, look for answers, ask questions, or compare materials, to just name a few cognitive operations students need to learn to be able to productively build knowledge. It is also important to note that shared reading should not be used to teach reading strategies one by one and in isolation[21] but to insure children can flexibly use a variety of strategies as pertaining to their inquiries. Therefore, in this procedure, in addition to teaching about how to, for instance, identify relevant information, the teacher also can encourage the students to think about this information in relation to other resources previously read. The procedure for shared reading that teaches the strategy of identifying relevant information and additionally reinforces connecting information across resources is as follows:

1. Both students and the teacher have a text copy.
2. Teacher introduces the text with a purpose, making it explicit and tied to the inquiry. For example, the purpose of reading can be identifying new information and its relation to students' inquiry questions. The teacher needs to explicitly teach students how to identify if the text they are reading answers their inquiry questions and to what extent. In order to teach them this important inquiry/research strategy, the teacher needs to model it (Other purposes for sharing

[19] Ibidem.
[20] Ibidem.
[21] S. Harvey, A. Goudvis: *Strategies that work...*

texts could be: learning how to form new questions, learning how to compare information across multiple texts, etc.).

In order to introduce learning how to read to identify if the text answers questions, the teacher might say: *Last time you asked: "How do animals become extinct?" and you found some answers to this question. You also came across a new concept – keystone species. We were all wondering what that is and how this is connected with animal extinction. Let's see if this article will help us in defining a keystone species. For me, highlighting works. As I read, when I find a part that related to the question about a keystone species, I will highlight the part.*

3. Teacher reads the first paragraph, stops, highlights some information, and models using *I*-statements (think-aloud), *As I read this first paragraph, I find it so interesting that a keystone species is often a predator, or hunter. I am still not sure what a keystone species has to do with extinction but a keystone species seems to be an important concept that may be connected to animal extinction*.
4. Next, the teacher asks one of the students to read aloud another section while everyone else is following in silence. After the student reads, the teacher may ask, *Did you find anything new that connects to our questions about keystone species and animal extinction?* Children discuss. It is important that the teacher does not direct the question only to the child who read. The teacher needs to ask all the children. After they discuss and answer, the teacher might ask, *How does this information add to the relationship between extinction and a keystone species from the other reading?* By asking the question to prompt children to compare information across resources, the teacher promotes flexible use of strategies, not just one strategy.
5. The teacher encourages children to read the next paragraph with a partner or in a small group and reminds them of the focus and of marking new information that relates to their question(s): *Read the rest of the text and mark sections that explain more about keystone species and their relation to extinction. Also, think how this information adds to the information you already know from the other reading*.
6. Teacher and children get back together and talk about what they found out.

As showed in the procedure, in shared reading, students' learning is scaffolded, which means that after the teacher models, the teacher slowly releases the responsibility and provides opportunities for students to practice the strategy.

Inquiry-based teaching structure and routines: quick writes and sharing

After students read in shared reading, graduate students ask children to share what they learned with each other and write quick writes, which are essentially written syntheses of what they learned from the reading. As children share their quick writes, they need to be able to agree or disagree with what they learned, add to each other's input, etc. In order to help children build the capacity for collaborative talk and purposeful and productive exchange of ideas, we ask our tutors to teach them how to achieve such purposeful talk.[22] Simply, children must talk with their peers to problem-solve, to construct understanding of what they read and how this contributes to their growing understanding of an inquiry problem they want to know more about. That is because we want teaching and learning to be dialogic in nature.[23] Such talk is also conducive to exchanging multiple perspectives for deepening thinking.[24] It also offers children an opportunity to wrestle with thinking and understand that meaning making is a complex process involving longer conversations in which thinking has a chance to evolve.[25] That is why at the beginning of the course I teach my tutors to teach their students the following language moves or, in other words, language stems: *Me too because... I can add on... I disagree with you because... What do you mean?*[26] I also encourage my students to incorporate teaching this purposeful talk in shared reading and also to facilitate it throughout the whole inquiry hour. In addition, I ask my graduate students to create visual reminders that are visible and handy for their students.

As for how to teach this purposeful talk process, although conversations are not predictable in their nature, in teaching it is important to engage children in three steps of the process of learning purposeful talk: gently focusing children on purposeful talk behavior, facilitating such talk as children talk to each other and exchange ideas, and offering feedback that links purposeful talk behaviors to the process of constructing meaning.[27] That means that we as teachers need to see every instance of children talking together as an opportunity to facilitate this kind of talk authentically in a way that allows children

[22] M. Nichols: *Comprehension through conversation: The power of purposeful talk in the reading workshop*. Heinemann, Portsmouth, NH 2006.

[23] M. Nichols: *Building bigger ideas: A process for teaching purposeful talk*. Heinemann, Portsmouth, NH 2019.

[24] Ibidem.

[25] M. Nichols: *Comprehension through conversation...*

[26] Ibidem.

[27] Ibidem.

to freely make meaning around their research. The main challenge is to facilitate the use of the purposeful talk between students without students turning constantly to talk to the teacher.

