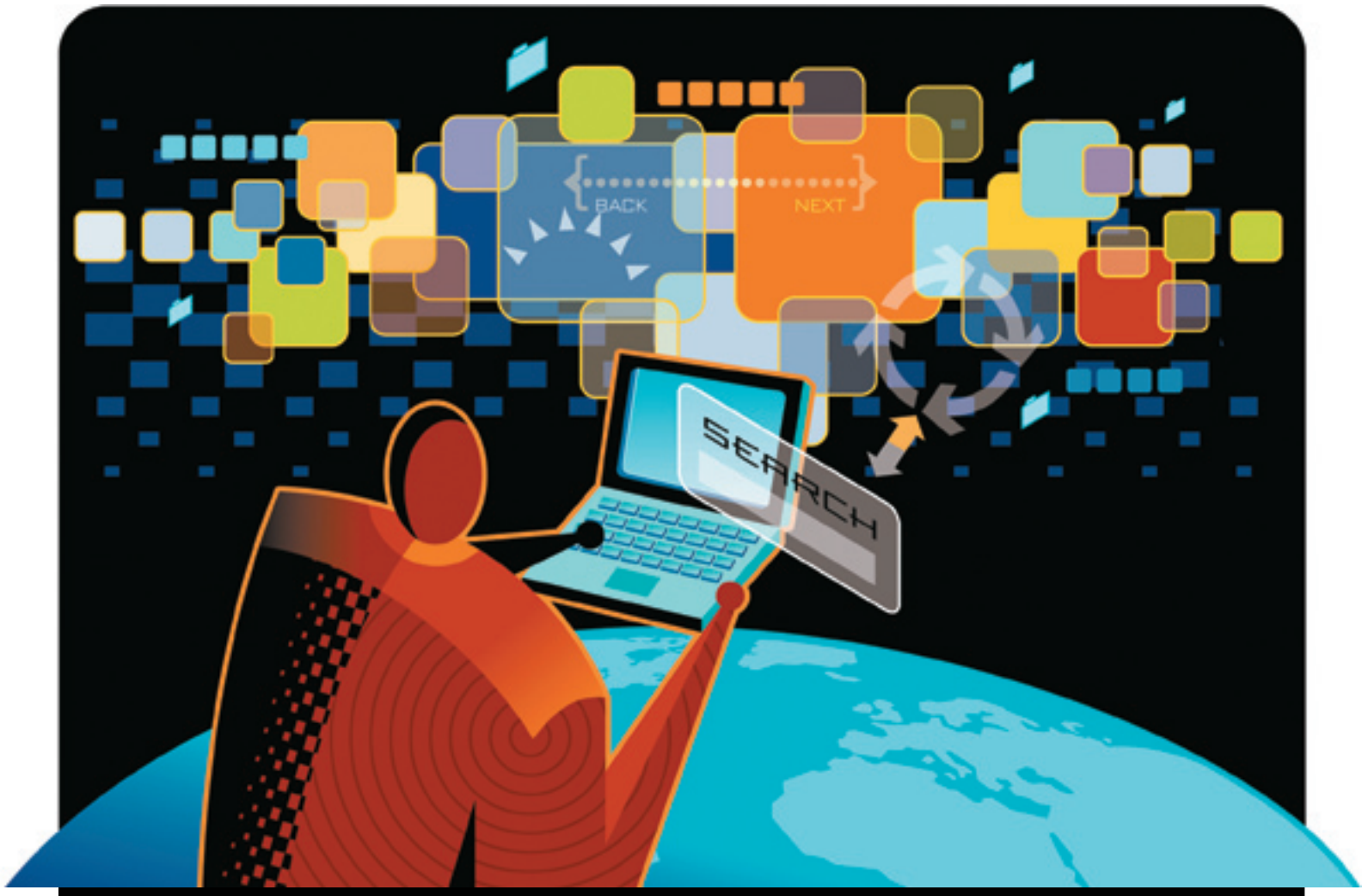

DESIGNING A WEBQUEST

WebQuests—inquiry-based lesson plans that harness the technology of the Internet—are easy to implement.

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Imagine designing a lesson plan that incorporates a high level of student engagement, cooperative learning, discovery learning, constructivism, student research, presentation skills, and technology. Such a lesson plan would undoubtedly provide an outstanding comprehensive learning experience for your students. Consider a WebQuest, an avenue through which instructors can integrate technology into the curriculum and incorporate all these valuable learning experiences.

WHAT IS A WEBQUEST?

A WebQuest is an inquiry-based lesson or activity in which students use the Internet to search for information (Dodge 1997). In this learner-centered activity, developed by Bernie Dodge and Tom March (Sun Associates 2001), the instructor's role is not to lecture to students who are passively taking notes but to plan, guide, and facilitate learning (Simon 2005). A WebQuest allows students to venture beyond the ordinary world of classroom learning and access the vast amount of information available on the Web.

