Fall 2002

An Inquiry into the Application of a Curriculum Chart in Science Education

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AN INQUIRY INTO THE APPLICATION OF A CURRICULUM CHART IN SCIENCE EDUCATION

By: Karen R. Fuller

MASTERS THESIS
Submitted to Graduate Faculty of the School of Education In partial fulfillment of the Degree of Master of Education

Grand Valley State University
Fall, 2002
ACKNOWLEDGMENTS

Thank you to the teachers and administrators from Coopersville Area Public Schools, Kenowa Hills Public Schools and Ravenna Public Schools for participating with the survey. Without your help and time, this thesis would have been impossible. Thank you to my loving husband, daughter, and family members for their support as I spent time in front of the computer, visiting schools, and in the library. Thank you to Professor Antonio Herrera for the continual feedback on the progress of the thesis. Have a wonderful, well-earned retirement!
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## DATA FORM
ABSTRACT

When a teacher decides how to teach science to the classroom of individuals, the first consideration to make is how to best meet the needs of the students. It is important to know what their prior knowledge is. A science curriculum chart would work like a checklist where the teachers would write when the student learned a science topic and how they succeeded in learning the science concept. The chart would also show education standards and benchmarks met.

The author surveyed West Michigan teachers, K-12, in order to determine if they would value the use of the chart. The teacher would have to find it useful to read the chart to find the student’s prior knowledge, but also fill out the chart for the student’s next science teacher.

The teachers found value in the science curriculum chart. The knowledge the chart gave helps to create lessons to meet the needs of every student in their classroom while meeting educational standards set by the individual school, state and nation. They also had some suggestions to improve upon it, like applying it to technology and having support in its implementation from their administrators.
CHAPTER ONE: THESIS PROPOSAL

PROBLEM STATEMENT

The elementary science knowledge learned by students is varied, even in the same school district where every teacher at each grade level has the same curriculum. Some elementary teachers have different expertise areas in science, and some feel they have zero expertise in science. Some teachers feel they do not have enough time to teach everything they have to teach, including reading, writing, arithmetic, social studies, civics, physical education, and more. Some have not had the exposure to science teaching in their preservice teacher training to feel they are able to teach science effectively. Some schools have dealt with these issues by providing more professional development or by offering positive reinforcements when strictly adhering to the school's curriculum. Around the country, many schools have done curriculum maps of their districts' teachings in hopes to find where any repeated concepts are taught and/or holes in the curriculum are.

Regardless of these efforts, the students are exposed to a different range of science areas. When a student enters the Middle and High School grade levels, their science teacher doesn't know exactly what was learned in their previous years. It is helpful to know what a student's prior knowledge is.
A method of keeping track of what was taught to each individual student could be helpful to the teacher by doing a science curriculum chart.

**IMPORTANCE AND RATIONALE OF THE STUDY**

Understanding a student's prior knowledge is key to teaching new material. In science, knowledge is built upon earlier science understanding. Knowledge isn't all learned in school. It may be learned in the classroom, or at home, or sometimes as the child is looking at the world and trying to make sense of his place in it. As a teacher plans for the next science unit or lesson, it is valuable to know what the lesson will build on. If a teacher had a record of each student's learning from prior years, this would give more information to the teacher in order to plan the next science lesson. The student's misconceptions of a topic could be addressed immediately. The teacher could meet the needs of more individuals in the class. The teacher would know up front what some of the difficulties the students would have instead of being surprised. This record would not take into account what was learned outside of the classroom, but eventually that knowledge would be apparent too.

Grayson, Anderson, and Crossley (2001) created a framework for identifying students' misconceptions and problems they had in introductory biochemistry class at the University of Natal in South Africa. The authors marked what level their student's were learning the new material. Using this
framework, the professors were able to understand the student's specific difficulties and use this information to address those difficulties in their lessons. They also were able to identify teaching strategies that improved their student's learning.

Heidi Hayes Jacobs (1997) has done some wonderful work in the area of concept mapping. Concept mapping is where the entire district's curriculum, including all the subjects, are listed (or mapped) to show what is being taught in what grade in which month. These maps helped teachers communicate with each other about what they taught in their classrooms. It helps to understand what the student is experiencing over time.

Some of the benefits to the students are far reaching. The importance of knowing each student's prior knowledge is reflective in the teacher's preparation of the next science lesson, or science unit. The student will not have to sit through the same lessons as the year before; the teacher will know the concepts have already been taught to them. If a student has had in the past on a particular topic, he can receive special attention from the teacher immediately because the teacher looked at the curriculum chart and found that information. With that kind of attention, it will be harder for a student to hide their science misconceptions.

This concept of a science curriculum chart is important to the author because it will help meet my school district's needs as well as be applied to other school districts. The science curriculum chart is simple, clear, and easy
to read. It could bring improvement to the way our teachers teach and at what level our students learn.

No matter how good of an idea, though, the concept will not succeed without acknowledging teacher's beliefs and thoughts. It must have the support of the teachers to be successful. Without their support, the curriculum chart becomes another piece of paper and wasted time by the teachers.

BACKGROUND OF THE STUDY

When the Soviets challenged the United States community with Sputnik in 1957, society looked at public schools and wanted the students challenged more in their studies of science and math. $2 billion was spent on the K-12 science curriculum in the 1950's and 1960's for its improvement. (Yager, 2000). In 1983, Japan was making great bounds in technology and economy, and again, a massive reform occurred in the US, especially in science and math education. Money was spent on new curriculum projects and teacher training. In 1996, the National Research Council (NRC) created the National Science Education Standards with four major goals for science education:

1. "Students should experience the richness and excitement of knowing about and understanding the natural world.
2. Students should use appropriate scientific processes and principles in making personal decisions.
3. Students should engage intelligently in public discourse and debate about matters of scientific and technological concern."
4. Students should increase their economic productivity through the use of knowledge, understanding and skills of the scientifically literate person in their careers." (NRC, 1996)

These goals couldn't have come soon enough for some. Educators in the United States in 1996 and 1998 were disappointed with the performance of their students compared with the international average on the Third International Mathematics and Science Survey or TIMSS. (Jorgenson, L. 2001) The United States score of 480 for science literacy of secondary students was 20 points below the international average of 500. According to the National Science Teachers Association (NSTA) members are calling the US performance in the TIMSS (1999) study as an accurate reflection of student performance in science.

In Michigan, the standardized science tests taken in the 5th and 8th grade are called the Michigan Education Assessment Program (or MEAP) tests. The science scores for most schools are very low. In 2001, out of a possible 100, the eighth graders in Kent and Ottawa County in West Michigan scored an average of 22.8 points. (Grand Rapids Press, 2001.) This score indicates that our students are not doing a good job.

Talking with West Michigan area science teachers in Masters level classes at Grand Valley State University and other professional development opportunities regarding our teachings of the planned science curriculum, a common theme always came up. Students have a wide range of prior knowledge, even if they stayed in the same school district where everyone
had the same curriculum. High school teachers had no idea what their students knew. Some students understood basic biology, where other students excelled at simple machines and physics, but knew nothing about biology. Frustration was especially a top problem for some fifth grade teachers because they had to get the students ready for the MEAP test. Many teachers felt they couldn't teach anything new because the student's prior knowledge wasn't where the curriculum said it should be. This added considerable difficulty to their science teaching load because they not only needed to teach the material at the next level but review "unlearned" science lessons from previous grades. If they didn't reteach the material, the student would do poor on the MEAP and, according to the standardized scores, it would look like the fifth grade teacher was doing a horrible job teaching science. It would be useful for the teachers to know what the students' prior knowledge was, what was taught to them, and whether they mastered that material.

A curriculum chart was created by the author in November 2001, in Dr. Loretta Konecki's GVSU Master's level curriculum class in attempt to address these concerns. (See appendix A.) In the vertical column, the chart lists the entire school's science curriculum for grades kindergarten through eighth grade. In the horizontal columns, there are spaces according to what grade the student is in where the teachers fill in what concept was learned with their signature. The teacher need not put specific details of the student's learning
on the chart, simply whether the student learned the material at a proficient (P), novice (N), or not-yet-novice (NN) level. The data in the curriculum chart is concise and clear.

The curriculum chart keeps track of the science learning for one child, since that child's learning is unique. Children can have different teachers in a school district than others or move to different schools. If a curriculum goal was not met or not taught, that space would be left blank indicating to the next teacher that the student would have little prior knowledge in that area of science.

This chart will follow the student throughout their school years, kindergarten through twelfth grade, in their permanent cumulative school record file called the cumulative assessment folder or CA60 file. A teacher can look at the data to easily see what a child has learned and at what level they learned it. If the school's curriculum changes, the chart can easily be moved around while still representing the child's learned science material.

With more teachers doing more paperwork on the computer, this makes the chart even easier to use, especially for middle school and high school teachers. They can search for everyone in their classes who is not proficient in a certain objective and compile a list of names instantly - shuffling 120 papers for each of their 120 students would not be necessary.

There are two ways teachers would have to utilize the science curriculum chart. First, the teachers would have to be willing to fill out the
chart for each student in their class. Then, the teacher would have to read and utilize the charts. As the child progresses through school and the chart is filled in, the teachers would be able to read the data to determine the child's knowledge and history of learning in science. Upper elementary and middle school teachers would have the previous grade's data available to them as well as continue to add data to the chart as the student's learning continues. High school teachers would simply be able to look at the prior knowledge of their students without being required to add more to the chart. (If a student is taking their last science class, it is not important to follow their progress any longer.)

STATEMENT OF PURPOSE

The purpose of this study is to research the validity of the curriculum chart in science education. To do so, area science teachers (K-12) were surveyed as to whether they think this curriculum chart could be beneficial to them or not. The science curriculum chart provides a list of the school's curriculum from kindergarten to eighth grade. Along the horizontal rows after each science concept required in the curriculum, there is a blank space where teachers mark the proficiency level of the student attained. Teachers at different grade levels from kindergarten to twelfth grade would use the chart in two different ways: filling in the student's data and applying the data. It is necessary for both ways to be practiced in order for the curriculum chart to be
valid for everyone. Finding out whether a teacher thinks it is important to know a student's prior knowledge in science or not is crucial to make the chart work for all teachers.

GOALS, OBJECTIVES, AND OUTCOMES

The goal of this thesis is to research the validity of the science curriculum chart, in order to determine the student's prior knowledge in their science background. It creates a framework that can be used to keep teaching in the school's curriculum on track while providing support and flexibility to the teachers.

The first objective is to gather necessary data by surveying K-12 teachers in the West Michigan area. The survey (see appendix B) will ask questions on the use and ease of use of the curriculum chart and whether teachers gathering data for each individual is worthwhile for their use.

The second objective is to analyze the data. Using a Likert scale to measure responses, a numerical value will be assessed to each question in the survey to find out how teachers and administrators feel. If the answer to a particular question is YES, the question will earn a five. If the answer is NO, the question will earn a one. Teachers can answer in any degree between one and five. Each question will earn an average score depending on how many people answered that question.
The third objective is to show how the results of the data will lead to the validity of the chart. If the responses averaged low, the teachers and administrators who answered the survey did not agree with the importance of the curriculum chart. If the responses averaged high, the teachers and administrators agreed with the importance of the curriculum chart and felt there was value in it.

Among several expected outcomes in this thesis, one is to determine that teachers find value in the science curriculum chart through data results. There is much teamwork that will have to be done in order to make the chart a success. If one or two teachers decide not to use the chart, this will create inaccurate data for the next science teacher. Without everyone using the chart to map student's learning, it will not be a success. Without teachers wanting to read the curriculum chart to find their student's prior knowledge, the chart becomes wasted busy work for the teachers who had already put in their data.

Another outcome is to show how valuable the knowledge of a student's prior knowledge is for a teacher. Spiral learning and curriculum mapping aid in the process of learning. Associating an old concept with a new concept creates an avenue where the student can find the knowledge easier than before.

A third outcome is to indicate how a curriculum map or chart is beneficial. Curriculum charts are an efficient way to see what is being taught
at all levels of school. This opens up communication among the teachers, as well as provides a way to show what a student experiences year after year. The map can show us where there are repetitions or gaps made in the teaching, or whether what we are teaching matches with standards.

The last and final outcome will be delivering the curriculum chart to the teachers and schools to further study these phenomena. It will take many years to implement the science curriculum chart into the school's program before teachers can reap the full advantage of the chart to help students learn.