Inquiry-based teaching structure and routines: independent inquiry time

Once students participate in shared reading and share what they wrote in quick writes, they talk to each other to see how this work informs their research and decide on further research in the inquiry time, the period taking place right after students share. Inquiry time is less structured and controlled by the teacher; however, at the beginning, the teacher still does quite a bit of explaining and modeling until children understand the expectations. The goal is for children to be able to communicate regarding what they learn and identify productive inquiry directions to be able to decide how to move forward with their investigations. Encouraging children to use purposeful talk that allows them to communicate with each other is a core aspect of ensuring their productive engagement and collaboration. With the understanding of how to communicate with each other, students then engage in interacting with each other as well as with various resources (videos, books, experiments), judge their credibility, and take both personal notes and notes for their group access in a dedicated app to document their growing understanding of the inquiry. They ask questions, form theories about how processes work using multiple sources, build on each other's thinking, begin to develop further understandings collaboratively, and work on clarifying arising confusions. Students' personal interests and ideas interconnect to give rise to shared focus/knowledge, which further situates/shapes individual meaning making. An additional resource, a book by Stephanie Harvey and Harvey "Smokey" Daniels[28] is also useful here, along with many mini lessons that it offers to support students' curious minds.

I let graduate students use different ways of note-taking with their pupils. I also often suggest a suite of apps, WeCollabrify Apps (http://www.imlc.io/apps), and let them experiment with which ones work best for their children's note-taking. Then, I suggest ideas for incorporating other existing literacy routines, such as learning centers, to provide children with a variety of resources they can access on their own. Therefore, at a reading center, students can access some reading material as they do more individual research. Other centers can have

[28] S. Harvey, H. Daniels: *Comprehension and collaboration: Inquiry circles for curiosity, engagement, and understanding*. Heinemann, Portsmouth, NH 2015.

iPads with some relevant videos or objects necessary to use in order to conduct an experiment. At times, children watch videos together and respond to it together trying to extract information that is relevant to their inquiry and moves the understanding of their phenomenon forward.

Once students research, they come up with exit ticket which essentially is a synthesis of what they learned about their topic throughout the whole hour and think about possible directions for the next session.

New directions to enhance knowledge building and literacy

In order to further advance learning and teaching of inquiry in my clinic courses, I consider incorporating more creative and technology-infused ideas from the extensive work by my collaborator from the University at Albany, Dr. Jianwei Zhang, as well as mine and his research we have been conducting together on conceptualizing the type of literacy that is present in these highly collaborative, creative, and experimental inquiry settings, such as Dr. Eric Jackman Institute of Child Study Laboratory School in Toronto. With such experimental settings, literacy for creative problem solving and collaborative knowledge generation is beginning to be investigated.[29] However, in the broader education field, researchers have devoted major efforts to develop innovative inquiry-based models for creative knowledge practices. Among these models is the Knowledge Building pedagogy whose aim is to transform classrooms into knowledge-building communities in line with how knowledge building takes place in the real world.[30] In this pedagogy, students do not solve pre-defined problems and tasks, but identify new and deeper problems themselves. A networked knowledge building environment – Knowledge Forum – has been developed to support knowledge building processes. Knowledge Forum provides a collective knowledge space that gives student ideas a public and permanent representation and supports their collaboration. Students contribute to ongoing conversations, build on each other's ideas, identify new problems, and advance their understanding.[31] My innovation in my inquiry clinic courses leads me to embedding Knowledge Forum

[29] J. Zhang, H.-Y. Hong, M. Scardamalia, C. Teo, E. Morley: "Sustaining knowledge building..."

[30] M. Scardamalia, C. Bereiter: "Knowledge building: Theory, pedagogy and technology." In: *The Cambridge handbook of the learning sciences*. Ed. R.K. Sawyer. Cambridge University Press, New York 2006, pp. 97–115.

[31] Ibidem.

and creating a KF database for my clinic to provide students with a common online space that already has some built-in scaffolds, such as: *We used to think…*, *My theory is (that)…*, *Now I think*, etc. to further support children's collaborations.

Furthermore, as innovative knowledge building practices also require students to advance their community's collective knowledge through dynamic interactions across social levels and timescales,[32] I plant to incorporate this idea into my inquiry clinic. Such interactions involve individuals collaborating in small groups formed by students within each classroom community, which is further part of a network of other classroom communities in different schools and even different countries.[33] In this dynamic environment, students engage in inquiry as members of a community who also learn from past communities and their artifacts, drawing from existing ideas, practices, and mentor texts, and making new contributions that other classroom communities will read, learn from, and build on. This idea would be also very important to implement in my inquiry clinic. As students do their own research in their own group, they can create their own research synthesis and access others' syntheses to see what others already found about these topics and learn from them.

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[32] J. Lemke: "Across the scales of time: Artifacts, activities, and meanings in in ecosocial systems." *Mind, Culture, and Activity* 2000, no. 7, pp. 273–290.

[33] J. Zhang, M. Bogouslavsky, G. Yuan: "Cross-community interaction for knowledge building in two grade 5/6 classrooms." In: *Making a difference: Prioritizing equity and access in CSCL, 12th International Conference on Computer Supported Collaborative Learning (CSCL) 2017, Volume 1*. Eds. B.K. Smith, M. Borge, E. Mercier, K.Y. Lim. International Society of the Learning Sciences, Philadelphia, PA 2017.

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