Abstract

Test scores are driving many of the education practices used in the Commonwealth of Virginia and throughout the United States. In response to accountability demands, students are required to retain a large amount of information in order to pass state tests. It is essential that classroom teachers create strategies to reinforce and integrate the content throughout the year.

This project explored a tool to aid students in integrating and retaining information. Students created a web page for each biology objective. The web pages included pictures to aid the understanding of difficult vocabulary and written explanations of important concepts. This research looks at the correlation between student performance on the biology objective tests and student performance on creating the web pages.

Review of Literature

Research has shown that certain learning strategies are particularly beneficial to English language learners (ELLs). These learning strategies include using visuals, communicating knowledge, and using content-specific language. Visuals such as charts, graphs, outlines, and pictures can develop higher-order thinking skills. Visuals allow students to “emphasize essential points and reduce extraneous information” (Anstrom and DiCerbo, 1998, p.7). Communicating knowledge permits students to express what they have learned using their own words which is an indicator of comprehension. Students who use the content-specific language become more comfortable with the language and content which promotes both linguistic and cognitive development (Anstrom and DiCerbo, 1998).

In addition to using various strategies in teaching ELLs, it is also important for teachers to develop alternative methods of assessment, which require students to display their knowledge in various forms. Hands-on, student-focused assessments have proven beneficial to the ELL population (Anstrom and DiCerbo, 1998). Alternative assessments should be, “continuous, allowing the teacher to track student growth throughout the school year” (Anstrom, 1997, p. 36).

Integrating curriculum is another strategy to successfully teach ELLs. Carlos Ovando and Virginia Collier state that “the more diverse the children, the more integrated the curriculum should be. That is, multiple content areas and language learning activities should be centered around a single theme” (Ovando & Collier, 1998, p.83).
Statement of the Problem

Due to the school’s diverse population, teachers are required to implement various teaching strategies as well as alternative forms of assessment. Teacher collaboration and integration of core content areas can support ELLs. Therefore, the problem of the study is to examine whether student-created web pages can enhance the understanding and retention of the biology curriculum.

Research Questions

1. Will more students pass the objective test if they complete their web page?
2. Will students who complete the web pages score higher on objective tests than students who do not complete the web pages?
3. Do students perceive that the web pages help them remember information for the objective tests?

Content

Wakefield High School is located in Arlington, Virginia. The school has 1579 students from grades nine through twelve. The population is 16% White, 46% Hispanic, 26% Black and 12% Asian. Twenty percent of the population receives services for English as a second language.

Wakefield High School has designed a ninth grade program that is organized into four houses. Students in each house have the same five teachers. These houses are responsible for teaching 5 core classes: biology (2 levels), math (3 levels), world history (2 levels), English (2 levels), and technology. This design encourages a lot of collaboration among teachers.

House Three is made up of 85 students. It includes 15 special education resource students who are mainstreamed in all classes. Approximately 30% of the students in the house have learned English as their second language, although none of these students still receive services. At home many of these students speak their native languages because their parents are not fluent in English. Most House Three students come from households of low socio-economic status with parents who work multiple jobs and are not home after school. Therefore many students are required to work or babysit after school. These responsibilities leave little time to complete homework and study for tests.

In order for these students to succeed they need a time and a venue to complete assignments and study for tests. It is imperative that students pass each objective test because it is a requirement for receiving credit. Throughout the course of the year the students complete ten objectives. Each objective is aligned with the Virginia Standards of Learning. The ten objectives are: study of life and scientific method, ecology, biochemistry, photosynthesis and respiration, cell and cell transport, mitosis and meiosis, genetics, DNA and protein synthesis, evolution, and classification.

Understanding the difficulties of tests and the needs of the students, a project integrating biology and technology was designed. Students in House Three created a series of web pages about biology throughout the year. Each web page was designed to correlate with the objective tests taken at the end of
each unit. Each web page had a rubric that defined the components of the web page. The web pages included pictures with captions, vocabulary, drawings, word problems, and statements of theory. The biology teacher was responsible for creating the criteria for each web page and for grading the content of each web page. The technology teacher was responsible for teaching web page design, for providing class time, and assessing technical skills.

This research project was started in October 2001 and continued throughout the school year. At first, the information in biology was taught and then the web page was designed. Once students understood the design functions of Netscape Composer, the web pages were built concurrently with the unit. The due date for the web page became the day of the biology objective test.