LIMITATIONS OF THE THESIS

Seven elementary schools, four middle/intermediate/junior high schools, and three high schools were asked to participate in the survey. All of these schools are located north and west of Grand Rapids, Michigan. Different sizes of schools (classes A, B, and C) are represented as well as rural and urban schools. All the teachers were surveyed who were responsible for teaching science at the elementary, middle, and high school level. The data is skewed more heavily in the elementary range, because, more elementary teachers are responsible to teach science than in the middle and high schools, where the teaching is more specialized to certain areas.
There were also time constraints in the data collections from the middle and high schools teachers. The science teachers did not regularly meet and it was harder to schedule everyone together, even if only for five minutes. The principals passed out the curriculum charts and surveys for them to answer on their own time. This did not allow for the researcher to describe all the advantages and disadvantages of the chart or answer any questions they could have had.

Because of the time constraints, it was also harder to control how many surveys were passed out and collected back in. The author speculates that because they weren't able to talk with me, the survey became just one more thing to do. Getting placed on the bottom of their large list of things to do, the survey did not have much meaning for them.

Currently, the curriculum chart only exists on paper. The author foresees its use in a computer program format that would make the chart extremely easy and quick to use. Unfortunately, this cannot be shown to anyone because of the technology available.

Another limitation of this research is the fact that this study would take many years to follow as the charts were filled out for students as they went through school. This chart is similar enough to the one used by Heidi Hayes Jacobs' curriculum map in her studies to make strong comparisons of its effectiveness. Plus, without it being given a chance to work by teachers, we will never know if it will work. Without the support of teachers and
administrators, the curriculum chart will not be given a chance to show its competence. Finally, if teachers don't believe in its purpose, it will fail. This thesis is only the first step in proving the capability of the curriculum chart.

SUMMARY

A science curriculum chart could be helpful to a teacher to understand what a student learned in the school's science curriculum as they progressed through the years. Their prior knowledge is essential to understand when deciding how to teach the next unit and lesson. The teachers would have to fill it out for each student, and also read the chart for their next year's students to find what prior knowledge they have.

Many benefits to the curriculum chart involve the student's learning history or prior knowledge. It also shows where the student has a learning misconception or where they learned something wrong. Flexibility, creativity, and control are not taken away form the teacher if they use the chart, it simply helps them keep on track as they work to meet the school, state, and national education standards. They will be able to decide how to use their teaching time in the best way to meet the needs of their students. The following chapter will examine the different sources that will support these benefits in research.
CHAPTER TWO: THESIS LITERATURE REVIEW

INTRODUCTION

A science curriculum chart can aid a teacher in understanding how the student's learning grows and evolves into science understanding. It provides a list showing the school's science curriculum from kindergarten to eighth grade. The spiraling of knowledge will be more evident as the teacher looks to build onto the next science concept. The national, state, and local standards are taken into consideration. In order for it to be effective, it will need teamwork from the entire teaching and administrative staff in addition to professional development requirements.

It takes time and energy to build a child's conceptual knowledge. A science curriculum chart will bring their prior knowledge to the front and center. A report card is nice; but in this case, it is not specific enough to tell the teacher and student exactly what was learned in what year to what degree. A teacher will also be able to see how the student's knowledge grew with their teaching in their own classroom environment.

The following sources were collected on the topics related to the research of this problem: curriculum mapping, prior knowledge, spiral learning, education standards, time constraints, reform, and professional development. The next part of the paper will discuss each of
those topics. Each of the sources is described to have a global knowledge content in the way it will aid this research.

**CURRICULUM MAPS**

Curriculum maps are the records of what is taught to students over a long period of time, in relation to lesson plans that contain what is taught over a day-to-day basis says R. Burns. (2001) in *Overview of the Curriculum Handbook* from *Association for Supervision and Curriculum Development*. When a teacher can see the continuity of instruction to the student from kindergarten to eighth grade, one can see how the topics are related from year to year. Gaps and overlaps in instruction in the learning are easily located and adjusted. The schools' curriculums are also easily compared with county, state and national standards.

Curriculum maps are intended to map out the entire district's curriculum. Thus, science instructors could compare with the math, social studies, English, physical education and art teachers, etc., of the curriculum being taught. Fenwick English (1980) in the article *Curriculum Mapping* published by *Educational Leadership* was the first person to define curriculum mapping as a recording of what was taught and how much time was spent on it. Curriculum charts in science are the first step in mapping out the entire districts' curriculum in every subject.
Unless teachers have a science curriculum chart or the district's curriculum map, they only have a vague idea of what is happening in other people's classrooms. Science teachers can't see what skills are being learned in the classroom by each student. The teacher can't walk down the hall to talk with every teacher that students had in order to identify what their prior knowledge is. The chart shows them the knowledge taught and learned.

According to Liu (2001) in Synthesizing research on student conceptions in science published in the International Journal of Science Education, "there are two demands to the development of an understanding of student conceptions.

1 Science education decision making, such as the curriculum and assessment framework development, requires a clear understanding of the ways that students think and learn in a broad general sense; and
2 School science teachers, in order to be able to plan for effective instruction, need an internally consistent framework for prediction factors that may impact on student learning."

If teachers had a science curriculum chart, the teachers would know what the student's prior knowledge is and be able to plan for it. It would not be a surprise to find out that someone doesn't know something they should. Sometimes, it is the easiest to assume that the child should have learned the required science concepts in the previous years, according to the science curriculum. Most times, this does not give us a clear representation of what the students really know. The science curriculum chart would be a consistent framework needed for teachers to give effective instruction.
Grayson, Anderson, and Crossley (2001) did a similar study at the University of Natal in South Africa. Published in the *International Journal of Science Education*, the article was called, *A four-level framework for identifying and classifying student conceptual and reasoning difficulties*. They created a framework for identifying students' misconceptions and problems they had in introductory biochemistry class. The authors marked what level their student's were learning the new material at and added assistance to those who were struggling with any concepts. Using this framework, the professors were able to understand the student's specific difficulties and use this information to address those difficulties in their lessons. "The framework also provides rigor, focus, and direction to the large body of information in lessons."

Jacobs (2000) says in her article, *Focus on curriculum mapping*, in *Curriculum / Technology Quarterly*, that "while reviewing their maps, educators should also consider ways to upgrade their teaching strategies and materials." Many times, curriculum maps can also guide us to ways of teaching more effectively or using another instructional strategies to emphasize learning.

A curriculum chart is used in the same way. Looking at the data of each student's prior learning, the teachers could find ways to teach the curriculum to meet the needs of their individual students. Teachers would keep the flexibility and creativity in their lessons while still following the
schools' planned curriculum. It is easy to see which student needs help to learn and succeed.

PRIOR KNOWLEDGE

From the Reading and Writing Quarterly magazine, Swafford and Bryan (2000) state in the article, Instructional strategies for promoting conceptual change, the importance of knowing the student's prior knowledge in order to design lessons to best teach their classes. In fact, the most important single factor influencing learning is what the learner already knows. When a child walks into the room, they will already have their own ideas about how the world works.

A teacher who understands what their student's prior knowledge is will be able to use this information to try to make connections between the old material and the new material. When a child has a built-in connection between the old and new learning and can associate one with the other, the student can move on to think about the knowledge in a more abstract way. He can move beyond simply recalling knowledge to using more higher-order thinking skills about the ideas.

As elementary age students, the students' ideas about nature are based on what they have directly observed. They have seen it, sensed it, or experienced it. Logical reasoning hasn't come into play yet. Published in the Journal of Biological Education titled Research in Primary Science
Education, Wynne (2001) discusses that "in order to help children to change their ideas to form more scientific ones, teachers need to gather information about the children's existing ideas."

The learner is constantly active in testing their new ideas. To move from their ideas from observed evidence of nature to a more abstract model is an important step. Children do not automatically see the different variables that may explain why something happens the way it does. A teacher can help facilitate the new knowledge by asking questions, suggesting ideas, and planning activities to give them a chance to test the newer ideas. In order for this to happen, the teacher has to know what they have learned in the past.

According to Liu (2001) in *Synthesizing research on student conceptions in science* published in the *International Journal of Science Education*, there is a variety of degrees in which student's learn the same material because of the differing relationships of the individual student and the scientific method or natural phenomenon being studied. When a student enters any classroom in any grade, that student will have some level of prior knowledge that is different from their classmates. The student's individual level of prior knowledge will be different depending on the subject. A curriculum chart easily shows the differences in each student's learning. A teacher can look at the chart and plan how the lessons will be taught to meet all the needs of the students in regards to their prior knowledge.
Published in the *International Journal of Science Education*, A four-level framework for identifying and classifying student conceptual and reasoning difficulties. Grayson, Anderson, and Crossley. (2001), say if a known difficulty for students in a science concept is occurring, teachers can adjust their teaching strategies. Developing instruction aimed at addressing those difficulties becomes very worthwhile.

With a curriculum chart, the teachers would not have to guess what their student's difficulties are. Teachers can shift from simply identifying their student's difficulties to developing strategies for remediating them. A student's report card science grade can give the teacher some information, but it doesn't tell them where the student's misconceptions are. If they are to design appropriate lessons, they need to have a tool to give them the information of the student difficulties.

The importance of prior knowledge is also stressed by Newman, Secada, and Wehlage (1995) in the *Guide to Authentic Instruction and Assessment: Vision, Standards, and Scoring*. They say that student construction of knowledge must be based on understanding of prior knowledge in order to assimilate that knowledge into higher order thinking skills.

This is further supported by Tsai and Huang (2001) in *Development of structures and information processing strategies of elementary school students learning about biological reproduction* published in *Journal of*
Biological Education. Every learner within the same learning environment is likely to develop different cognitive structures and varied ways of organizing scientific information, even though the information presented and the conditions of learning may superficially seem identical.

Teachers should encourage students to make connections between old and new concepts to combine as much information as possible. From there, they can then move on to higher thought levels through applying or analyzing the information. As she uses the combined knowledge of old and new, the chances of the student's success increases as she understands the information. This leads us to the use of spiral learning.

SPIRAL LEARNING

Spiral learning is a method that introduces concepts and skills at an early age using age-appropriate strategies and then the knowledge learned can be built upon in later years to a more difficult degree. Jerome Bruner supports the idea of spiral learning in Travers, Elliot, and Kratochwill (1993) Educational Psychology. He states that if teachers respect a student's thinking process and translate material into meaningful units, they can introduce great ideas to children at different times and with increasing difficulties.

Many schools' curriculums follow a spiral learning format. For instance, in kindergarten, children learn the difference between living and
nonliving things. Then, in first grade, the difference between babies and adults follows. In third grade, the life cycle of many different organisms is discussed. In fourth grade, the survival needs for all the different organisms are taught, and so on. Each concept is built upon the knowledge learned the year before.

In the State of Michigan's Science Standards and Benchmarks, there is a spiral format in teaching and learning the science curriculum at the elementary level (Michigan Department of Education (MDE), 2000). They emphasize the procedure where teachers should pose challenging, but developmentally appropriate problems for students. One goal of the MDE is for students to build and connect ideas about how the world works.

In Kent County in West Michigan, the Kent County Intermediate School District created the Kent County Collaborative Core Curriculum or KC4. In the KC4 Science (2001-2002), it is clearly marked which standard is connected to each Michigan Curriculum Framework Strand as well as connections to the knowledge required for the MEAP test. Following their direction, the KC4 is also spiraled in order to teach developmentally appropriate material to their students.

Gallagher (2000) discusses in Teaching for Understanding and application of science knowledge from the School Science and Mathematics journal, that "students are not commonly taught how to, nor that they should, make connections between new information and information that
they have previously learned in order to develop a deeper understanding of
the subject matter." Supporting students as they struggle to make sense of
new information and experiences and make connections among old and new
ideas is essential.

He goes on to say that teaching for the deeper understanding requires
teachers to have substantial, valid knowledge of their students' ideas and
reasoning about the science being taught in order to make valid instructional
decisions while planning for lessons. Descriptions of student difficulties
seemed to alert teachers to common misunderstandings. The curriculum
chart would easily alert the teacher to any problems the students had and
support them as they continue to try and master the science concepts.

According to Galten, Gray and Ruddick in the Osbourne & Collins
article Pupil's views of the role and value of the science curriculum from the
International Journal of Science Education (2001,) "there is little doubt that
the progression where teachers build on the prior understandings of their
students can pose formidable challenges for secondary teachers, partly from
lack of familiarity with the science education undertaken in primary schools
and partly from a failure to take into account what students already know."
Teachers need to think more carefully about student's prior experiences and
build on their previous knowledge.

Ritchie and Tobin (2001) also support this when they say students try
to learn by searching for a fit between the particular lesson and their prior

23
knowledge. This was written in the *International Journal of Science Education* journal in an article called *Actions and discourses for transformative understanding in a middle school science class*. It is important that the student learn the material at one level (or grade) so learning can take place at the next level of information.

The science curriculum chart gives teachers the prior knowledge needed to plan their teaching in order for the students to achieve successful learning. The teachers will be able to show them connections between old and new material. They can be aided as they move into higher order thinking skills on assignments with the science material. These strategies all lead to the success of the student.

