a real-life context. Being a large class, however, there were inadequate opportunities during the debate for all students to demonstrate that they could apply the concepts they had learned. In the second year that I used this debate idea in my science lesson, I also required individual students to write a letter or an e-mail (as if they were writing to the editor of a newspaper) explaining their position on the issues and to suggest what could be done to address the declining bee population. The checklist used to assess their letter or e-mail is:

- Were the claims made scientifically valid?
- Were the claims supported by relevant evidence and scientific reasoning?
- Did students build on claims/evidence presented earlier?
- Did students use appropriate language to present their ideas?
- Did students make relevant references to the concepts that they previously learned?

Conclusion
The bee article enabled me to bring science in the real world into the classroom. There are many articles in newspapers in other media that discuss current environmental issues and can be used to support the learning of science in middle-level classrooms. The use of these articles in a guided-debate format can help raise students’ awareness of how the science they have learned can be applied to the real world and how science could or could not help solve some of the world’s problems.

References

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ing their students a great disservice. The answer may lie not in rewriting and revising our entire curriculum, but simply tweaking what we already do and including more of these skills in our lessons and assessments.

One way to do this is to use interdisciplinary collaboration and communication among teachers, because the 21st-century demands a more holistic approach to learning rather than compartmentalized and separated subjects. As teachers at an independent, college preparatory school, we strive to prepare our students for the challenges and opportunities that await them in the 21st century. During grades 6–12, students must own and carry their own laptops. It is an integrated teaching and learning tool across the curriculum. All sixth graders take Study Skills, a class in which they learn techniques to enhance their learning processes as well as information and technology skills. Study Skills teachers conduct lessons with a “just-in-time” integrated approach, meaning they teach skills right before they are needed in other disciplines. The middle school media specialist also takes an interdisciplinary approach to collaborate with faculty and to teach research and information literacy skills in the context of each content-area course. Through our collaborative approach, we are able to develop common education goals, vocabulary, and teaching strategies when approaching research projects in our

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**FIGURE 1**

The 10-step research process: An outline for 140 minutes of instructional time
(By Cheri Dobbs, adapted with permission from Tri-C Publications)

1. **Choose a topic**
   - From a list of 13 types of sources, students circled the ones that would best help them find information to be able to choose a topic about the Middle Ages; they then chose the two or three most helpful sources and wrote why they chose those sources.

2. **Narrow topic**
   - Students brainstormed ideas for narrowing the topic of the Middle Ages by a specific subtopic, chronologically, geographically, or by a related problem or question.

3. **Create a timeline**
   - Using a graphic organizer and the SMART Board, students arranged the steps of the research process in the correct order and discussed the necessity of adding due dates for an actual project.

4. **Gather sources**
   - Students brainstormed and discussed the pros and cons of e-references, print references, nonfiction, online databases, and websites; students were also given scenarios involving specific sources and asked to determine if each source was reliable and useful.

5. **Take notes**
   - Using a sample as a guide, students set up paper note cards with four different titles/subjects, then read sample reference materials and took notes based on four assigned topics. They were instructed to number their notes and avoid complete sentences so they could practice paraphrasing and summarizing. Bibliographic information was recorded on the back of the card.

6. **Create an outline**
   - Students were shown an example of an outline. Using the four subject headings on their note cards as a reference, they correctly arranged the items in an outline.

7. **Write a rough draft**
   - Students were given a list of five sentences that were created from the information outlined in step 6. They had to choose one sentence to serve as a topic sentence, three for the body of the paragraph, and one sentence for the conclusion. This exercise demonstrated how to take brief notes and expand them with description and rich language; it also demonstrated how to logically order your notes when writing.

8. **Edit paper**
   - This is a brief exercise where students look for grammar and punctuation mistakes; it did not focus on the writing because students were not writing formal papers.

9. **Write a final draft**
   - This is homework for students.

10. **Create a bibliography**
    - Using premade charts that list the required elements of each type of citation, the class viewed five different types of sources (book, e-reference, website, reference article from an online database, and print encyclopedia) and practiced locating the bibliographic information for each source.
classrooms. Here are six steps to help you incorporate a collaborative approach in your school.

**Step 1: Look around**

Our collaboration began when we learned that the science and geography classes were both doing research projects at about the same time in the spring. To avoid redundancy and conflicts, it only made sense to work together in the following school year. It was surprising how similar both classes were in their emphasis of research, technology, and media literacy skills. The first step for any team of teachers should be to compare projects in the same way. By comparing lesson plans, teachers can piggyback on each other’s work while maintaining continuity for their students. This building of skills and tools is exactly what employers will be looking for: workers who are not only highly creative in one particular area, but can apply their talents in a greater variety of tasks. By collaborating with each other, we not only model this for our students, but also help them to see that the skills they learn in one class are not confined to those four walls.

