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Strategies for Overcoming Common Obstacles in the Online Environment: Issues in Virtual School Teaching

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CHAPTER 2

STRATEGIES FOR OVERCOMING COMMON OBSTACLES IN THE ONLINE ENVIRONMENT

Issues in Virtual School Teaching

Michael K. Barbour and Kelly L. Unger

K-12 online learning or virtual schooling has seen substantial growth in the United States over the past two decades. While the practice of virtual schooling has exploded, the availability of research-based best practices to guide teachers working in these environments is lacking. This chapter presents four cases from Michigan Virtual School (MVS) teachers that examine a variety of issues that virtual school teachers face when facilitating K-12 student learning in the online environment, including strategies to provide substantive feedback in English Language Arts, methods for addressing the demonstration of mathematical computations, using Web 2.0 tools to increase interaction in an online environment, and a five-step process for incorporating reading and writing to increase science literacy. Each case follows a similar format, outlining *why* the problem exists in the virtual school environment, followed by *what* strategies each MVS teacher uses, and *how* that strategy is implemented in virtual schooling.

INTRODUCTION

K-12 online learning or virtual schooling is growing at an exponential rate in the United States. The first virtual school program began in 1991 (Barbour, 2009), and by 2000 there were approximately a dozen states that had virtual schools (Clark, 2001). In the first national survey of virtual schooling, Clark (2001) estimated there were approximately 40,000 to 50,000 K-12 students enrolled in distance education courses. Less than a decade later, Watson, Murin, Vashaw, Gemin and Rapp (2012) found there were over 2,000,000 K-12 students enrolled in online courses; with significant K-12 online learning activity in all 50 states and the District of Columbia. Some have even predicted that online learning will encompass half of all of K-12 education by the year 2020 (Christensen, Johnson, & Horn, 2011).

In Fall 2007 the State of Michigan began requiring that all students complete an online learning experience in order to graduate from high school. This means that there is a potential for any high school teacher within the Michigan education system to be tasked with designing and delivering K-12 online learning content to their students. Yet, Kennedy and Archambault (2012) found that only 1.3% of universities in the United States provided any preparation for their pre-

service or in-service teacher education students on K-12 online learning. Further, Rice and Dawley (2007) found that less than 40% of all online K-12 teachers in the United States reported receiving professional development before they began teaching online. This indicates a need for teacher education programs to address pre-service and in-service teachers' ability to teach in environments that are completely mediated by technology.

At Wayne State University, the revisions required to address this deficit were made in the content of IT6230: Internet in the Classroom. A portion of the new content included incorporating two curricular projects created by Iowa State University: Iowa Learning Online cases and Teacher Education Goes into Virtual Schooling scenarios. This content was piloted in IT6230 and, while it was found to be quite useful, it was also limiting due to its geographic focus. While Iowa is a mid-western state, its statewide K-12 online learning program focuses on providing opportunity to rural students rather than the greater urban population Michigan's schools serves. This was the rationale for the creation of a series of Michigan-based cases

This chapter will describe the four Michigan-focused cases created to provide teachers with virtual schooling examples in language arts, mathematics, social studies and science. The cases were created in partnership with the Michigan Virtual School (MVS) – a division of Michigan Virtual University, using teachers from MVS and pedagogical issues they identified as having faced. The cases presented in the following section will cover the following objectives:

- Discuss potential problems that may arise for virtual school teachers.
- Provide exemplary strategies for virtual school teachers for overcoming common problems in K-12 online teaching environments.

Each case provides a rationale for the pedagogical issue, a description of the strategies and/or materials utilized by the teacher to overcome the issue, and finally a discussion of the literature related to that online pedagogical issue. The cases are followed by a general discussion of some implications for virtual school teaching and some questions for you to analyze the cases.