**EDUCATION STANDARDS**

As stated in the *National Science Education Standards* (NRC, 1996), there are four major goals for science education:

1. "Students should experience the richness and excitement of knowing about and understanding the natural world.
2. Students should use appropriate scientific processes and principles in making personal decisions.
3. Students should engage intelligently in public discourse and debate about matters of scientific and technological concern.
4. Students should increase their economic productivity through the use of knowledge, understanding and skills of the scientifically literate person in their careers."

It is extremely valuable that the teacher have as much information as possible in regards to the students' abilities. Every decision made leads to
how their student's develop and achieve these four goals. These four goals lead to the creation of the National Science Education Standards. They define the criteria to create quality experiences in science for all students in all science contents.

According to Nelson (2002) in *Benchmarks and standards as tools for science education reform* published by American Association for the Advancement of Science (AAAS), also believe that educators have to use standards to define the area of learning, K-12 and guide efforts in improving student achievement. The science curriculum chart can support them in these goals.

Glen Hass quotes in Wiles' (1999) *Curriculum Essentials: A Resource for Educators*, "A curriculum is all the experiences that individual learners have in a program of education whose purpose is to achieve broad goals and related specific objectives. (pp. 6)". A curriculum chart has those broad goals where teachers can decide what is best for their students under those goals. The goals must follow the standards and benchmarks of the given area in order to be valuable to the school.

Osbourne and Collins (2001), in *Pupil's view of the role and value of the science curriculum* published in the International Journal of Science Education, suggest that the national curricula that left more of the details open to interpretation by individual teachers and offering at least limited
opportunities for choice and selection, this would more likely result in a positive outcome for students.

Teachers must be able to take the National Education Science Standards and make them work for their own classroom. The standards are written in the abstract, leaving the small details to the instructors. This can make some teachers feel lost, and unsure of the direction of their teaching. For others, it gives them room to meet the standards while using their own creativity, flexibility and control in their lessons. The curriculum chart can support both kinds of teachers; it can provide direction and assistance, while leaving ample room for the teacher's own discretion in their teaching.

According to Phelps (2001) in *Benchmarking to the World's Best in Mathematics* from *Evaluation Review*, without common, enforceable standards, there may be no good way to affect performance systemwide other than through high-stakes standardized tests. Teachers will be judged based on their students' gains in scores on curriculum-based tests. Schools may suffer sanctions if it is shown that their students are not keeping up with their studies or studying the correct materials.

The United States seems to have less control over its curriculum and instruction that do the top performers on the Third International Math and Science Study, or TIMSS. In order to avoid judging our schools sole on standardized test, schools must follow the standards to a higher degree than they do now. Supporting a teacher to do just that will mean allowing them
more tools and other forms of materials and assessments. A curriculum chart can be one such tool.

**TIME CONSTRAINTS**

Written in the *International Journal of Science Education* from *Pupil’s view of the role and value of the science curriculum*, Osbourne and Collins (2001) say that one of the most common complaints among teachers and parents was "the sense that pupils were being frog-marched across the scientific landscape, from one feature to another, with no time to stand and stare, or absorb what it was that they had just learnt." This eliminates any opportunities to apply the concepts to real world situations or discussions. If the entire science content is to be taught in order to succeed on standardized tests and on all the standards, it must be taught fast.

This is further supported by Lawton (1996) in the article *Math. science curricula said to fall short* published in *Education Week*. The curricula for math and science in the United States expected teachers to cover too much. It leaves students at a disadvantage in academic success.

A curriculum chart is designed to give the teachers the curriculum in broad goals allowing them to teach something in depth without having to rush on to the next standard. It doesn’t emphasize exactly what detail needs to be taught in what order. It allows for the teacher to use any resource desired, in
any order, to whichever depth they feel is necessary for the students to learn those required concepts.

Romance and Vitale (2001), writing in the International Journal of Science Education in an article called Implementing an in-depth expended science model in elementary schools, say that it is difficult to improve classroom teaching when there is inadequate time during the classroom day to teach science in the depth needed for students to master the core concepts with the related concept applications. The curriculum is too large. They go on to say that it doesn't help to simply increase the time devoted to teaching science each day.

The authors suggest reviewing the student's prior knowledge each day, creating concept maps where students can visually see the relationships they have learned, and to integrate reading and writing instruction with science. Indicating that prior knowledge is important to teachers and students should further emphasize the need for a curriculum chart.

Writing in the Coalition of Essential Schools in the article called The Common Principles (2002), the authors state that we should teach using a "less is more" objective. Mastery and achievement of skills are more important than the effort to cover content.

For teachers, education standards are here to stay and it is their job requirement that they must meet. The curriculum chart is there for their
support, to keep them on track, and to push for student mastery and achievement of skills while covering the required science content.

Dever (1998), in The Learning Spiral: taking the lead from how young children learn and published in Childhood Education, says that learning experiences designed to teach reading, writing, and mathematics take up a large portion of the day for elementary teachers. These skills could be developed to a greater extent if the majority of their school experiences contain interesting events, objects, and living things from the "real-world."

These real world objects, living things and events could be easily linked to science. With some planning, it would be easy to incorporate science concepts while teaching about reading, writing, and math. The biggest obstacle is organizing the lessons to combine the lessons into one. In the short term, there would be a time commitment needed to become organized, but in the long term, teaching reading, writing, and math using science concepts would be a time saver. It would be one way to reach the education standards required.

REFORM

According to the National Science Teachers Association (April, 1999) written in Nation’s Science Teachers Register Concern Over U.S. Science Education in New Survey, more than three quarters “strongly agree” that reform efforts will fail or fall far short of their goals without the involvement of
teachers, school administrators and society. Science knowledge is critical for adults to have in order to make informed decisions about what is going on around them. Programs and more resources are needed to further aid in allowing the standards to achieve their goals.

According to this article, 58% of teachers have reported that they have a lack of science resources to make the standards work. 90% said they need help in better understanding the National Science Education Standards and using professional development to further their skills in teaching those standards. Many teachers (78%) say it would help bolster their own motivation and enthusiasm in teaching. Even more important, 83% of teachers feel it would heighten student interest in science and 65% say it would help students better understand the science content.

Discussed in the article, Assessing Teacher's Beliefs about their science teaching content, and published in the Journal of Research in Science Teaching, Lumpe, Haney, & Czernial (2000) say that changing the way we teach and adapting new methods of assessment fall upon schools and those who work in them. The role of teachers and their beliefs must not be ignored if enduring change is to result. Teachers need to be consulted about their attitudes, beliefs and knowledge of the subject when the decision is being made to make a change.

If the teacher is going to use the science curriculum chart and fill out the data, it is best if the teacher also believes in the value the curriculum chart
is or can be. If filling out the chart is viewed as busy work and one more form to fill out among the hundreds, the curriculum chart will not be of any help to the school.

The most important role to consider when making any kind of change is how it affects student learning and how the teacher can affect that learning. Anderson & Helms (2001) discusses in the Journal of Research in Science Teaching article, The influence of primary children’s ideas in science teaching practice, teacher’s beliefs about what the student’s experiences and abilities are important when trying to create a change in the school environment. This role leads into the next section of this literature review discussing professional development.

PROFESSIONAL DEVELOPMENT

According to Lowery (2002), educators need to know how teachers learn; what types of knowledge and levels of knowledge acquisition are necessary to become effective teachers; and what contexts are most conducive to learning how to teach. Written in the journal School Science and Mathematics in Construction of teacher knowledge in context: preparing elementary teachers to teach mathematics and science, she asks how teachers are expected to make reforms in order to teach the new standards if professionals don’t know the best ways to create professional development and preservice program opportunities.
Teacher educators must be aware that elementary teachers are sufficiently intelligent and resourceful to be able to find ways to increase their content knowledge if they are given the tools and the importance of doing so, say Akerson, Flick, and Lederman (2000) from The influence of primary children's ideas in science teaching practices in the Journal of Research in Science Teaching. It is necessary to help those teachers with the knowledge and experience further to develop their teaching.

They suggest, because primary teacher's main curricular goal is that their students developing into readers and writers, that science be fit into this goal. When the students and teacher share an experience like a science activity, they can use this experience to express their ideas about it, develop an understanding of it, discuss it, and write about it. These activities improve the student's skills in reading, writing, and speaking. The students now can achieve two goals: learning language arts and science.

Breube (2000) wrote on this topic in A conceptual model for middle school science instruction published in The Clearing House. She says that most middle school science teachers are not science specialists but rather generalists who either have to teach science as part of their daily load or specialize at the middle school level to teach middle school science. Professionals need to challenge these teachers to teach at the highest level possible.
What is needed is professional development that educates are teachers to teach more of the concepts of science at the elementary level and then spiral the learning in the high school with formulas and mathematical equations when students are ready to learn concepts in a much more abstract way. We need to help teachers learn ways to teach those concepts.

In the Goodnough article (2001) Teacher development through action research: a case study of an elementary teacher from Action in Teacher Education. Loucks-Horsley quotes that "professional development experiences must be uniquely tailored to meet the needs of those involved."

Teachers bring different experiences to a learning experience and have different ways of working. This should come as no surprise since we know that students also have different levels of understanding and experiences and prefer different ways to work on a subject.

Professional development opportunities are critical in helping teachers fulfill their goals and maintain their enthusiasm says Sarquis (2001) in Recommendations for Offering Successful Professional Development Programs for Teachers in the Journal of Chemical Education. Teachers are the student's representatives of the science world.

Teachers have many roles - guide, evaluator, decision-maker, and so on. Professional development aids the teacher in becoming empowered to succeed in their teaching of science in the classroom. By working with them
and giving them tools, resources, and experiences, this supports their efforts in giving quality science education.

Riel and Fulton (2001) writing in Phi Delta Kappan in the article, *The role of technology in supporting learning communities*, say that teachers, often faced with overwhelming problems, can benefit from access to collective solutions shared by peers in other locations. It also helps the teachers feel more supported as they take new steps to increase the knowledge base.

Supowitz and Turner (2000) say that teachers who felt supported by their principal reported significantly greater use of their professional development opportunities than did teachers who did not feel encouraged by their school leader. This, from *The effects of professional development on science teaching practices and classroom culture* published in the Journal of Research in Science Teaching, further emphasizes that teachers have a critical role in the classroom, but they need support in doing it. The process of change is a difficult one.

This is further supported by Gray, (1999), in *Improving your school’s test scores* in the journal Principal. "With teacher's support, success is probable. Without it, efforts for improvement are probably doomed.

Although administrators could say, "Do this!" and the teacher would have to comply, most administrators know the importance of having teachers agree with the purpose of the work. In teacher professional development and
in-service workshops, the teacher has to buy in to the goal to make it work. Without a teacher's support, the best plan can fall flat.

**SUMMARY**

Curriculum mapping, prior knowledge, spiral learning, education standards, time constraints, reform, and professional development are important topics to consider when thinking about the science curriculum chart and its benefits and drawbacks. The past research studies presented has found more benefits to the chart, especially in the important area of giving the teacher the student's prior knowledge while following national and state education standards. The drawback to using the curriculum chart is time. It takes time to fill out the chart for each individual student each year. It takes time to read the chart for each individual student's prior knowledge.

**CONCLUSION**

The sources briefly stated in this chapter support the values and benefits of the science curriculum chart. This science curriculum chart will help provide the teacher with some direction and focus in determining what has been learned and what needs to be learned. This chart will identify their student's difficulties so teachers can develop strategies to meet everyone's needs in order to succeed.
The four most important sources referred to were written by Heidi Hayes Jacobs (2000) in curriculum mapping, Grayson, et. al. (2001), in prior knowledge, and the national and state education standards given in the National Science Standards and Benchmarks (1996) and Michigan's Curriculum Framework Science Education Standards (2000). Curriculum mapping provided an important emphasis to understanding what was taught in different areas of school. Grayson, et. al. reveals a way to indicate student's prior knowledge which leads to greater student achievement. The education standards were absolutely necessary to follow if the science curriculum chart were to be of value to teachers. These four sources were the backbones of the science curriculum chart.

Chapter three will show us if teachers value the curriculum chart to make their time important enough to reap the benefits of the chart.
CHAPTER THREE: THESIS DESCRIPTION

INTRODUCTION

In the State of Michigan's science curriculum, the Michigan Curriculum Frameworks Standards and Benchmarks, there is a spiral format in teaching and learning the science curriculum. (Michigan Department of Education, 2000) In West Michigan, Kent County's science curriculum, the KC4, bases its curriculum on the State's Standards and Benchmarks and follows the recommended spiral teaching in order to teach developmentally appropriate material to their students. (Kent County Intermediate School District, 2002). The students learn a concept in kindergarten, and that concept is built upon in 1st grade, then 2nd grade, and so on through their school years. The KC4 is clearly marked which standard is connected to each Michigan Curriculum Framework Strand as well as connections to the knowledge required for the MEAP test, Michigan's standardized assessment test.