Methodology

The results of this experiment were measured in two ways. First, the scores were compared from three of the objective tests to the scores of the three web pages. Second, the students were surveyed about the web pages after they completed their third objective test (Appendix A). The students filled out the survey and turned it in before the end of class. Some students did not have time to fill it out and took the survey home, so not all were returned. The survey was anonymous although some students did voluntarily write their names on it. Parent permission was obtained for using this data.

Results

The grades for the web pages and tests are based on eighty-five House Three students. The first comparison was based on the pass rates of both the objective tests and the web pages. 47% of the students who completed their web pages on biochemistry passed the test. Only 7% of the students who passed the web page did not pass the biochemistry test. The second objective test was on photosynthesis and respiration. 44% of the students who passed the web page also passed the test. Only 10% of students who passed the web page did not pass the test. The third objective test was on the cell and cell transport. 59% of the students passed both the test and the web page. 20% of the students who passed the web page did not pass the test. In addition to looking at each score separately, there is an interesting correlation between students who turned in all three web pages. 94% of the students who passed all of the web pages also passed all of the tests.
Table 1
Comparison between Web Page Completion and In-Class Tests

<table>
<thead>
<tr>
<th>Objective</th>
<th>% who passed the web page and passed the test</th>
<th>% who passed the web page and failed the test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biochemistry</td>
<td>47%</td>
<td>7%</td>
</tr>
<tr>
<td>Photosynthesis/Respiration</td>
<td>44%</td>
<td>10%</td>
</tr>
<tr>
<td>Cell/Cell Transport</td>
<td>59%</td>
<td>20%</td>
</tr>
</tbody>
</table>

The second comparison was based on the difference in the average test grades for those students who completed and those students who did not complete the web pages. Students who completed the biochemistry web page scored 10% higher than those students who did not complete the web page. On the photosynthesis/respiration test students scored 5% higher if they completed the web page. The average test score for cell/cell transport was 12% higher for students who completed the web page.

Table 2
Comparison between Completion of Web Pages and Test Grades

<table>
<thead>
<tr>
<th>Objective</th>
<th>Test average of students who completed web page</th>
<th>Test average of students who did not complete web page</th>
<th>Difference in test grades</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biochemistry</td>
<td>77%</td>
<td>67%</td>
<td>+10%</td>
</tr>
<tr>
<td>Photosynthesis/Respiration</td>
<td>78%</td>
<td>73%</td>
<td>+5%</td>
</tr>
<tr>
<td>Cell/Cell Transport</td>
<td>74%</td>
<td>62%</td>
<td>+12%</td>
</tr>
</tbody>
</table>

The effectiveness of the web pages became more apparent in the student surveys. Question 2 asked, “Do you think creating a web page helped you prepare for the test?” 74% of the students who returned the survey said yes.
The students were then asked to explain why. While student answers varied, there were some common themes. Most students found making the web pages a good review. One student said, “I remember things better when I actually think about them (like when I’m typing them).” Similarly, another student commented, “As I was doing the web page my mind kept reviewing all of the information.” Other students found making the web page a good time to clarify what they had already learned in the biology classroom. One student stated, “Lots of the time to answer a question I had to search in a book, note or computer, so I studied.” The amount of time students spent on the web pages also helped prepare them for the test, “It helped me remember things and on the test I had flashbacks to my web page since I saw it so many times.”

Conclusion

The student-created web pages appeared to be a successful tool for reinforcing the biology content. The students were required to build upon what they had learned in class. Putting the page together required higher order thinking. The balance between pictures and written content helped to reinforce each concept. Also, while students worked on web pages they collaborated with each other. Their discussion of concepts allowed them to verbalize and clarify their understanding. Students also used the web pages as a review for the end of the year test. Some students also reviewed their web pages with the biology teacher and many found this to be extremely helpful.

Next Steps

This was also a learning experience for the teachers as well as the students. When the biology teacher graded the web pages, it gave insight to what her students comprehended. It also made student misconceptions apparent to the teacher. She found that many students cut and pasted definitions from the web. When she questioned her students on what those definitions meant they usually were not able to grasp the vocabulary. Therefore, next year the assignment will be more clearly stated that students must write the definitions in their own words. While the use of pictures had great potential to reinforce the ideas if the student did not explain the picture it was not helpful. Another finding was students need to make clear labels on each component. Students who did not label each component often could not remember what the picture or text was explaining. Also, the deadline of the web page needs to be coordinated with the date of the test to ensure review for the test.
References
