Science Education International
Vol. 25, Issue 4, 2014, 354-371

The Impact of Online Homework on Class Productivity

J. R. DODSON*

ABSTRACT: Even in an increasingly cyber-driven world, many classrooms are still heavily reliant upon paper and pencil assignments. More and more students are provided with computer access at school as well as at home, which presents educators with a tool that can minimize the use of paper within their classrooms and decrease the amount of energy and resources schools are using in their classroom on a daily basis. The purpose of this study is to determine whether online homework creates a measurable difference in student performance when compared to traditional, paper homework. Results showing increased student performance when utilizing paper homework may give support to explaining why most teachers still utilize this method. In contrast, if the use of online homework increases or maintains student performance, it may justify a push toward a more online-based extension of student learning. Overall, the results for this study seem to indicate that online homework, at the very least, maintains student performance within the classroom, although a greater study sample may be necessary to confirm this position.

KEY WORDS: Online homework, reducing paper use, classroom participation, class productivity

INTRODUCTION

Homework is seen by many educators as being a necessary extension of the classroom. Whether it is used for extended practice, reinforcement of old material or as an introduction to new topics, it is traditionally believed that homework has a very real (and important) place in classrooms and in student learning (Hong, Wan, & Peng, 2011, p. 280). There is an increasing number of educators who realize one fly in the ointment, however: as more homework is assigned, more paper is used. Of course, more paper means more trees are being harvested, which has major ramifications throughout the world. According to European Paper (2011), about 11% of the timber felled throughout the world is used for paper (Myths: The Paper Industry Destroys Forests section, para. 1). Harvesting paper not only eliminates trees (although there are some smart businesses

*Adjunct Instructor at Miami University, Oxford Ohio, Dragonfly Program, e-mail: Dodsonj2@miamioh.edu

that will do this sustainably) and destroys habitat – it also requires energy. Much of the paper that is used in schools is recycled, but this process also requires energy, often in the form of fossil fuels. Using less paper, therefore, means more trees remain and fewer emissions.

Minimizing the amount of paper used in the classroom is not only 'green,' but also saves the school district money. From a conservative estimate, Ben Johnson (2011) concludes that a school with one hundred teachers uses 250,000 sheets of paper annually, which costs the district $25,000 in paper alone (The Numbers section, para. 5). With school districts becoming increasingly strapped for cash, this cost can be significant. Such savings can thereby be utilized by the district to invest in their students, faculty or facilities. Therefore, cutting paper from certain aspects of the classroom can benefit the economy within the school, as well as the environment without.

An Alternative to Paper

One consideration is to utilize society's growing technological availability and have all homework assigned, completed and assessed online. Replacing traditional, pencil and paper, homework with a virtual, online assignment can cut the cost of the paper, the energy and the deforestation of the natural environment where these products are produced. The physical printing of a journal or periodical, for example, uses 65times as much energy as it does to share the same material online (Anderson, 2012, para. 8).

And getting classrooms online isn't as big a challenge as some imagine. According to a study by the education provider, Pearson, "92% of students under 16 now use a home laptop or desktop computer to complete their school work" (Stopher, 2010). Even though there are students who do not have access to a computer or the internet at home, schools in the United States have become highly technological: every regular classroom in my building in Rittman School District in Ohio, for example, has at least three student computers available, not to mention the computer labs and web-book carts.

In addition to the availability of computers, students in school today are seen as a 'technological' generation, and some educators have pointed out that we need to use a method with which these students are familiar. Technology in (and out) of the classroom has the potential to be used as a motivating tool. According to Doorn, Janssen and O'brien (2010) from a preliminary study on the subject of motivation within an online classroom setting, students "overwhelmingly report that online homework is beneficial in understanding material and preparing for exams" and go on to say that students "felt that it is at least as easy to use as traditional homework, and most recommend it" (p. 16). The work by Richards-Babb, Drelick, Henry and Robertson-Honecker (2011) reinforces this

sentiment; they point out that 80.2% of the students in their study group view online homework favourably (p. 92). Similarly, Hakverdi-Can and Sonmez (2012) show that comparable internet-based teaching techniques, such as the use of WebQuests, can be valuable for both the student and the teachers in terms of promoting inquiry (p. 348). As schools throughout the country catch up with technology while building up the resources within their buildings, and with students receptive to technological outlets during their school day, why dos teachers not follow through and remove the paper altogether?