**Step 2: Teach the basics**

Because we have a Study Skills class, it was only logical that our lessons would begin there. If your school does not have such a class, these skills could be divided up and taught across the curriculum. We began with the basics that apply to all different subjects, such as taking notes from a lecture or textbook, skimming, finding the main idea, and paraphrasing information. Many teachers already begin their school year with these lessons. The middle school media specialist taught lessons in using the library online catalog system and reviewed library organization and the Dewey Decimal system. The science and geography teachers collaborated with the media specialist to identify strategies for approaching each project and the education outcomes they desired, and the media specialist designed a series of lessons that introduced and reinforced the necessary concepts in a spiraling approach.

**Step 3: Teach students how to find information**

One of the fatal assumptions of many teachers is that students already know how to find the information they are looking for. However, students tend to rely solely on Google and Wikipedia for answers and give up all too quickly when they do not immediately find what they seek. Based on the framework of a 10-step research process (see Figure 1), our media specialist introduced students to the process of choosing and narrowing a topic, identifying the pros and cons of sources in a variety of formats, discussing the reliability and authority of sources, using note cards, and creating bibliographies. Students were introduced to new skills such as brainstorming search terms and keywords, selecting sources, and using subscription online databases. Learning to generate effective keywords is an ongoing process for most middle school students, but one strategy that helps many of them get started is to identify the nouns in their purpose question or topic as a starting point. Once the nouns, or main ideas, are identified, the media specialist and classroom teachers work with students to find synonyms and related terms that are broader and narrower. Students often list their keywords in an idea web or hierarchical chart to give them a visual representation of related terms.

In our geography class, students work on two major research projects throughout the year.
they study the United States and Canada, where they are first introduced to the research process. Students practice what they have recently learned in Study Skills about the physical organization of the library and the library’s online catalog to find books and other print materials to use for research. Notes are taken using a teacher-created outline designed around the five themes of geography. The outline is provided to students so that they can focus on the note-taking and paraphrasing aspects of this project as opposed to the organization of the notes. Another new skill that is introduced is the use of an online resource, NoodleTools (see Resources), which allows students to create their bibliographies online by inputting the pertinent responses into the bibliography generator, NoodleBib. Students no longer need to worry about formatting the information correctly, as the formatting is done for them. They must still record the necessary bibliographic information as they take notes so that they will have it at hand when they are ready to use Noodlebib.

Step 4: Raise the bar

After this initial introduction to research, students feel a little more comfortable with the research process, but there is still much more to learn. In the spring, our students begin to study invertebrates in science class, applying what they have already learned about how living things are adapted and how they interact with their environment. The invertebrates unit culminated in a project that gave students the opportunity to apply their use of research skills and allowed them to creatively display what they discovered. Because they were still new to the idea of narrowing their research topics on their own, students were assigned a class of invertebrates to study and given six subtopics, or clusters, on which to focus: specialized cells, body tissues, organ systems, body plan, method of reproduction, and special adaptations. One of the goals of the project was to give students practice with notetaking and paraphrasing. Because this was their first experience using note cards, the sixth graders were required to take all notes by hand on 3 × 5 note cards to encourage brief notes in their own words rather than pages of cut-and-paste notes. Students were instructed to take their notes in a bulleted list format rather than in complete sentences, which also helped to discourage plagiarism. They followed a prescribed format for their note cards, which required them to list a title, cluster, and page numbers at the top of each card with the bibliography information written on the back (see Figure 2). Students were required to take notes from a minimum of five sources, including at least one online database, and they were limited to using no more than two websites.

Students worked in small groups and were allowed to share sources and work as a team, making the research process a little easier and more fun. When students asked if they had done enough research, the science teachers could help them answer that question by simply arranging the note cards into six piles (one per cluster) and then turning over the cards to check for the proper sources. If they met the requirements, students were then given a list of specific questions to answer about their invertebrate. For example, “Compare and contrast symmetrical and asymmetrical animals” or “Explain why starfish are not fish.” Students answered the questions via a “foldable,” a three-dimensional graphic organizer that students create out of paper to present their research. We used Dinah Zike’s Big Book of Science (2001) for inspiration, which also includes many samples of different types of foldables and instructions for making each fold. If a student chose a question that could be easily answered using the completed note cards, the research was complete and the student could begin working on the foldable. If not, a little more research was required. Most students did not mind returning to the library to find more answers, as they were becoming adept at locating information.

Step 5: Step back and watch

We made sure to teach our students how to use the federated searching feature of the library’s online catalog, which means that with one query students can find library books as well as authoritative and reliable websites and articles from multiple subscription online databases. Students were also taught how to search the library’s reference e-book collection and download articles for further reading. Because they had been introduced to the index card method for notes via the invertebrates project in science, students were ready to go one step further and use the online note cards (available through our subscription to NoodleTools) as they moved on to a new geography project. Students were encouraged to organize their
### Invertebrate project rubric