Teachers struggle with teaching new science concepts to students if the students didn't learn previous concepts taught at earlier grades. In order for their current teacher to teach the required science curriculum, the unlearned science concept must be retaught. This takes away valuable class time and causes parts of the curriculum not to be taught - adding to a different spiraling effect of not teaching the curriculum. If a teacher could look at their
student's records throughout their school years to see what has been taught and learned, it would lead to positive and perhaps timesaving changes in how the teacher teaches the new science concepts.

The purpose of this study is to research the validity of a science curriculum chart. Teachers at different grade levels would use the chart in two different ways - filling in the data and applying the data. It would be necessary for both ways to be practiced in order for the curriculum chart to be practical for everyone. Finding out whether a teacher thinks it is important to know a student's prior knowledge in science is crucial to making the chart work for all teachers.

This chapter looks at the data collected from surveys given to teachers in three different school districts. The results of the data were correlated with research published on prior knowledge, curriculum mapping, professional development, education standards, reform, and time constraints.

In conclusion, suggestions are given for implementing the science curriculum chart into a school and what concerns teachers may have over its implementation.

SUBJECTS

Teachers from elementary, middle and high schools were surveyed to find out their thoughts and opinions on using the curriculum chart. The teachers had to be responsible for teaching science at least one part of the
day or week. More elementary teachers fell into this category than middle and high school teachers. A school district from three different counties in West Michigan was asked to participate. Each school district represented different size schools (size A, B, and C) in addition to representing rural and suburban districts.

When analyzing the results, the teachers are grouped by what level they teach - elementary, middle, or high school science. The three groups will use the curriculum chart in different ways and so will have different perspectives on it. Elementary teachers will be mostly responsible for putting data into the chart. There will be less data to see how a student did in previous years if, for instance, that student is only in first grade. Older elementary and middle school teachers will appreciate the curriculum chart to a greater degree from having more data to review on each student through their first five grades or so. The middle school teachers will also be responsible for putting in their data for approximately 120 students, and their science curriculum standards are quite lengthy. High school teachers will benefit from the curriculum chart with the least amount of work required than the other teachers in the district. They will see the student's entire history of learning, K-8, without being responsible for adding more data to the chart. They will reap the benefits of the work done by the elementary and middle school teachers.
Asking teachers their opinions is important when trying to make a change or improvement. Gray (1999) stressed this fact when saying that success is doomed without teacher's support. Supowitz and Turner (2000) say that teachers are critical in their roles, and need administrators support, not only in using professional development opportunities, but also in feeling encouraged to make risks by making changes in their teaching.

Superintendents and administrators were not surveyed on their beliefs and opinions of the science curriculum chart. The author's purpose of this study was to see how teachers felt about the chart, not administrators. Their roles in schools are related but different. Administrators should be interested in the results of this thesis, as it could be valuable if they were interested in adding the science curriculum chart to their assessment program in their school districts.

DESIGN OF STUDY

Procedure

Letters were written to principals in schools of different sizes asking for permission to survey their teachers. (See appendix C.) Once the permission was granted, I talked with the principals on the phone to discuss the merits of the curriculum chart. Once the principal understood what I was asking his or her teachers to do, I asked to be invited to a staff meeting to present the curriculum chart to the teachers and ask that they voluntarily answer my
survey. When finished, they could turn their survey into a postage-paid envelope I left in their school office so the secretary could mail it after a certain amount of time.

Many times, the principals felt they couldn't take time in their staff meetings for one more thing, or their science staff didn't meet more than one or two times a semester. This occurred mostly in the middle and high schools. I wrote up a direction sheet for the curriculum chart (see appendix G) for the teachers to read. This was in place of what I would have said at a staff meeting. I packaged the directions with the science curriculum chart and teacher survey, and put it in the teacher's school mailboxes. Then, the head science teacher or principal would collect the surveys and mail them in the postage-paid envelope I had provided.

I would have preferred to talk directly with the teachers (and keep my survey techniques consistent), but I appreciated any time the teachers had to give me. They didn't have time to meet and talk with me, but they did have time to fill out a survey. If they had any questions, they unfortunately, didn't get them answered. On the other hand, what I was asking them to look over wasn't very long or very complicated.

The survey was voluntary and anonymous. The numbers of surveys sent and received back were documented. The survey also asked whether the respondent was an elementary, middle school science, or a high school science teacher. I did not keep track of which school each of the surveys
came from. Some of the schools I surveyed were so small; it would have been too easy to ruin their anonymity.

Instrumentation

The survey uses the Likert scale to measure the response of each of the questions. Opinions have a scale from one to five. An answer of a NO earns a score of one and a YES earns a score of five, with the range in between. If the respondent doesn't believe in the statement or disagrees, the value of the response will be a one. If the respondent believes the statement is very important or agrees, the answer will be rated at a five. Then, if the respondent doesn't totally agree or disagree, that person can decide to which degree they believe or oppose the statement.

After the surveys were received, I analyzed the data by viewing the respondents' opinions and tallying how many people answered a question in each range, one through five. I computed an average score for each question. Whether it is in the higher range or the lower range gave a clear answer of whether the respondents agree or disagree with the question on the survey. A percentage was also given to show how many people out of the total felt a certain way about an item on the survey.
Data collection

Sixteen buildings in the 3 school districts were asked to participate in the survey during September and October, 2002. Schools who participated are 5 elementary schools, 2 middle schools, and 3 high schools (10 buildings total.) A total of 124 surveys were distributed to the teachers in the 10 schools. 58 surveys were received back, giving a participation percentage of 47%. The author can only speculate on why there wasn't greater participation. When teaching, students are their first priority and there are always time constraints to tend with. Overall, this survey was voluntary and teachers do not need to have a reason to decide not to participate.

At the elementary level with 5 buildings represented, 86 surveys were given out and 37 surveys were received back. (43% participation) In the middle school, with 2 buildings participating, 11 surveys were given and 9 were collected. (82% participation) At the high school level, with 3 buildings participating, 14 were given and 12 were collected. (86% participation)

The suburban school had the most buildings participating at 5. The next smaller size school district in a rural area had all 4 buildings participate. (This school district also had worked with the author before) In the smallest, rural district, only the high school chose to participate.

Of the schools who declined participation, three of the elementary buildings and 1 middle school declined participation because of time constraints or lack of interest. I had a principal who said her staff was not
interested in using the curriculum chart in their school because they already have an alternative method for evaluating student's performances and level of prior knowledge. An explanation was necessary to convince her that I wasn't asking for their participation in filling out the chart, simply what their opinion was on its theoretical usage. The difference in these two requests is a major amount of time. The surveys would have taken about 5 minutes. Filling out the curriculum chart for each student would have taken much longer, depending on the grade level, and then followed through each year until the student's eighth grade. Fortunately, she could be convinced to ask for her staff's participation. Unfortunately, the others were unable to be convinced. Plus, participation was voluntary and it is their prerogative to decline for any reason.

Two more buildings simply put the surveys in the teacher's mailboxes without any letter of introduction or direction; the principals communicated that they didn't receive any surveys back. This lack of results was not counted in the total because the methods of distribution were not followed and the author cannot be sure the teachers understood the purpose of the curriculum charts.

Looking at each grouping of schools, elementary, middle and high school, there were a higher number, but lower percentage, of surveys returned from the elementary schools. It was easier to meet them face to face in a staff meeting and answer any questions they had. I wasn't a
faceless researcher asking for data but a person who was someone's colleague or someone else's relative. In the middle and high schools, I had fewer surveys returned, but a much higher percentage attained.

**Data analysis**

Answers to the teacher surveys were tabulated by groups, elementary, middle school and high school. Then the answers were combined to see the opinion all teachers together, since the science curriculum chart will require teamwork to be beneficial to everyone. Average scores and percentages were computed for each answer. Results were recorded for each answer and summarized. The results of all this information will appear in raw data and graph form in chapter three as well as in the appendices E and F.

**DATA RESULTS**

My interest in gathering this information came from personal experiences and discussing these experiences with other West Michigan area science teachers having similar problems. If a child stayed in the same school district, we knew what science curriculum that child was expected to learn. There was no data to know if they knew the concepts or not. Pre-tests took away valuable classroom time, but so did having to reteach science concepts that were not learned. A teacher's understanding of a student's prior
knowledge was necessary in order for the teacher to build upon it. An assessment tool was missing.

This thesis examines the value of the science curriculum chart for teachers and students, and if teachers would use it for their benefit. This was the main reason for creating and administering the survey. Their thoughts and opinions are important if we are to expect change to occur in the classroom. Ultimately, educators have the biggest impact on our student's learning. As quoted by the National Research Council:

"The decisions about content and abilities that teachers make, their interaction with students, the selection of assessments, the habits of mind that teachers demonstrate and nurture along their students, and the attitudes conveyed wittingly and unwittingly all affect the knowledge, understanding, abilities, and attitudes that students develop." (NRC, 1996)

The following section will be a discussion of the data. Each survey question the teachers answered will be analyzed according to the subject matter of the question.

**DISCUSSION OF DATA**

**Question 1:**

*Does it help to know what a student's prior knowledge is before teaching a lesson in science?*

The average response is a 4.33 out of five. 56.9% of the teachers surveyed said it is very important to know the student's prior knowledge, with
another 24.1% saying it is important, for a total of 81% in the top two categories. 1.7% said it isn't important at all, because "they still had to teach the required curriculum, no matter what the child knew." 15.5% are in the middle, not sure whether it is helpful or not.

![Responses Scale](image)

According to Swafford and Bryan (2000), Wynne (2001) and Liu (2001), the information about the student's prior knowledge is the most important factor when considering how to teach a lesson. Lessons can be planned to meet the needs of the classroom. Grayson, Anderson, and Crossley (2001) reinforces the idea that if teachers know where the student is struggling, teachers can adjust their teaching strategies to address the known difficulties. If students are getting their needs met, they are more likely to reach success in their academic studies. In addition, when students are successful in their lessons, the teachers can evaluate what is working in their teaching strategies.

When teachers look at how to teach their science lessons, they could assume the student has learned that information because it was required in the curriculum. This can be done with a pretest or an interview with the student or by looking at the report card from previous grade. Sometimes, it is the easiest to assume that the child understands the science concepts.
because s/he should have learned it in the previous years, according to the science curriculum. Most times, this does not give us a clear representation of what the students know. A science curriculum chart would give us a better picture.

**Question 2:**

*Is the curriculum chart easy to read?*

Overwhelmingly, the teachers respond that the curriculum chart is easy to read. The average response is a 4.16 out of five. 82.8% answer the question in the top two categories. One person out of 54 responses said it isn’t easy to read, and 12.1% said it is moderately easy to read.

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Average = 4.16

Something doesn’t have to be complicated in order to bring about positive results. When English (1980) first created curriculum mapping, he simply concentrated on what was taught and how much time it took to teach it. Since then, curriculum mapping has evolved into something more complex. The curriculum chart is similar to curriculum mapping, with the difference being science the only subject targeted.

Jacobs (1997) discovered many benefits to mapping out the curriculum. There is an increase of teacher communication across subject
areas and grade levels. A big picture of what a student learns through their voyage in school is created. The curriculum can be aligned with standards and benchmarks of the state and nation, as well as be evaluated for repetition, gaps, timelines, and possible areas of integration with other subject areas. It is also shows teachers what is actually going on in the curriculum, not just what should be happening.

A curriculum map involves all the subjects in the school in all grades. The science curriculum chart is the first step in creating a curriculum map, and only involves science. As a science chart, it can do similar things. The continuity of instruction is easily seen over the course of the school years. Gaps in the learning are easily located and adjusted. The schools' curriculum is easily compared with state and national standards. Teachers can compare with other teachers what is taught in other classrooms. Overlaps in instruction are avoided. These improvements increase the level of achievement the student can attain.

**Question 3:**

*Would a science curriculum chart be helpful for the child's current science teacher to understand what the student's prior knowledge is?*

3.57 is the average answer when teachers are asked if the chart would be helpful. More than half of the respondents, 55.2%, think it is either very important or important to have a chart to show prior knowledge. Only
13.8% of teachers think that the chart would not be helpful for the current teacher to understand the child's prior knowledge.

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Average = 3.57

Liu (2001) says teachers need a consistent framework in order to attain a clear understanding of the way students think and learn. Most teachers surveyed agree with this. A curriculum chart easily shows the differences in each student's learning. A teacher can look at the chart and plan how the lessons will be taught to meet all the needs of the students, in regards to their prior knowledge. If he knows that one or a few children struggled with an idea, the teacher can be sure to present that concept again. The student can try again, test their new and improved ideas, and take the next step toward success.