CASE STUDIES

In partnership with the MVS, the College of Education at Wayne State University created Michigan-focused cases using teachers from MVS and the pedagogical issues they faced. The online teachers were selected by the MVS as being teachers who were known within the online program as being effective teachers. Each case provides a rationale for the pedagogical issue, a description of the strategies and/or materials utilized by the teacher to overcome the issue (with links and samples), and finally a discussion of the online pedagogical issue within the literature. This format is the same that was used by the Center for Technology in Learning and Teaching at Iowa State University for the 'Good Practice to Inform Iowa Learning Online' cases (<http://ctl.t.iastate.edu/~vhs/index.htm>). The purpose of the cases is to provide examples of good practice that can be replicated to support K-12 students and educators with teaching online.

The first case is where we examine three strategies that English Language Arts teacher, Julie Swartz, uses for providing substantive feedback to her students. The second case looks at how Algebra and Calculus teacher, Elisha Murphy uses four methods for addressing the demonstration of mathematical computations in the online environment. Strategies for increasing interaction in an online environment are discussed in the third case by examining Social Studies teacher, Jay Bennett's use of Web 2.0 tools. The final case examines Science

teacher, Lorri MacDonald's systematic five-step process for incorporating reading and writing in the online science environment for increasing science literacy.

Strategies for Providing Substantive Feedback in Language Arts in the Online Environment

Subject: English Language Arts

Technology Used: Course Management System, Word Processing & Writing Revision Software

Media Files Available At: <http://tinyurl.com/wsucase-english>

Why?

Providing students with appropriate and timely feedback when they are learning to write, and become successful in the writing process, can be very difficult for a classroom teacher. The difficulty resides in the lack of agreement amongst teachers and researchers on whether the focus of feedback should be on form or content (Fathman & Whalley, 1990). After determining whether to focus on form or content the teacher must then select the appropriate evaluation method. Many times there is no one method available to assess each student's writing needs. Each student needs to have individualized attention, and the teacher needs to have enough time to provide the kind of substantive feedback that students need in order to be successful in a language arts curriculum.

In 2001, the United States implemented the No Child Left Behind (NCLB) Act in 2001 that required testing in reading, writing, and math. States were punishing districts throughout the U.S. because children were not writing with enough detail. Julie Swartz, online language arts teacher for MVS, claims that today's students "almost write as if they are providing an outline." Students are not providing enough detail in their discussion of topics, and are using fewer paragraphs in their writing.

In order to combat this issue and broaden children's understanding about what they have written, teachers need to find ways to elevate student engagement with the content, as well as provide meaningful feedback that means something to the student. The feedback must provide students substantial information, so they can expand on their writing, develop a deeper understanding, and be able to engage in a thorough discussion about what they have written.

What?

Julie has been teaching English Language Arts for the MVS for approximately eight years, but she has 40 years of classroom teaching experience. As an online language arts teacher, Julie finds it important to discuss with students what they said in their writing. She indicated, "my job is to deepen and broaden their thinking, and [I] need to utilize tools that engage them."

The market is full of tools that allow students to complete course content online or through various technology-mediated software. The problem with many of these tools, according to Julie, are that they don't meet content expectations and they don't provide a real-life person who can supply specific individualized feedback. Studies suggest that feedback, combined with positive reinforcement is a critical component of maximizing performance (Chapanis, 1964; Ilgen, Fisher, & Taylor, 1979; Balcazar, Hopkins, & Suarez, 1985).

How?

Throughout her years in teaching Julie has been able to develop and employ various strategies to provide her students with substantive feedback in her language arts classes. She has successfully transferred these strategies to the online environment for her students at MVS. She is also interested in trying to incorporate programs, like Harvard's Project Zero, into her and other MVS courses. The goal of Project Zero is to "help create communities of reflective, independent learners; to enhance deep understanding within disciplines; and to promote critical and creative thinking" (Project Zero, 2009).

To implement these beliefs, Julie uses three different strategies for providing feedback for her students: (1) the comment feature in a word processor, (2) Quick Write comments, and (3) writing revision software. Her responses must follow MVS's requirements for feedback response times, which indicate that students must receive a response within 24 hours of a message and receive feedback on their homework and assignments within 72 hours.

The comment feature in a word processing program enables Julie to provide substantive feedback on students' grammar, and writing and language mechanics. A rubric is used for each essay and is copied at the bottom of the students' work.