To complete this learning quest, students answer a set of closed or open-ended questions by using a list of Internet resources assembled by the instructor before the activity (Simon 2005). A well-designed WebQuest will require learners to search for and analyze relevant information, thus facilitating a discovery learning process that enables them to answer the questions effectively (LoParrino 2005). This approach allows students to be actively engaged in the learning process, often working independently and using higher-order thinking skills (Brown and Crawford 2002). Moreover, students are able to work at their own pace, whether individually or in groups (Network for Instructional TV Inc. 2001).

WebQuests are now being integrated into the curriculum, and many teachers have posted them on the Internet for other instructors to use. Dodge maintains an online resource on WebQuests at www.webquest.org. In addition, various sites on the Internet are specific to mathematics WebQuests, such as school.discoveryeducation.com/schrockguide/math.htm. Here teachers can find many ideas for designing WebQuests for the mathematics classroom. However, finding an appropriate WebQuest online is sometimes difficult, so teachers should be able to create a plan of their own.

THE WEBQUEST FORMAT

A WebQuest can be designed for almost any grade level or subject matter, as long as the students are able to navigate the Internet. It can involve as many class periods as desired and can also culminate in a report or presentation. The first step in designing a WebQuest is to decide on the specific lesson or instructional objectives (Network 2001). Choose content that requires students to be creative and to work on multiple levels (Dodge 2004). The more closely a WebQuest relates to the in-class material, the more effectively it will help students learn the subject matter. Also, when choosing the content, find a topic for which students can use basic skills they already possess. This process will allow them to incorporate newly found information with previously learned skills. Finally, before making the decision on a topic, research the Internet to see whether or not enough sites exist to provide several online resources for students. These sites should contain content that is appropriate for the age and level of the learners (Network 2001).

A well-designed WebQuest should contain the following components:

1. An *introduction* will set the stage and provide background information. Here the teacher introduces the activity or lesson and perhaps asks the question or questions that start students thinking about the WebQuest topic. If the WebQuest relates to a person or a place, the inclusion of a photograph, general information, or even audio content may be worthwhile. The idea is to get the students interested in completing the activity (Dodge 1999).
2. The *task* helps students focus on the assignment and describes specifically what they will learn. Assigning roles to students or allowing them to work in a group might be advisable. Students should know what the activity's end product will be—whether a report, a presentation, a paper, or a combination of these. Students may also be asked to come to a conclusion or form an opinion about what they have learned (Internet4Classrooms 2000).
3. During the *process*, students learn how they will complete the task, what resources are available, and how they might organize the information they need to gather. The process component may take the form of a hard-copy answer sheet on which students record results of their research. If students are not designated to play a particular role, instruct them to work individually and then compare their results or to work collaboratively as a group (Dodge 1999).
4. A focused set of Web sites, the *resources* for the research that will enable students to complete their task, must be provided. One general site is www.webquest.org/findlinks, which contains a list of links that may be useful in finding sites for your WebQuest (Network 2001).
5. The *evaluation* component informs students about how their performance will be assessed. Providing a link to an online rubrics page so that students can see how their efforts will be graded is one way to accomplish this. Specify whether the group members will receive a common grade or whether the students will be graded individually (Dodge 2004).
6. The *conclusion* summarizes what the students will have accomplished and encourages reflection. This component can point out the relevance or importance of what they have just learned. Additional links or rhetorical questions may be included to stimulate their curiosity beyond this particular lesson (Network 2001).

In Search of the Fibonacci Sequence

Introduction

You are about to go on a search for the answer to one of the most famous problems in mathematics. This problem was posed in 1202 by a brilliant mathematician named Leonardo of Pisa, also called Leonardo Fibonacci. In conducting this search, you will discover his intriguing sequence of numbers that exists not only in mathematical patterns but also in nature. You will also learn that this amazing mathematician from the Middle Ages brought about changes in mathematics that affect all of us today.

Assignment

- Each group of students will research Fibonacci and the sequence he discovered. The groups will then prepare a written report about Fibonacci and his works as well as a presentation to the class of an example of this sequence in everyday life.
- Use the questions below to guide you in your quest for information to prepare your report. Other information may be included as well. The report should be no more than two typewritten pages.
- At the conclusion of this project, your group will present to the class an example of the Fibonacci sequence, either natural or humanmade, found in the natural world or at a plant nursery, a grocery store, or a discount store. In your presentation, you will have to show how your example illustrates the Fibonacci sequence.
- This is a group project and will be graded accordingly. Click here to see how you will be graded.

A. Researching the answers to this first group of questions will give you background information and help you determine who Fibonacci was and the era he lived in.

- Who was Leonardo of Pisa? What other name or names was he known by?
- What were the times like in the 1200s, when he wrote about his famous sequence?
- How was he regarded in the world of mathematics?
- What other contributions to mathematics did he make?

B. Use the next group of questions to help you discover properties of the Fibonacci sequence of numbers.

- What was the famous Rabbit problem? Can you answer the question posed by this problem? Show how you arrived at the answer.
- What different patterns can you find in this famous sequence? Show examples of these patterns.
- What examples of the Fibonacci sequence can you find in nature?
- Can you name any humanmade examples that exhibit the numbers in the sequence?
- What famous number can be found by using quotients of the numbers in the sequence?