Grayson, et. al. (2001) created their own framework to identify student's success and difficulties in biochemistry class. They said it was easier to see where the student's needed additional help in the subject. They also discovered when a student caught on to a lesson, the researchers were able to evaluate their instructional strategies to decide what achieved success and what didn't meet their student's needs. An additional benefit they found to using the chart is that it gave them a direction, or focus, in their lessons.
We also need to evaluate the variety of backgrounds the students have in terms of their prior knowledge in order to best meet their needs in the classroom. Every student learns differently. Tsai and Huang (2001) say that the child may learn the same science concept, but develop different thinking strategies or organize it internally differently from the student sitting next to them. Knowing what these strategies would have given the teacher a chance to build upon that knowledge and push to develop higher-order thinking skills.

**Question 4**

*If you were the teacher, would you use the science curriculum chart to understand your student's prior knowledge in science?*

When the question was asked in a more personal way, the answers changed. Only 13.8% of teachers say "Yes," they would definitely use the chart. However, another 63.8% say that they probably or maybe would use the chart. Without any type of further explanation or professional development, teachers see the importance of this chart and would be willing to use this chart to help them discover their student's prior knowledge. On the average, most teachers didn't really know; the response of a 3.29 has their response at a firm 'maybe.' Only 10.3% say "No", they would not use it with another 12.1% who say they were not likely to use it.

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<tr>
<td>Scale</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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</tbody>
</table>

51 responses. Average = 3.26
Spiral learning, or the building of new knowledge on learned concepts from the past, can influence a student's learning by allowing more difficult concepts to be taught. Jerome Bruner in Travers, Elliot, and Kratochwill (1993) assumes that by teaching the students, we are in effect assisting their growth. To allow children to grow requires them, among other things, to build a mental model of the way the world works. In order to do this the children need to comprehend the structure of how things work. To understand the structure, a child must learn how things are related. Information on the student's prior knowledge is needed by the teacher and a science curriculum chart can accomplish this.

Galten, Gray and Ruddick said in the Osbourne and Collins (2001) article that it is important that high school teachers think carefully about what a student learned in their elementary years and to emphasize how the new topic is different while building on their previous knowledge. The student then can make connections with their prior experiences and add to the firm foundation of learning.

Higher-order thinking skills can develop if there are connections made from prior knowledge and the new knowledge trying to be taught and learned. Newman, Secada and Wehlage (1995) support this idea. The student's prior knowledge must be understood to move onto applying, analyzing, discussing,
and evaluating their new knowledge to other areas of science. Gallagher (2000) endorses the importance of prior knowledge in order to make connections to the new material to help students reach a deeper understanding of the material.

Ritchie and Tobin (2001) say that the construction of knowledge is personally active process, but it takes the involvement of teachers and peers to establish it. The science curriculum chart is an easy way for teachers to be involved in this process of construction knowledge, while allowing individuality in each person in their classroom.

Question 5
Is the science curriculum chart worth filling out for the student’s next teacher?

53.5% say yes or that it is probably worth it to fill out the chart with the data for the next year’s teacher. 29.3% say no or that it is only somewhat worthwhile to fill out the chart. The average score is a 3.26. Another 17.2% said they are not sure or that it was moderately important.

A teacher commented that it is much easier for an elementary teacher to keep up with 25 students than it is for the middle and high school teacher. Fortunately, the elementary teachers would be the ones most responsible for filling out the chart, while the high school teachers would use that information to their instructional benefit. The response of an 84% by high school teachers alone feeling that it was important or very important shows how much they
would value the information provided by the science curriculum chart. The middle school teachers, who would do double duty in filling out the chart and benefiting from the data from previous years, had only an average response of a 3.00, meaning it might or might not be worth filling out the chart.

| Responses | 12.1% | 17.2% | 17.2% | 39.7% | 13.8% |
| Scale     | 1     | 2     | 3     | 4     | 5     |
| Average   | 3.26  |

One adjustment not mentioned in the survey was the possibility of using technology while manipulating the science curriculum chart. The author believes the science curriculum chart could be even quicker and easier to use. One of the biggest concerns for the middle and high school teachers were that they could not even imagine rifling through 120 papers to find each of their student's information on their prior experiences. If they could use technology to search for who was not proficient in a particular concept and have the computer provide a list of names based on the data available, it would be extremely valuable and time saving information. Unfortunately, this thesis does not include the use of technology while evaluating the use of the science curriculum chart.

Question 6:

Would a teacher find it to be a waste of time to fill out the chart each year when s/he already does so much other paperwork and report cards?
Question six is similar to question five in that it examines the value of time. The average response is a 3.17 from all teachers, with a slightly higher response from the elementary and slightly lower response from the middle school. Only 13.8% say it would not be a waste of time. 32.8% are not sure whether it would be or not. 25.9% say it would be a waste of time to fill out the chart.

<table>
<thead>
<tr>
<th>Responses</th>
<th>13.8%</th>
<th>17.2%</th>
<th>32.8%</th>
<th>10.3%</th>
<th>25.9%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scale</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

This data tells this author that teachers don't need another assessment tool thrown at them without something else being taken away. One shouldn't commit to an additional task if there isn't enough time to do it correctly. Lawton (1996) says that teachers are expected to cover too much. Romance and Vitale (2001) it's hard to improve classroom teaching when there isn't enough time to do what is needed to do now. Teachers do not want busy work. If the work is meaningful to them, it will be worth the time to contribute their valuable time to it. With only 36.1% of surveyed teachers saying the science curriculum chart would not be a waste of time, adjustments need to be made in order to make the science curriculum chart a success.

These adjustments can be in the form of a variety of techniques. Perhaps there is another assessment the teachers are using that doesn't work as well as the science curriculum chart and it could be replaced.
Principals and teachers are the best ones to decide what their schools' priorities are. Another time saving technique, according to Dever (1998), is that teachers could easily combine science instruction with lessons on reading, writing and math. Then, standards are still met, and it could save time in the long run. We would have a solution to our time-crammed day. One necessity to this idea is to know how the curriculum is mapped across all subjects and then be able to fit the science curriculum into it. A curriculum map and curriculum chart would be helpful.

Question 7

Would a teacher feel the science curriculum chart is an assessment on the student's learning only?

Many elementary teachers are not sure of their thoughts about this question. Again, the average response is in the maybe range of 3.12. Only 28.7% say definitely or probably yes; it is only an assessment on the student. 44.8% say maybe. Only 25.9% say no or it isn't likely that the science curriculum chart is only an assessment on the student's learning. One teacher commented that the science curriculum chart is a quick and concise way to assess a student in science and what is taught at other levels. Another teacher said that curriculum charts are great to a point, but there is no evidence that they do anything but help a teacher see what the student should know.
The NRC (1996) say, "it is important for teachers to use assessments of students and of their own teaching to plan and conduct their teaching." If teachers use the curriculum chart, the chart can be their support as they follow the NRC's goal in becoming more effective science teachers.

Nelson (2002) and the American Association for the Advancement of Science (AAAS) says educators can use standards to do the following things:

1. Define the area of learning,
2. Promote K-12 connections,
3. Deciding the curriculum, instruction, and assessment,
4. Displaying areas needed in professional development.
5. Guide efforts to improve achievements for all students.

Teachers surveyed here believe that the curriculum chart might be an assessment that can achieve those goals.

**Question 8**

Would a teacher feel the science curriculum chart is really an assessment on the teacher's teaching rather than on the student's learning?
On a positive note, many teachers, 48.3%, did not think the curriculum chart would be an assessment on them. 44.8% think it might be, with another 6.9% saying that the chart is or probably is an assessment on them. The average score is a 2.34, which indicates teachers do not feel it is likely that the curriculum chart would be used for teacher assessment, but they are leaning toward maybe.

For the 44.8% of teachers who are not sure if it could be an assessment on them, administrators will have to enforce that it will be used in a variety of ways in order to help their teaching, not to discipline them. As quoted by Heidi Hayes Jacobs (1997), "Principals are wise to reassure teachers that mapping is not used for evaluation purposes. Clarify the task of mapping and acknowledge that no one ever 'does it all' during the course of the school year."

The author believes that teachers feel one way or another depending on the support they receive from their administrators. Akerson, Flick and Lederman (2000) say that if teachers are given the tools to do something and the importance of it, then the teachers will find a way to make it work. The more a teacher is supported, the more likely it will lead to success. The more
success that is experienced, the more likely that teacher is content with their job.

The curriculum chart isn't designed to be an assessment on teachers; it is an assessment on the student's learning. It can give valuable information, though, in addition to the student's learning. This includes areas of strength and weaknesses in the curriculum and areas where professional development is needed to make the teachers stronger in their instructional practices. These assessments are created to allow students to reach for higher standards in their education (Burns, 2001.)

Phelps (2001) believes that without common assessment in standards, there is no other way to affect a student's performance than through standardized tests. Teachers will be judged on how their students and their school perform on those tests. A curriculum chart, designed to assess students, and not teachers, may be a form of assessment needed for the students to help them reach higher academic goals. Then, standardized test scores will be less meaningful.

Both Osbourne and Collins (2001) and Glen Hass in the Wiles article (1999) agree that curriculum goals need to be broad, allowing teachers to have flexibility in their teaching. It allows teachers, when they see something that needs more time, to be able to accommodate for extra instruction and for student's to have extra class time to digest and analyze science concepts.
Time is needed to stand and stare at what was learned. Coalition of Essential Schools (2002) agrees that we should teach with the theory of "less is more."

A list of standards and benchmarks can lead teachers to teach our students the necessary material, as deemed by national, state, and local education goals, but only teachers can decide what is best for each individual student. To accomplish this, teachers need the flexibility and a science curriculum chart can aid them in this goal of positive outcomes for students.

**Question 9:**

*Does your school presently use a checklist like this science curriculum chart?*

100% of all middle school teachers and 84% of elementary teachers say No. The high school teachers, on the other hand, say that 42% of them did have some version of the science curriculum chart. In one school the author talked with, the school had a version of the curriculum chart used in the high school only, but the data was only shared with the curriculum director. Many of the teachers there commented that it could be helpful to them to communicate with the others about the student's progress.

The author feels that professional development could increase the teacher's awareness of the usefulness of the science curriculum chart in their teaching. Goodnough (2001) say that professionals need to accommodate the needs of teachers when planning professional development. Their unique needs need to be planned for in order to make an accomplishment in their
training. This is what we expect our teachers to do for our students, and teachers need similar considerations when they are expected to be the student. Sarquis (2001) adds to this thought when he says that we need to empower teachers through professional development because they are so influential to our children's lives.

Breube (2000) asserts that elementary and middle school teachers need professional development in science because most teachers at that level are specialized in teaching young students and not specialized in teaching science. Science is not always a comfortable subject to teach because it is more difficult. Professional development will support those who feel they can improve. Riel and Fulton (2001) adds that when a teacher feels supported in their learning, it helps them to increase their own knowledge.

Lowery (2002) suggests many solutions to help professionals help teachers learn. First, learning through collaboration was an important attribute for teachers. It provided support when the subject wasn't familiar. There was also a feeling of active learning that increased their knowledge in the subject area. Second, learning through reflection helped the teachers realize what was important in their own teaching. They gained confidence, increased hands-on activities, acted as a facilitator in the lessons, and improved their own knowledge base.
Question 10:

What do you feel are good traits of the science curriculum chart?

Many elementary teachers commented that it is clear and easy to read. They like that it is basic and simple while being able to see all the data for each student all at once. It is organized and categorical while providing a snapshot of where the student is, how s/he is progressing, and what is needed to be learned. It is helpful in showing a student's strengths and weaknesses while allowing for a quick check of student progress or lacking areas. There is a nice layout showing an overall continuum in the science curriculum for all grades to see. They love that the benchmarks are included while knowing what the objectives are in the curriculum, K-8. The chart also helps teacher communicate with each other; it would help them share materials and aid each other with lesson ideas.

The middle school teachers have many of the same ideas, but added comments relative to their job position. They said it is easy to see what objectives were mastered by the student and what still needed some work. It would be easy to recognize what the earlier levels did and did not teach. "The chart would be worth filling out", another teacher added, "as long as others used it as well." Another says teachers could use this chart for school board presentations to show how the students were progressing in school.

The high school comments are again similar to the elementary and middle school. They like how the science curriculum chart has clear criteria
and a rating scale. "It gives education a personal, tailored approach." It helps teachers organize class data, keep focus on what is taught, and use it to evaluate what is being taught in their class. Many like how it addresses all the benchmarks set by the State of Michigan; it helps the teachers keep track of their students' proficiency levels.

Question 11:

What do you think can be improved on the science curriculum chart?