English Language Arts Rubric

Remarks are provided at the end of the essay focusing on both the content and the assignment requirements. It is important to note that substantive feedback can also be provided in the assignment feature in *Blackboard* or through an e-mail message. However, MVS discourages the use of outside external e-mail systems with students because the virtual school would not possess a copy of those interactions.

A "Quick Write is a literacy strategy designed to give students the opportunity to reflect on their own learning" (Louisiana Public Broadcasting, 2009). Students are provided short open-ended statements and given only a few minutes to complete them. As such, Quick Writes do not focus on writing mechanics, but rather on students' thoughts and understanding and on the written expression of those ideas. In the Quick Write example provided, Julie asked the students about their feelings and provided them an opportunity to reflect on a situation that they had experienced.

The use of Quick Writes reflects Julie's belief that technology-mediated software doesn't provide a real-life person who can supply individualized feedback and that online teachers need to utilize other pedagogical strategies. The Quick Writes allowed students to reflect on previous situations and things they have learned in the past, and Julie was able to provide personalized feedback for each student's response. The activity also helps to build the online relationship between the student and teacher.

Over the past twelve months, Julie has altered her use of the Quick Writes in her course. Due to the amount of writing the students were completing, Julie felt it would be better incorporated if she had students relate each assignment to something from their own life experiences. Students now write a paragraph or two offering opinions, examples, description, observations, experiences, etc. as appropriate for all of their writing assignments. Julie tries to choose topics that will connect them to the overall lesson, as a way to build upon the students' existing schema. This allows Julie to use the principles of the Quick Write in a slightly different manner.

Writing revision software is a tool that students can use before they submit work. Julie expressed that, "it allows them to plop in their work and then, for example, analyzes and calculates all of the sentences that begin with the word well." The software is intuitive and enables students to see, on their own, where a majority of their errors are originating. Using the

software provided students have an opportunity to fix any errors before submitting their work to the teacher.

The writing revision software used at MVS is part of the SAS Curriculum Pathways educational arm. At present, Julie does not require her students to use it. However, she is in the process of incorporating it into several of her courses. She plans to have students use this revision software for every essay assignment in her courses, allowing students to consider making suggested changes before submitting their assignment. Julie also believes non-English language arts instructors would benefit from using the revision editor with their students; as the demand for non-English language arts teachers to focus on writing increases, and many may not have effective strategies to help students revise their writing.

Discussion

There are many technology tools available that allow students to complete online assignments. However, Julie feels that these tools do not often meet the content requirements and lack a real-life person to provide the necessary individualized feedback needed to really deepen and broaden the understanding of the content and writing form of students. To assist in providing the substantive feedback needed to facilitate this understanding, Julie has implemented strategies by using the comment feature in a word processor, implements Quick Write Comments, and suggests students use writing revision software.

While the importance placed on writing has increased in recent years (Yore, Hand & Prain, 1999), less time is spent on writing instruction (Hurwitz & Hurwitz, 2004; National Commission on Writing, 2003) and students continue to score poorly on writing assessments (US Department of Education, 2007). Interestingly, a survey of employers who hire high school graduates reported that 73% found the writing skills of these employees to be “poor” or “fair” (Public Agenda, 2002). This was likely due to the fact that only 49% of high school seniors reported to completing writing assignments of three pages or greater in length. The systematic approach to writing exhibited by Julie is one way to use the tools provided by the online environment to address these issues and focus on improving students’ ability to express themselves in the written format. While this case focused solely on English Language Arts, these strategies could be used by any subject area teacher who was providing feedback to written work.

Strategies for Showing Computations in Math in the Online Environment

Subject: Math – Algebra, Calculus

Technology Used: Course Management System, Scanner, Equation Editor, Virtual Classroom
Media Files Available At: <http://tinyurl.com/wsucase-math>

Why?

Teaching and learning math in an online environment has the potential to be extremely difficult for both teachers and students. In a traditional face-to-face math course, students complete handwritten calculations on paper and turn it in to the teacher. The teacher is able to assess the students understanding of computations by reviewing the steps the student has taken. The difficulty students’ have when trying to “write” in a computation format in an electronic environment increases the challenge of the assessment task for an online teacher and can also become cumbersome for the student. Multiple choice and fill-in-the-blank tests, often used in

many self-paced online environments, provide an opportunity for students to cheat or guess the answers without completing any calculations (Blomeyer, 2002). These types of assessment make it difficult for the teacher to assess whether the student understands and can complete the steps required for solving problems.