Even beyond the students, the ease of assigning and checking homework online can save teachers time (Arasasingham, Martorell & McIntire, 2011, p. 70). In an online classroom, gone are the wasted moments of issuing and collecting homework. Papers cannot get lost in transit from home to the classroom, and teachers can track exactly what time the assignment was complete and submitted. Grading can be quick and easy, with all of the students' work available on one resource. As Alhami and Alsmadi (2011) point out, the grading of multiple choice online assignments is "straightforward and does not require any artificial intelligence" (p. 77). They go on to describe a method of creating an automatic grading system for extended response questions, which in turn saves a great deal of time in the long run (p. 77). This new-found time allows educators to devote a larger part of their days to preparing better lessons and assessment strategies to connect with their pupils.

Having digital homework can also be one way to keep curriculum fresh within the classroom. An online homework system can enable the teacher to consistently update his/her website, thereby decreasing the amount of work to keep the material current and up-to-date. And having contemporary messages within curriculum enhances learning within the classroom by promoting student interest in local topics and giving them ownership over their own communities/assignments. For example, Poon, Toh and Tan (2010), after giving a lesson involving an article about the local decline of bees, conclude that "there are many articles in newspapers and in other media that discuss current environmental issues and can be used to support the learning of science" (p. 67). Keeping topics local and current creates a situation where the topics discussed are pertinent to the student—therefore creating a learning platform in which students are more likely to 'buy in.' The maintenance of an online system of learning is one way of tackling this.

Issues with Going Paperless

Some readers by this point may see the obvious draw-backs to this paperless method, however. Depending on the environment, there may be some issues with the technology itself. Some students may be unfamiliar with the software/website or have difficulty confronting a technical

problem when away from the class. This can be answered by training the students on the use of the technology, just as an educator would train for anything else. Yes, this would take a small amount of extra time on top of the regular material for the course, but with the time that is saved by not passing out or collecting homework, it probably evens itself out.

On the other hand, some might point out that going paperless can open the door to issues with academic dishonesty. As Kupetz (2008) points out: technology "that facilitate access to and sharing of information also provide students with additional opportunities to cheat" (p. 39). A teacher can curb this by utilizing a website which requires a student to sign-in, but even that can be bypassed. Determined students can still share passwords and plagiarize the work of others. However, one can argue that this is no different from the paper and pencil method already being utilized in classrooms—the work in both cases is completed outside the classroom, and outside the teacher's supervision. In either case, it is impossible to tell from looking at the work alone whether it is actually the student who completed it. The responsibility falls upon the teacher in both cases to follow up on every assignment and reinforce the material, which may give the educator a better premonition of the student's true understanding.

Does Online Homework have an Effect on Student Performance?

Despite all the potential environmental and time-saving benefits of using web-based homework, educators are primarily interested in the impact of online homework on student performance. The purpose of this study is to determine the effectiveness of online homework in conjunction with student learning. According to Arasasingham, Martorell and McIntire (2011), online homework "can be engaging to students, present opportunities for self-directed study to learn the desired material, provide effective feedback and supply a range of opportunities for practice" (p. 78). Their study is conducted at the college level; the purpose of this inquiry is to determine whether the same holds true in a high school classroom. With this in mind, this study addresses the following questions:

1. Will online homework in a high school course have an increased motivational force on student participation/assignment completion?
2. What effect does online homework have on student grades, compared to traditional, paper and pencil assignments?

The results may have real ramifications on how educators assign homework and how much paper is utilized in the classroom. If online homework enhances learning or maintains the traditional level of student progress, then why does a teacher not utilize the technology? On the other

hand, if students do not benefit from the online homework, then it has no place in teaching and new solutions must be found to our overwhelming reliance on paper for out-of-class assignments.

METHOD

This study took place over the course of an academic quarter (half a semester), in two environmental science classes. Both classes consisted of junior and senior-level students. Each class was given the same material for homework over this time period, with the only variable being that one group (online class or OC) was assigned and completed homework on a class website, while the other group (paper class or PC) was assigned homework in a traditional, paper format. For the OC, two websites that were used—Blogger and Weebly—each at different points throughout the quarter. Regardless of class, sets of homework had the same due dates, and both classes followed the same pacing guidelines. The specific material that was covered over the course of the testing period centred on problem solving and climate. A complete list of material is given in Appendix 1.