The biggest comment for improvement on the science curriculum chart is the need for it to be computerized. Many of the issues concerning time would be solved using technology already available. It would also solve a problem teachers saw with the chart being too small, with not enough space for them to write. Many teachers also comment that they would like the standards and benchmarks written in more detail without making the amount of paperwork increase, easily solved using the computer. The computer would make it more teacher friendly, as some teachers commented, while being quicker to use when they have a class of 120 students.

Another comment made by many instructors is that they would like to see the chart not be individualized, but as a class chart. The problem with their suggestion is that the current teacher would have to look through the files of each and every teacher in earlier grades to find the one student s/he is looking for. The data for one student would be scattered rather than being in
one concise chart. Plus, the chart can't follow them if they move to another school district or even school buildings. On the other hand, with computers, these problems may be easily eliminated. It could be easy to sort out who achieved what proficiency level, no matter what class they were in.

Another suggestion for improvement made by teachers in all three grade levels was the need for a common assessment. The asked what exactly the criteria is for the proficient, novice or not-yet-novice levels. "If there isn't a specific criterion, their judgment on the student's proficiency level is subjective. It is more of a judgment than a measurement." Some suggest a written or verbal test, while others suggest using technology to test and rank their new knowledge. The author believes they have some good points but it may be difficult to do without considering using standardized tests. This may take away a teacher's flexibility in teaching to the standards and benchmarks. This issue may need to be solved by each school's administrators and staff.

Other teachers simply do not like it. They say it is busywork and should be eliminated. "If a school's scope and sequence are in place, then it shouldn't be necessary." Others say that it doesn't matter what a student's prior knowledge is, the teacher still has to stick to teaching the school mandated curriculum for that grade. Another teacher says the curriculum chart would be more appropriate, not for the teacher, but for the curriculum planning committee. Even though these comments are true to a point, the
bottom line is the student's needs aren't being met. The issues spoken are relevant, and important for the principal to address to the teachers.

**SUMMARY OF DATA RESULTS**

When teachers are asked whether or not they would use the science curriculum chart to understand their student's prior knowledge in science, 70% respond in a positive way. Very little training or any kind of professional development was given to the teachers on the uses of the chart, but teachers see the importance of this chart. They would be willing to use this chart to help them discover their student's prior experiences. If the teachers are willing to use it, the curriculum chart can be a success.

The biggest concern is time-related. To fill out 120 science curriculum charts for 120 students is a large time commitment. In 53% of teacher's opinion, the time will be worthwhile to commit, but there still are another 47% to convince. There are plenty of other things to complete like progress reports, special education reports, report cards, etc., in addition to helping students, creating lessons, and teaching class. The chart requires teamwork, and it will be everyone's responsibility to do his or her part.

With the other issues asked in the survey, teachers aren't sure of the outcome. 45% say that the science curriculum chart might be an assessment only on students. 45% believe the curriculum chart might be an assessment on their teaching as well as the student's learning. These are important
issues that will need to be addressed by the principal and through professional development training at each school.

CONCLUSIONS

Overall, teachers find value in the science curriculum chart. Teachers understand the usefulness of knowing student's prior experiences and prior knowledge it provides. In order to create lessons to teach the science curriculum, instructors need to know what was taught at previous levels to build upon that knowledge. With a spiraled curriculum, the repetition the students' experience aid in their development of higher order thinking skills. To be sure we do not have gaps or repetitions in our spiraled curriculum, curriculum charts or maps help schools verify that it is meeting education standards created by the nation, state and various school committees. These accomplishments all lead to prosperity for students in school.

The science curriculum chart is beneficial because it also provides instructors with a guideline of what needs to be taught in their classroom because it impacts the teachers in later years. However, these guidelines do not take away any flexibility or control a teacher has of their classroom. In fact, the science curriculum chart provides information leading to better instructional practices to meet the needs of every individual in the class.

There are also concerns with the science curriculum chart that need to be dealt with. Time constraints are a major factor in the success of the
curriculum chart, but the use of a computer can greatly enhance the effectiveness of the chart while minimizing the amount of time spent collecting and searching for student data. There is also a need for trust that the chart will not be help against them, verified through administrative support and professional development.

Suggestions are given for implementing the science curriculum chart into a school and what concerns teachers may have over its implementation. It is important to evaluate teacher's beliefs and thoughts. The science curriculum chart requires teamwork of every teacher who teaches science in the school district. If there are concerns they have, administrators needs to confront those concerns and do what is necessary to alleviate them. Time constraints are a major factor for teachers. They do not want another assessment tool thrown at them. They will need professional development to implement the process of doing the science curriculum chart. Some teachers may need convincing that the curriculum chart will be useful for them in the long run.

Teachers will need assurance that the science curriculum chart is not to be used as an evaluation tool against them, but as an assessment tool of the students learning. The curriculum chart may simply bring forth areas needed for a teacher to further develop in their own teaching techniques.

The science curriculum chart can be a valuable assessment tool in a school. It provides valuable information to teachers about students as well as
to a curriculum committee and other administrators. It follows national and state education standards and can be modified easily as things change throughout the years. Implementation of the science curriculum chart requires teamwork and commitment from the entire science teaching staff and administrative support to be valuable. With the science curriculum chart, the student will have an increased chance of academic success in science.

PLANS FOR DISSEMINATION

The researcher will share this thesis with my fellow teachers from Coopersville Area Public Schools, Kenowa Hills Public Schools, and Ravenna Public Schools who provided valuable data by participating in the teacher survey. In addition, this will be a valuable tool for teachers to use when evaluating the curriculum and viewing the needs of the students and teachers.

The research of this thesis will be valuable to all schools because the science curriculum chart has been proven appropriate for providing an assessment of a student's prior knowledge. If a student moves to another school district that doesn't use a science curriculum chart, the new teachers will know what their prior knowledge is from the previous school, but they will not be adding to it for further use. If all schools use the science curriculum chart, the student moving will more easily be assimilated into the new district and perhaps into a new science curriculum.
The researcher plans to share the work with principals and other administrators at the intermediate school districts. They may be interested to see how the teachers thought about the science curriculum chart and what they need to do to implement the curriculum chart into their own school district. Also, making this research available to the intermediate school districts is important, as they are integral to what curriculum the schools in their districts teach. An intermediate school district may be able to provide professional development to the schools in their districts easily and most cost effective.
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APPENDICES

DISCLAIMER

The sources cited in this document, An Inquiry into the Application of a Science Curriculum Chart, have been checked for copyrights. Some materials are from public domain, some from copyrighted sources, and some are the creation of the author. For the surveys, letters granting permission have been attached. (See appendices C and D.) Based upon this knowledge, there has not been an infringement of any copyrights of the sources cited in this document.
# Science Curriculum Chart

**Kent County Collaborative Core Curriculum or KC4 Science (2001)**

Teacher: Please sign your name and the student's mastery level with **P** (proficient), **N** (novice), or **NN** (not yet novice).

<table>
<thead>
<tr>
<th>Grade</th>
<th>Objectives</th>
<th>K</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
<th>6th</th>
<th>7th</th>
<th>8th</th>
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<td>Classify Living and Non-living</td>
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<td>Identification of Properties in Objects</td>
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*This Science Curriculum Chart Not-To-Scale, Reduced to Fit Paper Size*
Appendix B
Science Curriculum Chart Survey
What are your thoughts of the use of a science curriculum chart? Do not put your name on it - your answers will remain confidential and anonymous.

Please rate the following questions: 1 - NO or not important 3 - MAYBE or of moderate importance, 5 - YES or very important

1. Does it help to know what a student's prior knowledge is before teaching a lesson in science? ................................................1, 2, 3, 4, 5

2. Is the science curriculum chart easy to read? ........................................1, 2, 3, 4, 5

3. Would a science curriculum chart be helpful for the child's current science teacher to understand what the student's prior knowledge is? .................................................................1, 2, 3, 4, 5

4. If you were the teacher, would you use the science curriculum chart to understand your student's prior knowledge in science? ..................1, 2, 3, 4, 5

5. Is the science curriculum chart worth filling out for the student's next teacher? .........................................................................................1, 2, 3, 4, 5

6. Would a teacher find it to be a waste of time to fill out the chart each year when s/he already does so much other paper work and report cards? .................................................................1, 2, 3, 4, 5

7. Would a teacher feel the science curriculum chart is an assessment on the student's learning only? ........................................1, 2, 3, 4, 5

8. Would a teacher feel the science curriculum chart is really an assessment on the teacher's teachings rather than on the student's learning? .................................................................1, 2, 3, 4, 5

9. Does your school presently use a checklist like this curriculum chart? _________

10. What do you feel are good traits of the science curriculum chart?

11. What do you think can be improved on the science curriculum chart?

12. Are you an elementary, middle, high school teacher or an administrator? Please return to the envelope or to Karen Fuller. (785-8688) Thank you for filling out the survey.

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Karen Fuller
4122 6 Mile Rd. NW
Grand Rapids, MI 49544
616-785-8688
fullerck@cs.com

October 28, 2002

Principal Ron Veldman
Coopersville High School
198 East St.
Coopersville, MI 49404

Dear Mr. Veldman,

I am currently taking a course at Grand Valley State University (GVSU) Advanced Studies in Education Program and I am writing a thesis for the completion of my Master's of Education. My thesis is entitled "An Inquiry into the Application of a Curriculum Chart in Science Education." The curriculum chart (see enclosed) consists of a sample science curriculum, K-8, which will work like a checklist as a student learns science. I am interested to see if teachers would find it useful to see individual students' prior knowledge of science learning as they progress through school. I am trying to understand if teachers feel the curriculum chart would be helpful. (See enclosed survey.)

May I receive permission to survey you and your teachers and use the information in my thesis? My thesis will be cataloged in the GVSU library and will be available for other students and colleges for circulation.

Please contact me at your earliest convenience so that we may set up a meeting to discuss the merits of the curriculum chart. I would also like to give your teachers directions on how to use the science curriculum chart to describe its functions and ask for their voluntary participation in the survey. Thank you.

Sincerely,

Karen Fuller
Enclosed: Science Curriculum Chart, Teacher Survey

Yes, I give you permission to survey the teachers regarding the science curriculum chart.

Name: _____________________________  Date: 10/26/02
September 24, 2002

Principal Tom Fox
Junior High
Coopersville Area Public Schools
Coopersville, MI 49504
616-997-3400

Dear Mr. Fox,

I am currently taking a course at Grand Valley State University (GVSU) Advanced Studies in Education Program and I am writing a thesis for the completion of my Master's of Education. My thesis is entitled "An Inquiry into the Application of a Curriculum Chart in Science Education." The curriculum chart (see enclosed) consists of a science curriculum, K-8, which will work like a checklist as a student learns science. I am interested to see if teachers would find it useful to see individual students' prior histories of science learning as they progress through school. I am trying to understand if this would be helpful for a teacher and be worthwhile to fill out. (See enclosed survey for more questions.)

May I receive permission to survey you and your science teachers and use the information in my thesis? My thesis will be cataloged in the GVSU library and will be available for other students and colleges for circulation.

Please contact me at your earliest convenience so that we may set up a meeting to discuss the merits of the curriculum chart. I would also like to briefly meet with your teachers to describe the functions of this chart and ask for their voluntary participation in the survey. If you desire, I would come to an already scheduled science (staff) meeting. My presentation would take approximately 5 minutes. Thank you.

Sincerely,

Karen Fuller

Enclosed: Science Curriculum Chart, Teacher Survey
Karen Fuller  
4122 6 Mile Rd. NW  
Grand Rapids, MI. 49544  
616-785-8688  
fullerck@cs.com

October 15, 2002

Principal Bev Walcott  
Coopersville High School  
198 East St.  
Coopersville, MI 49404

Dear Mrs. Walcott,

I am currently taking a course at Grand Valley State University (GVSU) Advanced Studies in Education Program and I am writing a thesis for the completion of my Master's of Education. My thesis is entitled "An Inquiry into the Application of a Curriculum Chart in Science Education." The curriculum chart (see enclosed) consists of a sample science curriculum, K-8, which will work like a checklist as a student learns science. I am interested to see if teachers would find it useful to see individual students' prior knowledge of science learning as they progress through school. I am trying to understand if teachers feel the curriculum chart would be helpful. (See enclosed survey.)

May I receive permission to survey you and your teachers and use the information in my thesis? My thesis will be cataloged in the GVSU library and will be available for other students and colleges for circulation.

Please contact me at your earliest convenience so that we may set up a meeting to discuss the merits of the curriculum chart. I would also like to give your teachers directions on how to use the science curriculum chart to describe its functions and ask for their voluntary participation in the survey. Thank you.

Sincerely,

Karen Fuller

Enclosed: Science Curriculum Chart, Teacher Survey

Yes, I give you permission to survey the teachers regarding the science curriculum chart.