<table>
<thead>
<tr>
<th>Note cards</th>
<th>Foldable</th>
<th>Bibliography</th>
<th>Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turned in six clusters of note cards that included all of the following: titles, clusters, page numbers, paraphrased notes, and bibliography.</td>
<td>The foldable is put together extremely well, as instructed. Folds and flaps are done correctly. The foldable is colorful and includes correct information.</td>
<td>All five sources are properly documented and in correct bibliographic form, according to type of source on the back of each note card.</td>
<td>The student was always responsible and took ownership of the project. Always came to class prepared and did not disturb other students. Returned this rubric with the final product.</td>
</tr>
<tr>
<td>Turned in five clusters of note cards and/or included at least four of the following: titles, clusters, page numbers, paraphrased notes, and bibliography.</td>
<td>The foldable is put together reasonably well. Folds and flaps are mostly aligned. The foldable is not colorful and includes some incorrect information.</td>
<td>Three or four of the sources are properly documented and in correct bibliographic form, according to type of source on the back of each note card, or one or two sources are missing.</td>
<td>The student was usually responsible and took ownership of the project. Usually came to class prepared and did not disturb other students. Rubric was not returned with the final product.</td>
</tr>
<tr>
<td>Turned in four clusters of note cards and/or included at least three of the following: titles, clusters, page numbers, paraphrased notes, and bibliography.</td>
<td>The foldable is put together insufficiently. Folds and flaps are somewhat aligned. The foldable is not colorful and includes mostly incorrect information.</td>
<td>Two of the sources are properly documented in correct bibliographic form, according to the type of source on the back of each note card, or three sources are missing.</td>
<td>The student was responsible at times and took some ownership of the project. Sometimes came to class prepared. Sometimes disturbed other students. Rubric was not returned with the final product.</td>
</tr>
<tr>
<td>Turned in three clusters of note cards and included at least one of the following: titles, clusters, page numbers, paraphrased notes, and bibliography.</td>
<td>The foldable is not put together as instructed. Folds and flaps are not aligned. The foldable is not colorful and includes none of the correct information.</td>
<td>One of the sources is properly documented in correct bibliographic form, according to the type of source on the back of each note card, or four sources are missing.</td>
<td>The student was rarely responsible and hardly took ownership of the project. Rarely came to class prepared. Usually disturbed other students. Rubric was not returned with the final product.</td>
</tr>
<tr>
<td>Turned in at least one of the note cards and included at least one of the following: titles, clusters, page numbers, paraphrased notes, and bibliography.</td>
<td></td>
<td>None of the four sources are properly documented in correct bibliographic form, according to the type of source on the back of each note card, or all sources are missing.</td>
<td>The student was not responsible and did not take ownership of the project. Never came to class prepared and disturbed other students. Rubric was not returned with the final product.</td>
</tr>
</tbody>
</table>

**FIGURE 3**

/40 = ____________

Your points Your grade

Parent signature: _____________________________________________

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49

Summer 2010
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notes into online “virtual” clusters instead of the piles of cards used in science class. Now the system of organization was entirely up to them. The sixth graders virtually shared their citation list and note cards with their classroom teacher and the media specialist, providing them access and the ability to comment on students’ lists and notes. The teachers found this sharing feature to be very helpful in checking the progress of individual students, while still allowing them the independence to practice their new skills.

Step 6: Keep on building
The results of this collaboration showed tremendous progress in students’ ability to find adequate information among the plethora of sources available to them and to make great strides toward proper citation and paraphrasing techniques. In a final assessment of their research skills, students were quizzed on their knowledge of library and internet resources with an average score of 83%, and the Study Skills teachers introduced the use of internal citations in an additional short research paper. Students wrote a short (two paragraphs) research paper about a study skill or learning technique that they had learned in this class. The teachers helped by finding sources online and directing students to print resources in order to save time and to allow them to focus more on the internal citations. Most of the work is done in class with teacher assistance, as this is certainly the first time that students have had to cite sources within their paper. This time, students included accurate parenthetical references with the help of an online bibliography tool.

Frequent use of skills is key to developing a more comprehensive understanding of technology and high-quality research. This is true for any learner and especially for preadolescents. Their young minds are constantly taking in new information and without repetition and transference, they are more likely to forget how or why they may need to use these tools. For example, in the seventh and eighth grade, our students begin their year with science fair project. The science teachers expect students to begin the project with some prior knowledge; however, any major research assignment within our school’s curriculum usually starts with a class session of research review with our media center specialist. This guides students to the right path, yet still allows them independence.

Again, students are required to use NoodleTools virtual note cards as their primary note-taking method. Although students do need reminding as to how to use this note-taking tool at the beginning of the year, their experiences with the sixth-grade projects are still in their memories.

These experiences also impact other academic research assignments, such as history, language arts, and even some extracurricular activities such as Science Olympiad. Thanks to our persistent reinforcement and collaboration, students leave middle school and enter high school with a greater sense of confidence and technological savvy. These skills have been necessary throughout the last century and will continue to be beneficial throughout the 21st century as well. This could be easily implemented in a school that has a computer lab or student computers in the library. Because much of the work is done online, teachers could also assign sections of the research as homework if there are not enough computers available during the school day.

References

Resources
BibMe—www.bibme.org
EasyBib—www.easybib.com
NoodleTools—www.noodletools.com
Partnership for 21st Century Skills—www.21stcenturyskills.org