Students transiting from standard arithmetic to higher-level math courses, such as algebra and calculus, often have a difficult time with the material. These higher-level courses involve symbols, equation solving, and emphasis on relationships (Cavanaugh, et al., 2008), which many find challenging. In an online environment students must also acquire technical skills and abilities, as well as have access to the appropriate technology, to represent these symbols and solve these equations. These challenges pose potential burdens to student success in virtual school mathematics courses. In order to address these challenges, Elisha Murphy, a mathematics instructor for MVS, has implemented a variety of strategies to overcome some of these issues with her online algebra and calculus students.

What?

Elisha has taught Algebra 1 and AP Calculus for the MVS for five years as a full-time teacher. Like many mathematics teachers, she states that her online math students fall into three categories: (1) motivated, (2) motivated but lacking the knowledge and ability to complete the work, and (3) unmotivated; with most falling into the latter two categories. In order for Elisha to provide her students an opportunity for success in their math courses; she has developed a series of strategies for students to use when submitting work to demonstrate the computations on their math problems. Specifically, Elisha utilizes four methods that students can use to demonstrate the steps they've taken to solve the problem: (1) students scan their work and attach the file to an e-mail or upload it to the digital drop box in *Blackboard*, (2) students use the Equation Editor in *Microsoft Word*, (3) students utilize an agreed upon symbol sheet in a word processor that replaces much of the computational language, and (4) students demonstrate their workings using a synchronous communication tool.

How?

Scanning handwritten math work and submitting it to the teacher, as an attachment to an e-mail message is the easiest method for work submission. Elisha models what is expected by providing students with samples of work completed by hand, scanning the document to a computer, and attaching it to an e-mail or posting it in *Blackboard*. The problem arises when students do not have access to scanners, which often happens when students complete work at home.

Another alternative is to use the Equation Editor, which is a feature that is available in *MS Word*, for showing the steps for solving math problems. Equation Editor provides a large number of symbol tools and completes much of the formatting for the students by keeping the size of the graphics and numbers consistent. To assist students who are not familiar with this tool, Elisha created an instructional handout to guide the students. Many students are not familiar with this tool prior to the start of the course, and they choose not to use it because it adds the stress of learning the tool to an already difficult subject (not to mention being an additional topic the teacher would need to cover).

The third method Elisha uses is a symbol key. The symbol key is created and agreed upon by the students, and can be used for submitting work. Specific keyboard keys are assigned to various math symbols that provide the students a quick and easy way to show their computations

digitally. It also reduces the students' level of frustration of not having access to a scanner or knowing how to use the Equation Editor.

Finally, Elisha uses a number of synchronous tools to allow her students to demonstrate their computational understanding. For example, she speaks with students online or on the telephone to have them talk through their answers to make sure students are able to verbalize their mathematical processes. Elisha also allows students to demonstrate their work using *Adobe Connect Pro*, where the teacher and students to communicate in real-time and work through their problems together. This method is sometimes difficult because it often requires access to an electronic pen and tablet, which many students do not have at home or at school. The alternative is to use the mouse to draw calculations, however, this can be very difficult to accomplish. In addition to using the free-hand feature, many synchronous programs also have graphing calculators included as a part of the software or available as an add-on to the virtual classroom.

Regardless of which strategy the students use to submit their written math work, Elisha provides feedback to her students by making handwritten corrections on the student document based on a COST rubric (Correct answer, Organization, Shows work, and Technically correct writing). She then scans the corrected document and e-mails the graded work to her students as an attachment. This rubric is a 5-point grading scale, but also serves as a graphical organizer for students, which allow them to organize their thoughts and also provides a communication tool for the teacher.