Name:  
Date: 12-3-02
Karen Fuller
4122 6 Mile Rd. NW
Grand Rapids, MI 49544
616-785-8688
fullerck@cs.com

October 14, 2002

Principal Rich Salo
Coopersville West Elementary School
198 East St.
Coopersville, MI 49404

Dear Mr. Salo,

I am currently taking a course at Grand Valley State University (GVSU) Advanced Studies in Education Program and I am writing a thesis for the completion of my Master's of Education. My thesis is entitled "An Inquiry into the Application of a Curriculum Chart in Science Education." The curriculum chart (see enclosed) consists of a sample science curriculum, K-8, which will work like a checklist as a student learns science. I am interested to see if teachers would find it useful to see individual students' prior knowledge of science learning as they progress through school. I am trying to understand if teachers feel this would be helpful. (See enclosed survey for more questions.)

May I receive permission to survey you and your teachers and use the information in my thesis? My thesis will be cataloged in the GVSU library and will be available for other students and colleges for circulation.

Please contact me at your earliest convenience so that we may set up a meeting to discuss the merits of the curriculum chart. I would also like to briefly meet with your teachers to describe the functions of this chart and ask for their voluntary participation in the survey. If you desire, I would come to an already scheduled staff meeting. My presentation would take approximately 5 minutes. Thank you.

Sincerely,

Karen Fuller
Enclosed: Science Curriculum Chart, Teacher Survey

Yes, I give you permission to survey the teachers regarding the science curriculum chart.

Name: __________________________ Date: 10-14-02

84
Karen Fuller  
4122 6 Mile Rd. NW  
Grand Rapids, MI 49544  
616-785-8688  
fullerck@cs.com  

October 3, 2002  

Principal Dale Overbeek  
Ravenna Middle School  
2700 S. Ravenna Rd.  
Ravenna, MI 49541  
231-853-2268  

Dear Mr. Overbeek,  

I am currently taking a course at Grand Valley State University (GVSU) Advanced Studies in Education Program and I am writing a thesis for the completion of my Master's of Education. My thesis is entitled "An Inquiry into the Application of a Curriculum Chart in Science Education." The curriculum chart (see enclosed) consists of a science curriculum, K-8, which will work like a checklist as a student learns science. I am interested to see if teachers would find it useful to see individual students' prior histories of science learning as they progress through school. I am trying to understand if this would be helpful for a teacher and be worthwhile to fill out. (See enclosed survey for more questions.)  

May I receive permission to survey you and your teachers and use the information in my thesis? My thesis will be cataloged in the GVSU library and will be available for other students and colleges for circulation.  

Please contact me at your earliest convenience so that we may set up a meeting to discuss the merits of the curriculum chart. I would also like to briefly meet with your teachers to describe the functions of this chart and ask for their voluntary participation in the survey. If you desire, I would come to an already scheduled staff meeting. My presentation would take approximately 5 minutes. Thank you.  

Sincerely,  

Karen Fuller  

Enclosed: Science Curriculum Chart, Teacher Survey
Karen Fuller  
4122 6 Mile Rd. NW  
Grand Rapids, MI. 49544  
616-785-8688  
fullerc@cs.com

October 14, 2002

Principal Ruth Posthumus  
Kenowa Hills Middle School  
3950 Hendershot NW  
Grand Rapids, MI 49544

Dear Ms. Posthumus,

I am currently taking a course at Grand Valley State University (GVSU) Advanced Studies in Education Program and I am writing a thesis for the completion of my Master’s of Education. My thesis is entitled “An Inquiry into the Application of a Curriculum Chart in Science Education.” The curriculum chart (see enclosed) consists of a sample science curriculum, K-8, which will work like a checklist as a student learns science. I am interested to see if teachers would find it useful to see individual students’ prior knowledge of science learning as they progress through school. I am trying to understand if teachers feel this would be helpful. (See enclosed survey for more questions.)

May I receive permission to survey you and your teachers and use the information in my thesis? My thesis will be cataloged in the GVSU library and will be available for other students and colleges for circulation.

Please contact me at your earliest convenience so that we may set up a meeting to discuss the merits of the curriculum chart. I would also like to briefly meet with your teachers to describe the functions of this chart and ask for their voluntary participation in the survey. If you desire, I would come to an already scheduled staff meeting. My presentation would take approximately 5 minutes. Thank you.

Sincerely,

Karen Fuller  
Enclosed: Science Curriculum Chart, Teacher Survey

Yes, I give permission to survey the teachers regarding the science curriculum chart.
Name: __________________________ Date: 10/15/02
October 15, 2002

Principal Eric Vermeulen
Zinser Elementary
Kenowa Hills Schools
Walker, MI 49544

Dear Mr. Vermeulen,

I am currently taking a course at Grand Valley State University (GVSU) Advanced Studies in Education Program and I am writing a thesis for the completion of my Master's of Education. My thesis is entitled "An Inquiry into the Application of a Curriculum Chart in Science Education." The curriculum chart (see enclosed) consists of a sample science curriculum, K-8, which will work like a checklist as a student learns science. I am interested to see if teachers would find it useful to see individual students' prior knowledge of science learning as they progress through school. I am trying to understand if teachers feel the curriculum chart would be helpful. (See enclosed survey)

May I receive permission to survey you and your teachers and use the information in my thesis? My thesis will be cataloged in the GVSU library and will be available for other students and colleges for circulation.

Please contact me at your earliest convenience so that we may set up a meeting to discuss the merits of the curriculum chart. I would also like to give your teachers directions on how to use the science curriculum chart to describe its functions and ask for their voluntary participation in the survey. Thank you.

Sincerely,

Karen Fuller

Enclosed: Science Curriculum Chart, Teacher Survey

Yes, I give you permission to survey the teachers regarding the science curriculum chart.

Name: ___________________________ Date: 12/3/02
October 3, 2002

Principal Gary Papke
Fairview Elementary School
Marne Elementary School
363-3879
677-1222

Dear Mr. Papke,

I am currently taking a course at Grand Valley State University (GVSU) Advanced Studies in Education Program and I am writing a thesis for the completion of my Master’s of Education. My thesis is entitled "An Inquiry into the Application of a Curriculum Chart in Science Education." The curriculum chart (see enclosed) consists of a sample science curriculum, K-8, which will work like a checklist as a student learns science. I am interested to see if teachers would find it useful to see individual students’ prior knowledge of science learning as they progress through school. I am trying to understand if teachers feel this would be helpful. (See enclosed survey for more questions.)

May I receive permission to survey you and your teachers and use the information in my thesis? My thesis will be cataloged in the GVSU library and will be available for other students and colleges for circulation.

Please contact me at your earliest convenience so that we may set up a meeting to discuss the merits of the curriculum chart. I would also like to briefly meet with your teachers to describe the functions of this chart and ask for their voluntary participation in the survey. If you desire, I would come to an already scheduled staff meeting. My presentation would take approximately 5 minutes. Thank you.

Sincerely,

Karen Fuller
Enclosed: Science Curriculum Chart, Teacher Survey

Yes, I give you permission to survey the teachers regarding the science curriculum chart.

Name: ____________________________ Date: ____________________________
Karen Fuller  
4122 6 Mile Rd. NW  
Grand Rapids, MI 49544  
616-785-8688  
fullerck@cs.com  

October 23, 2002  

Principal Gary Rider  
Kenowa Hills High School  
3825 Hendershot NW  
Grand Rapids, MI 49544  

Dear Mr. Rider,  

I am currently taking a course at Grand Valley State University (GVSU) Advanced Studies in Education Program and I am writing a thesis for the completion of my Master's of Education. My thesis is entitled "An Inquiry into the Application of a Curriculum Chart in Science Education." The curriculum chart (see enclosed) consists of a sample science curriculum, K-8, which will work like a checklist as a student learns science. I am interested to see if teachers would find it useful to see individual students' prior knowledge of science learning as they progress through school. I am trying to understand if teachers feel this would be helpful. (See enclosed survey.)  

May I receive permission to survey you and your teachers and use the information in my thesis? My thesis will be cataloged in the GVSU library and will be available for other students and colleges for circulation.  

Please contact me at your earliest convenience so that we may set up a meeting to discuss the merits of the curriculum chart. I would also like to give your teachers directions on how to use the science curriculum chart to describe its functions and ask for their voluntary participation in the survey. Thank you.  

Sincerely,  

Karen Fuller  
Enclosed: Science Curriculum Chart, Teacher Survey  

Yes, I give you permission to survey the teachers regarding the science curriculum chart.  

Name:  
Date: 12/3/02
Karen R. Fuller  
4122 6 Mile Rd. NW  
Grand Rapids, MI 49544  
616-785-8688  
fullerck@cs.com

October 4, 2002

Ruth Moxon  
Kent Intermediate School District  
2930 Knapp NE  
Grand Rapids, MI 49525

Dear Ms. Moxon,

I am currently enrolled in the Grand Valley State University (GVSU), Advanced Studies in Education Program, and I am writing a thesis for the completion of a Master's of Education. My thesis is entitled, "An Inquiry into the Application of a Science Curriculum Chart." May I receive permission to include a sample of the Kent County Collaborative Core Curriculum (KC4) on the curriculum chart? (See attached curriculum chart.)

Your signature at the bottom portion of this letter confirms ownership by the Kent County Intermediate School District of the above information. The inclusion of your copyrighted material will not restrict your re-publication of the material in any other form. Please advise if you wish a specific copyright notice to be included on each page. My thesis will be catalogued in the GVSU library and will be available to other students and colleges for circulation.

Sincerely,

Karen Fuller

PERMISSION IS GRANTED to Karen Fuller to include the requested material in her GVSU Master's of Education thesis.

Kent County Intermediate School District  
Permission Granted by:  
Title: Curriculum Consultant  
Date: 10-18-02
### Elementary Surveys

#### Questions

1. Does it help to know what a student's prior knowledge is before teaching a lesson in science?

   - Not Important: 1 (2.7%)
   - Not Somewhat Important: 0 (0.0%)
   - Somewhat Important: 6 (16.2%)
   - Moderately Important: 9 (24.3%)
   - Probably Important: 21 (56.8%)

   **Total:** 37
   **Average:** 4.32

2. Is the science curriculum chart easy to read?

   - Not Important: 0 (0.0%)
   - Not Somewhat Important: 1 (2.7%)
   - Somewhat Important: 4 (10.8%)
   - Moderately Important: 15 (40.5%)
   - Probably Important: 17 (45.9%)

   **Total:** 37
   **Average:** 4.30

3. Would a science curriculum chart be helpful for the child's current teacher to understand what the student's prior knowledge is?

   - Not Important: 3 (8.1%)
   - Not Somewhat Important: 3 (8.1%)
   - Somewhat Important: 12 (32.4%)
   - Moderately Important: 11 (29.7%)
   - Probably Important: 8 (21.6%)

   **Total:** 37
   **Average:** 3.49

4. If you were the teacher, would you use the science curriculum chart to understand your student's prior knowledge in science?

   - Not Important: 6 (16.2%)
   - Not Somewhat Important: 5 (13.5%)
   - Somewhat Important: 9 (24.3%)
   - Moderately Important: 11 (29.7%)
   - Probably Important: 6 (16.2%)

   **Total:** 37
   **Average:** 3.16

5. Is the science curriculum chart worth filling out for the student's next year's teacher?

   - Not Important: 6 (16.2%)
   - Not Somewhat Important: 6 (16.2%)
   - Somewhat Important: 7 (18.9%)
   - Moderately Important: 13 (35.1%)
   - Probably Important: 5 (13.5%)

   **Total:** 37
   **Average:** 3.14

6. Would a teacher find it to be a waste of time to fill out the chart each year when s/he already does so much other paperwork?

   - Not Important: 4 (10.8%)
   - Not Somewhat Important: 5 (13.5%)
   - Somewhat Important: 13 (35.1%)
   - Moderately Important: 4 (10.8%)
   - Probably Important: 11 (29.7%)

   **Total:** 37
   **Average:** 3.35

7. Would a teacher feel the science curriculum chart is an assessment on the student's learning only?

   - Not Important: 4 (10.8%)
   - Not Somewhat Important: 2 (5.4%)
   - Somewhat Important: 19 (51.4%)
   - Moderately Important: 4 (10.8%)
   - Probably Important: 8 (21.6%)

   **Total:** 37
   **Average:** 3.27

8. Would a teacher feel the science curriculum chart is really an assessment on the teacher's teachers rather than on the student's learning?