To judge the effectiveness of online versus traditional homework, four criteria were examined: homework completion rates, homework grades, class participation, and final, quarterly grades. Homework completion rates and class grades were straightforward enough, if time consuming, to collect and record. Homework assignments were 'collected' (either virtually or physically) immediately at the beginning of class. Late homework in either case was not accepted and counted for our purposes as a 'zero.' Examples of homework is given in Appendix 2.

Class participation was more difficult to gauge. Over the course of the quarter, I tallied up voluntary participation within the class. In an effort to minimize the subjectivity of this task, I used straightforward guidelines when assessing participation. Students obtained a mark if they volunteered to answer a question, read a directive for a classroom activity, performed a part in a classroom discussion or brought up an insightful idea. Students did not receive any mark if they did not initiate the dialogue (for example, if I called on them to perform a task). Student activity that was blatantly silly, or off topic was not tallied.

RESULTS

This study included a total of twelve assignments for each group. For both classes, the results for the average homework grade and completion were within two percentage points of one another. As is outlined in the chart below (Figure 1), the OC had an average completion rate of 72.5%, compared to the 74.1% rate for the PC. Over the course of these same

assignments, the average grade was 58.8% for the OC and 60.8% for the PC.

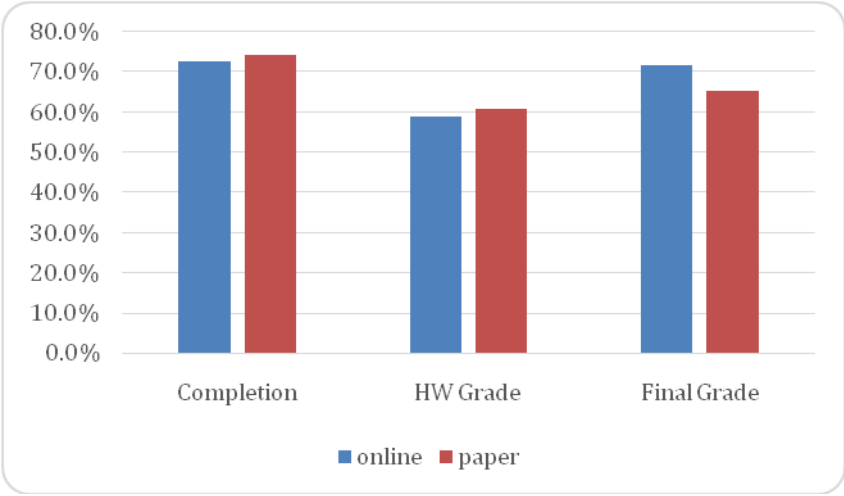


Figure 1. Completion, HW and final grades for online class and paper class.

Whereas the groups were statistically very similar for the homework rates of completion and the average homework grades, the overall final grade mean for the OC was 71.8%, compared to 62.3% for the PC. These scores effectively represented the students' final grades for the entire first quarter, meaning that it factored in tests, laboratory assignments and homework scores. The statistical difference between these two groups seemed significant at first glance and is discussed further in the next section.

Perhaps the largest difference between the groups could be found in the category of participation. Class participation (Figure 2) differed between the two classes, with the OC having an average of 2.4 marks less than the PC. Whether this is the result of homework or classroom dynamics is discussed further in the next section. The full results for homework completion and grades are given in Appendix 3.

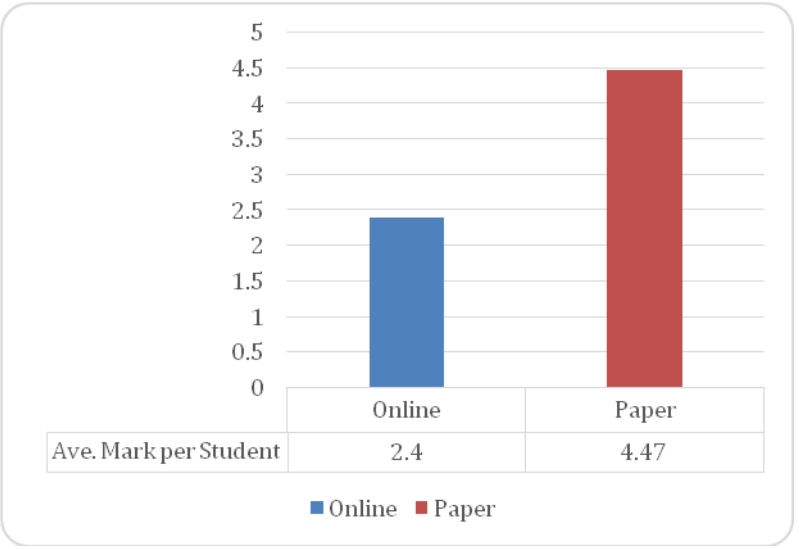


Figure 2. Average student participation between paper and online classes.