Discussion

As students transition to higher-level math courses, it is imperative that they demonstrate the steps in their work because of the increased use of symbols and equations used in these courses. Accomplishing this already difficult task in an online environment can add an extra burden to these students, due to insufficient technology skills, content ability level, and motivation towards the course. An online math teacher needs strategies in place to assist students with overcoming barriers.

At the Virtual School Symposium in 2007, Susan Patrick (President and CEO of the International Association for K-12 Online Learning) indicated that Algebra I and Algebra II were the two highest enrollment K-12 online courses in the United States. One of the reasons for this trend is that almost all jurisdictions in the United States require students to complete at least one full year of mathematics in order to graduate from high school. In their report of eight North Central Regional Educational Laboratory funded studies, Smith, Clark and Blomeyer (2005) described a study conducted by Ferdig, DiPietro and Papanastasiou that compared learner outcomes between online and face-to-face education, and whether prediction for online success could be made. The summary of this study described how many of the students who enroll in these online math courses were students who had already failed the course one or more times in the classroom (see Ferdig et al., 2005). This is further evidence that many of these students already find math a challenging subject, without placing additional technology-based obstacles in the students' path. Elisha's experience demonstrates four strategies that online math teachers can use to help students overcome some of the barriers associated with showing the computations necessary to complete their math problems.

Strategies for Increasing Interaction in an Online Social Studies Environment

Subject: Social Studies

Technology Used: Course Management System, Web 2.0 Tools

Media Files Available At: <http://tinyurl.com/wsucase-socialstudies>

Why?

The normal type of interaction that occurs between a teacher and their students in a classroom can be difficult to replicate in an online learning environment. Online teaching is new to most teachers, and many have problems with coming up with ways to effectively interact with their students in order to keep them engaged with the course content. The face-to-face classroom allows teachers to communicate with their students in a variety of ways, ranging from visual and auditory communication to “nonverbal cues such as facial expression, direction of gaze, posture, dress, and physical presence” (Gunawardena, 1995, p. 148). Consistent and effective communication between students and their teacher is necessary if the students are going to have a successful experience, particularly in an online environment that can often be isolating for a student (Swan, 2002).

However, many online teachers and students are also new to the technical tools used in this instructional delivery model. In addition to being new to having to learn how to use a course management system (CMS), many teachers and students often find the CMS communication tools limit their ability to build relationships in the online environment. Teachers need to learn to use a variety of tools and strategies to provide an equal level of interaction with their students as they would receive in a face-to-face environment.

What?

Keeping students engaged and building relationships between students and their teacher in an online learning environment is a specialty for Jay Bennett. Jay is currently the Instruction and Course Coordinator at MVS, but has been a social studies instructor with MVS for the past nine years. Jay has developed a number of strategies, utilizing a variety of online tools, to put his own personality into the online courses he teaches. He believes it is important for students and teachers in the online environment to create a personal identification with the course and with each other. Increasing that personal touch in the online environment allows all participants to demonstrate who they are when interacting with each other – regardless if they are a student in the course or the teacher.

How?

For personalizing the course, as an online teacher Jay believes that using avatars, graphics, and audio and video materials can go a long way in terms of introducing yourself to the students. MVS uses *Blackboard* as its CMS, which allows teachers to post standard announcements, contact information, and teacher pages. Jay also posts some pictures of himself with his family, and other images that would allow the students to get to know him better (e.g., an image of the mascot from his alma mata). Simple images are a great place to begin to allow students to learn a little more about the teacher.

Before starting the actual course content, Jay uses *Camtasia* to create course tutorials that show the students how to use the CMS. *Camtasia* is a screen recording programs that allows teachers to create videos of computer screen recordings to illustrate to students how to do specific tasks they will need to complete in the course (examples of similar programs include *ScreenFlow* and *Jing*). Then Jay uses podcasts to introduce himself to the students. Podcasts are

audio or video recordings that are uploaded to the Internet and streamed via Real Simple Syndication or RSS.

Jay uses these podcasts for the course introduction, teacher information page, and many of the announcements. To record and edit the podcasts Jay uses Audacity, a free open source software, and then he uses *GCast*, a free online service, to host those podcasts. Along with the podcasts Jay also provides a written script or, at a minimum, a synopsis of what was said in the podcast in case a student is not able to use sound features at their school.