   - Not Important: 14 (37.8%)
   - Not Somewhat Important: 5 (13.5%)
   - Somewhat Important: 15 (40.5%)
   - Moderately Important: 2 (5.4%)
   - Probably Important: 2 (5.4%)

   **Total:** 37
   **Average:** 2.24

9. Does your school presently use a checklist like this curriculum chart?

   - Not Important: 31 (84%)
   - Not Somewhat Important: 2 (5%)
   - Somewhat Important: 4 (11%)

   **Total:** 37
   **Average:** 1.54
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<thead>
<tr>
<th>Questions</th>
<th>Not Important</th>
<th>Somewhat Important</th>
<th>Moderately Important</th>
<th>Important</th>
<th>Very Important</th>
<th>Total</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Does it help to know what a student's prior knowledge is before</td>
<td>0%</td>
<td>11%</td>
<td>22%</td>
<td>33%</td>
<td>33%</td>
<td>9</td>
<td>3.89</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>2. Is the science curriculum chart easy to read?</td>
<td>11%</td>
<td>0%</td>
<td>33%</td>
<td>22%</td>
<td>33%</td>
<td>9</td>
<td>3.67</td>
</tr>
<tr>
<td>3. Would a science curriculum chart be helpful for the child's current</td>
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<td>33%</td>
<td>44%</td>
<td>11%</td>
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<tr>
<td>4. If you were the teacher, would you use the science curriculum chart</td>
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<td>11%</td>
<td>56%</td>
<td>22%</td>
<td>11%</td>
<td>9</td>
<td>3.33</td>
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<tr>
<td>to understand your student's prior knowledge in science?</td>
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<td>5. Is the science curriculum chart worth filling out for the student's</td>
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<td>44%</td>
<td>22%</td>
<td>22%</td>
<td>11%</td>
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<tr>
<td>6. Would a teacher find it to be a waste of time to fill out the chart</td>
<td>22%</td>
<td>22%</td>
<td>22%</td>
<td>11%</td>
<td>22%</td>
<td>2</td>
<td>2.89</td>
</tr>
<tr>
<td>each year when s/he already does so much other paperwork?</td>
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<td></td>
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<tr>
<td>7. Would a teacher feel the science curriculum chart is an assessment</td>
<td>11%</td>
<td>33%</td>
<td>33%</td>
<td>0%</td>
<td>22%</td>
<td>9</td>
<td>2.89</td>
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<td>on the student's learning only?</td>
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</tr>
<tr>
<td>8. Would a teacher feel the science curriculum chart is really an</td>
<td>11%</td>
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<td>33%</td>
<td>0%</td>
<td>22%</td>
<td>9</td>
<td>2.56</td>
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<tr>
<td>assessment on the teacher's teachers rather than on the student's</td>
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<tr>
<td>9. Does your school presently use a checklist like this curriculum chart?</td>
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<td></td>
<td>0%</td>
<td></td>
<td>9</td>
<td>1.00</td>
</tr>
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</table>
High School Surveys

Questions
1. Does it help to know what a student's prior knowledge is before teaching a lesson in science?
2. Is the science curriculum chart easy to read?
3. Would a science curriculum chart be helpful for the child's current teacher to understand what the student's prior knowledge is?
4. If you were the teacher, would you use the science curriculum chart to understand your student's prior knowledge in science?
5. Is the science curriculum chart worth filling out for the student's next year's teacher?
6. Would a teacher find it to be a waste of time to fill out the chart each year when s/he already does so much other paperwork?
7. Would a teacher feel the science curriculum chart is an assessment on the student's learning only?
8. Would a teacher feel the science curriculum chart is really an assessment on the teacher's teachers rather than on the student's learning?
9. Does your school presently use a checklist like this curriculum chart?

<table>
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<th>No Not Somewhat</th>
<th>Not likely</th>
<th>Maybe</th>
<th>Probably</th>
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<th>Total</th>
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<td>8.3%</td>
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<td>8.3%</td>
<td>25.0%</td>
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<td>16.7%</td>
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<td></td>
</tr>
<tr>
<td>16.7%</td>
<td>25.0%</td>
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<td>8.3%</td>
<td>16.7%</td>
<td></td>
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</tr>
<tr>
<td>16.7%</td>
<td>25.0%</td>
<td>33.3%</td>
<td>8.3%</td>
<td>16.7%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.3%</td>
<td>33.3%</td>
<td>58.3%</td>
<td>0.0%</td>
<td>0.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>58%</td>
<td>0%</td>
<td>42%</td>
<td>5</td>
<td>12</td>
<td>2.67</td>
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</tr>
</tbody>
</table>
## Combined Surveys

### Questions

1. Does it help to know what a student's prior knowledge is before teaching a lesson in science?
2. Is the science curriculum chart easy to read?
3. Would a science curriculum chart be helpful for the child's current teacher to understand what the student's prior knowledge is?
4. If you were the teacher, would you use the science curriculum chart to understand your student's prior knowledge in science?
5. Is the science curriculum chart worth filling out for the student's next year's teacher?
6. Would a teacher find it to be a waste of time to fill out the chart each year when s/he already does so much other paperwork?
7. Would a teacher feel the science curriculum chart is an assessment on the student's learning only?
8. Would a teacher feel the science curriculum chart is really an assessment on the teacher's teachers rather than on the student's learning?
9. Does your school presently use a checklist like this curriculum chart?

<table>
<thead>
<tr>
<th>Questions</th>
<th>No Not Important</th>
<th>Not Likely Somewhat Important</th>
<th>Maybe Moderately Important</th>
<th>Probably Somewhat Important</th>
<th>Very Important</th>
<th>Total</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Does it help to know what a student's prior knowledge is before teaching a lesson in science?</td>
<td>1 17%</td>
<td>2 1.7%</td>
<td>3 15.5%</td>
<td>4 24.1%</td>
<td>5 56.9%</td>
<td>58</td>
<td>4.33</td>
</tr>
<tr>
<td>2. Is the science curriculum chart easy to read?</td>
<td>1 1.7%</td>
<td>2 3.4%</td>
<td>3 12.1%</td>
<td>4 43.1%</td>
<td>5 39.7%</td>
<td>58</td>
<td>4.16</td>
</tr>
<tr>
<td>3. Would a science curriculum chart be helpful for the child's current teacher to understand what the student's prior knowledge is?</td>
<td>4 6.9%</td>
<td>5 6.9%</td>
<td>6 31.0%</td>
<td>7 32.8%</td>
<td>8 22.4%</td>
<td>58</td>
<td>3.57</td>
</tr>
<tr>
<td>4. If you were the teacher, would you use the science curriculum chart to understand your student's prior knowledge in science?</td>
<td>6 10.3%</td>
<td>7 12.1%</td>
<td>8 29.3%</td>
<td>9 34.5%</td>
<td>10 13.8%</td>
<td>58</td>
<td>3.29</td>
</tr>
<tr>
<td>5. Is the science curriculum chart worth filling out for the student's next year's teacher?</td>
<td>7 12.1%</td>
<td>8 17.2%</td>
<td>9 17.2%</td>
<td>10 39.7%</td>
<td>11 13.8%</td>
<td>58</td>
<td>3.26</td>
</tr>
<tr>
<td>6. Would a teacher find it to be a waste of time to fill out the chart each year when s/he already does so much other paperwork?</td>
<td>8 13.8%</td>
<td>9 17.2%</td>
<td>10 32.8%</td>
<td>11 10.3%</td>
<td>12 25.9%</td>
<td>58</td>
<td>3.17</td>
</tr>
<tr>
<td>7. Would a teacher feel the science curriculum chart is an assessment on the student's learning only?</td>
<td>7 12.1%</td>
<td>8 13.8%</td>
<td>9 44.8%</td>
<td>10 8.6%</td>
<td>11 20.7%</td>
<td>58</td>
<td>3.12</td>
</tr>
<tr>
<td>8. Would a teacher feel the science curriculum chart is really an assessment on the teacher's teachers rather than on the student's learning?</td>
<td>17 29.3%</td>
<td>18 19.0%</td>
<td>19 44.8%</td>
<td>20 1.7%</td>
<td>21 5.2%</td>
<td>58</td>
<td>2.34</td>
</tr>
<tr>
<td>9. Does your school presently use a checklist like this curriculum chart?</td>
<td>47 81%</td>
<td>48 3%</td>
<td>49 9%</td>
<td>50 16%</td>
<td>51 1.69%</td>
<td>58</td>
<td>1.69</td>
</tr>
</tbody>
</table>
APPENDIX F

Does it help to know what a student's prior knowledge is before teaching a lesson in science?

Is the curriculum chart easy to read?
APPENDIX F

Would a science curriculum chart be helpful for the child's current teacher to understand the student's prior knowledge?

<table>
<thead>
<tr>
<th>Importance</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
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<td>Somewhat Important</td>
<td>6.9%</td>
</tr>
<tr>
<td>Moderately Important</td>
<td>31.0%</td>
</tr>
<tr>
<td>Important</td>
<td>32.8%</td>
</tr>
<tr>
<td>Very Important</td>
<td>22.4%</td>
</tr>
</tbody>
</table>

Would you use the science curriculum chart to understand your student’s prior knowledge in science?

<table>
<thead>
<tr>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>13.8%</td>
</tr>
<tr>
<td>Not likely</td>
<td>10.3%</td>
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<tr>
<td>Maybe</td>
<td>29.3%</td>
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<tr>
<td>Probably</td>
<td>34.5%</td>
</tr>
<tr>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX F

Is the science curriculum chart worth filling out for the student's next teacher?

45.0% 40.0% 35.0% 30.0% 25.0% 20.0% 15.0% 10.0% 5.0% 0.0%

Not Important Somewhat Important Moderately Important Important Very Important

39.7%

Would a teacher find it to be a waste of time to fill out the chart each year?

35.0% 30.0% 25.0% 20.0% 15.0% 10.0% 5.0% 0.0%

No Not likely Maybe Probably Yes

13.8% 17.2% 32.8% 10.3% 25.9%
APPENDIX F

Would a teacher feel the science curriculum chart is an assessment on the student’s learning only?

No: 12.1%  Not likely: 13.8%  Maybe: 44.8%  Probably: 8.6%  Yes: 20.7%

Would a teacher feel the chart is really an assessment on the teacher’s teaching rather than on the student’s learning?

No: 29.3%  Not likely: 19.0%  Maybe: 44.8%  Probably: 1.7%  Yes: 5.2%
APPENDIX F

Does your school presently use a checklist like this curriculum chart?

- 81% No
- 3% Maybe
- 16% Yes
Dear Science Teachers,

I am currently writing a thesis for the completion of my Master's of Education at GVSU. My thesis is entitled "An Inquiry into the Application of a Curriculum Chart in Science Education." I am interested to see if teachers would find it useful to see individual students' prior knowledge of science learning as they progress through school. The curriculum chart (see enclosed) consists of a sample science curriculum, K-8, which will work like a checklist as a student learns science. Please fill out the survey and return to Pete Smith by Monday, October 7, 2002. Thank you for your valuable time.

How to use the curriculum chart...
1) The chart shows the school's curriculum, grades K-8, for each student.
2) The teacher would fill in the chart with their signature when a topic in science was taught and at what mastery level the student learned it, proficient (P), novice (N), or not-yet-novice level (NN).
3) The chart would be put in the student's cumulative file for the next year's teacher to read and add their data.

Advantages:
1) A student's prior knowledge in science would be shown in clear and concise detail.
2) If the student had trouble with a certain science topic in the past, the new science teacher could direct the science lessons in order to confront that particular struggle.
3) The chart would help keep the teacher on track teaching the required school curriculum.
4) With having only broad curriculum goals, the teacher would keep their flexibility, creativity, and control over what was taught.
5) Broad curriculum goals also gives the teacher more room to teach a topic to the desired depth rather than just skimming a topic at its surface before having to move on to the next lesson.

Disadvantages:
1) It is a lot of paperwork to fill out a chart for each student. (Think about how technology could make it much easier.)
2) It would require total school effort. If, for example, a teacher does not fill out the chart, this leaves gaps in the data.
3) Would teachers feel it is an assessment on their teaching rather than an assessment on the student's learning?

Your responses will be kept anonymous and confidential.

THANK YOU FOR YOUR TIME.
Name: Karen Fuller

Major: (Choose only 1)

- Ed Tech
- Ed Leadership
- Sec/Adult
- Elem Ed
- G/T Ed
- Early Child
- Elem LD
- Sec LD
- SpEd PP
- Read / Lang Arts
- Mid/High: Physics

Title: An Inquiry into the Application of the Science Curriculum Chart.

Paper Type: Thesis

Sem / Yr Competed: Fall / 2002

Supervisor's Signature of Approval: [Signature]

Using the ERIC Thesaurus, choose as many descriptors (3-5 minimum) to describe the contents of your paper.

1. Science Curriculum Chart
2. Science Education
3. Curriculum Mapping
4. Curriculum
5. Prior Knowledge
6. Spiral Learning

Abstract: A science curriculum chart can be used to chart a student's academic history in science, K-12. This thesis evaluates how the teachers value its potential use in their classroom.