Resources

The following resources can be used to investigate the questions posed above. These resources are meant to serve as a guide for your research, and you are encouraged to explore further Web sites on your own. Use the information you find to create your report. You do not have to limit your report to answering the questions posed above.

- mathforum.org/dr.math/faq/faq.golden.ratio.html
- plus.maths.org/issue3/fibonacci/
- www-groups.dcs.st-and.ac.uk/~history/Mathematicians/Fibonacci.html
- www.maa.org/devlin/devlin_10_02.html
- www.mathacademy.com/pr/prime/articles/fibonac/index.asp
- www.mcs.surrey.ac.uk/Personal/R.Knott/Fibonacci/fibnat.html
- www.nndb.com/people/922/000095637/

Conclusion

You will learn about the life of Leonardo of Pisa, including his numerous contributions to mathematics that we use today. You will discover many intriguing patterns in his famous sequence and realize that he was one of the most gifted mathematicians of the Middle Ages.

Fig. 1 Assignment page for the WebQuest "In Search of the Fibonacci Sequence"

A WEBQUEST ON THE FIBONACCI SEQUENCE

This article presents one example of a WebQuest, "In Search of the Fibonacci Sequence." The purpose of this WebQuest is for students to discover the Fibonacci sequence of numbers and note its remarkable existence in everyday objects (Knott and Quinney 1997). Mathematical skills may involve sequencing, sums of numbers, quotients of numbers, and projection using patterns.

The Classroom Environment

This particular WebQuest could be used in secondary or postsecondary school mathematics courses and could also be simplified to accommodate students in the middle school grades. Allow two to three class periods to complete this project, although not necessarily on consecutive days. Students will require the use of a computer lab for the first two classes so that they may research their material. They will also need a simple calculator. Students should be grouped into twos and do their research in class under the teacher's guidance. During the last class period, each group will submit a report incorporating the information found through the WebQuest and present an example of the Fibonacci sequence to the class.

Procedures and Learning Activities

The assignment page (see **fig. 1**) outlines the procedures and explains the learning quest students will undertake. It should be provided as hard copy and also be made available electronically so that students can easily access the provided links to resources. (Note: Sources for suggested images are listed in the resources in **fig. 1**. See **table 1** for rubrics; this table would be accessed in the electronic version of this assignment page.)

Expected Outcomes

Students will discover the relationship of the Fibonacci sequence to the golden ratio, which is found everywhere—in ancient Greek architecture, the artwork of Leonardo da Vinci, and the human body (Knott and Quinney 1997). The students' research will culminate in locating an object that

Table 1

A Rubric for Assessment (maximum score: 12)

	Poor (1–3 points)	Fair (4–6 points)	Good (7–9 points)	Very Good (10–12 points)
REPORT				
Background expectations				
To describe the life and times of Fibonacci	Gives minimal information about Fibonacci, such as name, birth date, etc.	Gives minimal information plus describes a little about what times were like	Gives more details about Fibonacci's background; tells how he was regarded in the world of mathematics	Gives many more details about Fibonacci's background; tells how he was regarded in the world of mathematics
To describe contributions made to mathematics by Fibonacci	Names just the sequence as answer to the Rabbit problem	Describes the sequence and one or two patterns found in the sequence	Describes the sequence and two patterns; cites how this sequence is found in nature	Describes how to answer the Rabbit problem, names two or more patterns, cites how these are found in nature; tells relationship to golden ratio
PRESENTATION				
Expectation				
To present an example of the Fibonacci sequence and show how the sequence is found in the object	Shows a picture of an example of the Fibonacci sequence	Shows an example of the sequence but does not explain how the sequence is found in the object	Shows an example of the sequence and explains how the sequence is found in the object	Shows more than one example of the sequence (natural or humanmade) and shows how the sequence is found in each object

A well-designed WebQuest will require learners to search for and analyze relevant information, thus facilitating a discovery learning process that enables them to answer the questions effectively

exhibits the sequence—a pinecone, a pineapple, a three-by-five-inch or a five-by-eight-inch note card, or a sunflower, to name a few—and present it to the class. This show-and-tell part of the project will emphasize how this incredible set of numbers occurs in our lives.

CONCLUSION

When engaged in a WebQuest, students use technology to experience cooperative learning and discovery learning while honing their research, writing, and presentation skills. Wagman (2005) found that using experiential activities in the classroom greatly improves motivation, critical thinking, and problem-solving abilities. And because most students today are very comfortable using a computer, as well as the Internet (North Central Regional Educational Laboratory 1999, 2005), we can enhance their learning experience by using a mode of instruction that interests them (Brown and Crawford 2002). According to Zimmerman, students need to become "active participants in their own learning process" (1989, p. 1), and a WebQuest promotes this type of engagement. Because a WebQuest can be designed in many forms and for any type of subject matter, the possibilities are endless. Regardless of the topic, students will be engaged and remember what they have learned.

As we strive to incorporate technology into our mathematics classroom, we must also keep our students motivated, interested, and engaged. The WebQuest is one way to do just that.

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