Another way Jay interjects his personality into the online courses he teaches is to use various pictures, movies, voice recordings, icons, avatars, and characters. He also encourages his students to create these as well in order to increase content engagement and build relationships with others in the course. These tools also assist with drawing the students into the content. Jay says, "They add a little snap, a little pop, to the online classroom." Jay often uses these Web 2.0 tools, such as *SimpsonizeMe*, *Blabberize*, *GoAnimate*, *Moviestorm*, and *XtraNormal*, course announcements, although they can also be used to cover course content.

After creating these announcements, Jay provides them to his students in one of two ways: (1) by embedding them directly into documents or (2) by providing links to the sites he used to create them. Similar to the podcasts, he also includes the text or a synopsis of the audio with these tools.

In addition to the interactive items that Jay creates on his own, he also makes use of the many existing examples and services that are available on the Internet. One example that Jay regularly uses is the Week in Rap. The Week in Rap is produced every week during the school year to discuss the current events for that week. Not only does it present these current events in rap form, but it also provides an accompanying text that contains links to the stories included in the video. This tool allows Jay to take content many students may find mundane, and present it in a way that is more exciting and engaging to students. Another resource that is available to all MVS teachers, and all teachers for that matter, is the MI Learning Portal at iTunes U; which contains over 200,000 free educational audio and video files.

Finally, Jay also uses more traditional Web 2.0 tools to interact with his students. The Virtual Sociology wiki that Jay has created on Wikispaces is a good example. This wiki was created through an assignment where students had to post one line or fact about a sociologist. As the wiki has been developed over multiple semesters, later students have begun to run out of material from the online textbook that they can add. This has forced students to seek other resources in order to continue contributions to the wiki. This simple assignment of only one line turned into a plethora of information that could be used in other ways throughout the course.

Discussion

Online teaching is a new approach for many teachers, and they need to be sure to employ strategies for engaging their students in the course content, provided consistent and effective communication, and also learn the technology tools used to teach in this environment; they need to be prepared to provide the same interaction online as they would in a traditional face-to-face classroom. This case discussed ways for the teacher and students to add their own personality to the course for increasing interaction among the group.

The Web 2.0 tools used throughout Jay's social studies courses provide an avenue for developing personal identity in the online environment, as well as opportunities to engage and interact with the teacher, content, and other students. Over the past two decades, there have been a variety of possible interactions identified within the online learning environment. Moore

(1989) began this process with his identification of the interaction that occurs between the student and the teacher, between the student and their fellow students, and between the student and the course content. Later Hillman, Willis and Gunawardena (1994) described the interaction that occurs between the student and the CMS and its tools, which was different than the interaction between the students and the actual course content. Finally, Sutton (2001) identified the notion of vicarious interaction or the interaction that takes place when the student watches or lurks while other students interact with each other or the teacher. Through the use of various Web 2.0 tools in his social studies courses, and Jay's belief that online teachers must try to engage their students in a variety of ways, he is able to extend the amount and type of interaction his students have with their teacher, with other students, with the course content, with the CMS and its tools, and in a vicarious manner. Teachers of all subject areas can incorporate these tools in their online environments for increasing interaction and content engagement.

Strategies for Using Reading and Writing in the Online Science Environment

Subject: Science

Technology Used: Course Management System, Concept Mapping & Word Processing Software
Media Files Available At: <http://tinyurl.com/wsucase-science>

Why?

Like many subject areas, it is impossible to teach students everything there is to know about a discipline like science because of the wide array of related fields and sub-fields. Many science teachers focus solely on content, as K-12 science is often organized around content-based fields (e.g., biology, chemistry, physics, etc.), and neglect teaching students how to access, filter, and critically review scientific information.

Science literacy is the application of an individual's scientific knowledge "to identify questions, acquire new knowledge, explain scientific phenomena, and draw evidence-based conclusions about science-related issues" (National Center for Educational Statistics, 2009, ¶ 3) Other characteristics of an individual's science literacy include viewing science as a form of human knowledge and enquiry; demonstrating awareness of how science and technology shape our world; and show the willingness to engage in science-related issues as a reflective citizen.

Incorporating science literacy can be challenging for teachers because they need to make sure students go beyond just memorizing facts. Teachers need to ensure students are able to solve problems, while also incorporating proper language conventions into their responses. The virtual environment poses an additional challenge because teachers and students are not able to directly converse, as in a traditional face-to-face manner, so it is important to incorporate appropriate strategies that require students to 'talk' in written format.

What?

Lorri MacDonald, has been a classroom teacher, an administrator, and now an online teacher with the MVS. In 2008 she was selected as the first MVS Online Teacher of the Year. She teaches the MVS course in forensic science and is currently developing biology courses. Lorri demonstrates that students can be successful when science literacy is incorporated into the content of her online science courses.

How?

In her online courses Lorri guides students through a five-step process to increase students' science literacy: (1) gather information, (2) create a visual organizer, (3) compose a summary, (4) develop a concept map, and (5) conduct a critical analysis. Lorri provides feedback throughout the entire process. Students are provided with a rubric, and Lorri comments on writing mechanics, detail, accuracy of the content, and application, among other criteria.

The process begins with gathering information. Students are provided with a variety of websites and encouraged to explore each site in detail. Lorri usually provides a general graphic organizer to guide students on how to collect or note the specific information (e.g., list the site, its purpose, the important points, etc.).

Next, Lorri requires her students to present their information in a visual manner. Throughout the course, Lorri uses several different styles of visual organizers, depending on the purpose, type of information, and the nature of the task. For example, if Lorri wants the students to simply organize information, the students will usually use a basic table format. If she wants the students to compare and contrast the content, they would often use a Venn diagram. Lorri provides specific written directions and also an audio-based "mini lecture" on different ways to represent information in a visual format. "Mini-lectures" are narrated presentations that are typically six to ten minutes in length. Lorri uses PointeCast to turn these narrated *MS PowerPoint* presentations into *Flash* files that the students can view online. A written transcript of the audio is included in the *PowerPoint* notes section, which allows students the option to read and/or listen to the lecture.

The third step for students is to compose a summary. In some instances students may simply summarize the information they found on a specific concept. Other times students may need to summarize cases. An example of a case would be *Murder By The Book*, where students make the real-world connection of the importance of soil composition in crime solving. Using these aids completed in the first two steps, students know to search for specific points or clues that will solve the case or find important information. "Science talk" is another strategy used for increasing science literacy, and is recognized for increasing student understanding (McKee & Ogle, 2005; Winokur & Worth, 2006). Since the course is asynchronous and there isn't really a "talking" component, students post to the discussion board and "talk" about their findings; the idea is to promote understanding and application of the science content to real life situations.

Next, Lorri has the students develop a concept map with definitions for the vocabulary to assist with increasing student understanding of the necessary terms. Students are provided with written directions and another 'mini lecture' to help guide them. If students use the definition from the text or Internet verbatim (as opposed to developing their own), she provides feedback such as, "I'm looking for you to construct your own meaning," or "There is no sense in redoing someone else's work, but next time you should develop your own meaning." This type of feedback tells students to extend their own definitions in a comfortable and encouraging environment, and also lets them know they need to work a little bit harder on the next assignment. Finally, it gives them an opportunity for further exploration of the content to further expand their understanding of the specific term in order to develop ownership of the science language (McKee & Ogle, 2005).

Finally, Lorri directs the students to combine the information, visual organizers, summaries, concept maps, and instructor feedback from each of these steps to develop a critical analysis of the content. She instructs her students to decide what is fact and what is opinion, in the process of developing and composing a critical review of the content that is supported by their research.

Students submit their assignments as attachments in the course management system. This critical review provides an opportunity for the students to display the major concepts they learned through the assignment. It also gives Lorri a summative assessment tool to evaluate the student's understanding of the overarching concept being taught, and their ability to apply it to a real context.

This sequential process allows students to gather, analyze and synthesize information in a systematic way. This method also provides students an opportunity to mentally organize the information in multiple ways, within the context of real world scenarios.

Discussion

Developing high-levels of science literacy in students is a difficult task for teachers. It goes beyond having students simply memorize facts solely about content. Instead, teachers must support their students and emphasize all aspects of science literacy. When distance is now becomes a factor between the teacher and a student, the task becomes more difficult because they cannot converse directly face-to-face. The online teacher must now include strategies that require students to "talk" in written format to fully encompass the scientific nature of the material. Lorri's systematic five-step process assists students in increasing their science literacy.

The use of writing as a pedagogical strategy to reinforce science concepts has been used in a variety of contexts for more than three decades. One of the best examples of this strategy is the activity of microthemes. Microthemes have been described as an essay that can fit on a 5" x 8" index card (Work, 1979). Essentially, it is a concise form of writing in response to a question or prompt. Several studies into the use of microthemes have found them to be an effective strategy for student learning in science (Ambron, 1987; Collins, 2000; Kirkpatrick & Pittendrigh, 1984; Moore, 1993, 1994). Lorri's use of writing to teach science literacy to online students at MVS is an example that utilizes a similar strategy of having students write in directed ways in a very specific manner to learn scientific concepts. Teachers can use this systematic process in other subject areas as well.

IMPLICATIONS FOR DISTANCE EDUCATION

A major theme that emerges from the four cases is the importance of communication. All teachers in these cases needed to overcome obstacles that impacted the way they communicated with their students. They needed to develop strategies for delivering the course content while making it engaging and for providing meaningful feedback.

A second theme throughout the cases, tied to communication, is the need to use various technology tools for communicating. Not only did the online teachers need to deliver content and feedback through these tools, but they had to be able to also deliver instruction for their students on how to use these tools.

Online teachers often fall into the role of teaching multiple content areas, including, the subject they are teaching, the tools they are using to communicate, and skills for successful online learning. A third theme among the cases is that these teachers also had to implement strategies that also taught their students had to be successful in online courses. The strategies they implemented not only taught the content, but also demonstrated various ways that they can communicate more effectively in the online environment. These cases demonstrate strategies for overcoming these obstacles in the online learning environment.

CONCLUSION

This chapter focused on various strategies that online teachers from MVS used to overcome obstacles in their online teaching. Using the same format as Iowa State University, researchers from Wayne State University partnered with the MVS to develop four cases that addressed pedagogical issues faced by online teachers. Each of the four cases described in this chapter addressed potential problems for online teachers, discussed strategies, tools, and materials used to overcome the problems, and provided a discussion of the pedagogical issue within the literature.

While all four cases underscored the importance of effective communication, each individual case focused on addressing one challenge related to teaching online in the K-12 environment. The Language Arts case emphasized the need for, and ways to, provide substantive feedback for deepening and broadening student understanding of content and the writing process. Elisha's case discussed methods and tools for assisting students with communicating their computational steps in higher-level math courses. The Social Studies case supplies various tools that can be used in the online environment to facilitate content engagement and interaction among students, teacher, and content. The fourth case centered on ways to increase science literacy through reading and writing in an online science course.

QUESTIONS FOR ANALYSIS/DISCUSSION

1. How can a virtual school teacher provide substantive feedback in an online environment?
2. What are several ways a virtual school mathematics teacher can have their students show computations when submitting their work online?
3. Describe several strategies and/or tools a virtual school teacher can use to increase online student-student, student-instructor, and student-to-content interaction?
4. What strategies can a virtual school teacher utilize for increasing students' science literacy when teaching in a virtual school environment?
5. What possible factors could affect the successfulness of implementing these same strategies in a different subject area? Different age level? Different students?
6. How, if at all, do using new technology tools for delivering the content interfere with student learning?

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DEFINITIONS

K-12 online learning: the generic term to refer to distance education at the K-12 level that uses the Internet.

Virtual school – a supplemental K-12 online learning program where students attend a brick-and-mortar or traditional school and are enrolled in one or more online courses to supplemental their classroom studies.

Cyber school – a full-time K-12 online learning program where the students do not attend a brick-and-mortar school, but complete all of their studies online.

Note that these three terms are often used incorrectly as synonyms.

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