DISCUSSION

Prior to the study, I predicted that there would be little difference between a group given online homework and one that was assigned traditional homework. I expected students in the online group to have some difficulty at first, but after practice, it would have the same results/completion rates as regular homework. In light of the aforementioned successes with online learning, I predicted that the online learning group would be at least as successful, if not more successful, than the traditional learning group.

After analyzing the data, two things jump out: both classes have nearly equal rates of completion and grades in their homework, but there is a clear difference in participation and final grades. Let's focus on the rates of completion and grades first. With only a 1.6% and a 2% difference in homework completion and homework grade, respectively, the averages are clearly very similar. However, when taking standard deviation into account, one can see that the PC has a much wider range of scores than the OC. For example, in homework completion, one standard deviation for the OC is 12.6%, whereas one standard deviation in the OC is 18%. This seems to indicate that the work the OC completed is much more uniform, and that perhaps, if 'zeros' aren't taken into account, we may find that the OC on average has a much higher grade rate. Because of the fact that there was only a 2% difference in completion, this can usefully lead to a follow-up study taking these added factors into account.

Of note is that the OC scored 9.5% higher for their quarterly final grades, which are influenced by these homework grades both in terms of

points as well as content. If there is a direct correlation between homework grades and final grades, the expectation is that the class with the higher homework grade has a higher final grade. As aforementioned, this is not the case. The reasons behind this remain unknown. Perhaps the OC is simply a better test-taking group. On the other hand, perhaps the online homework, although similar in actual grades, is somehow more conducive to learning when going over it in class. In either case, it is difficult to tell, but further study are suggested towards finding an answer.

Another major difference between classes was classroom participation. Prior to the study, I predicted that the class with the most background knowledge about a topic (and therefore the class that performed better on their preparatory homework) would participate more often in class because of this knowledge. However, there was a large difference between the classes in average participation, despite the fact that both classes remained similar in homework completion and grades. The results seemed to indicate one of two things: Either the online homework provided a much weaker platform for students to spring from when discussing concepts in class, or homework and classroom participation weren't closely related. Because the OC had nearly the same homework grades and a significantly higher overall grade, it would suggest that the first option should be discarded and acceptance of the second conclusion, which was that background knowledge and participation weren't necessarily related with one another. Something that I certainly noticed during the study, but was difficult to measure because of its subjectivity, was that one class (OC) had students that were much more introverted than the other. This was the case in many situations, and although participation should increase student learning, through experience it was shown that it wasn't fully necessary in every case. Therefore, although the students in the PC participated more regularly than those in the OC, including participation into judgment of homework effectiveness was not meaningful.

Lastly, it was worth noting that both classes had students with IEP's (Individual Education Plans). Five of the nineteen students in PC had an IEP. Compared to three students with IEP's in the OC. Because the numbers of these students with accommodations were relatively similar to each other, this was not seen as accounting for a significant difference between test groups, and therefore the data could be interpreted in its present form.

Action Component

The approach and outcomes of this study were shared with my professional colleagues. To do so, I created a pamphlet with information and tools so that other teachers within my district could use the information that I had researched. Because so many teachers were

unaware of the online tools and the possibilities that each tool presented to a class, I created a list of resources available, all of which were free for use. With these resources, I added descriptions so that educators could understand the pros and cons of each program, thus enabling educators to personalize their own online homework in a way that suited them and their classes. In order to stay true to the goals of this study, the information was made available on the school district's network folder (online), so that all staff could use it at any time and no paper was used in the process. The pamphlet was as shown in Appendix 4. On top of providing this information on the network, I spoke at one of the district's in-service meetings to enable everyone to know my results and make sure that the staff was aware of the resources compiled.

In light of the results from this study, I have endeavored to make all of my classes as paperless as possible, with all homework being available online. This online homework, in conjunction with previous studies in which I focused on removing the textbook from the classroom, is intended to make student learning much more up-to-date and interactive in the long term.

CONCLUSION AND RECOMMENDATIONS

I had predicted that the OC would perform at least as well as the PC, and overall, this was the case. Although there was a slight drop in completion and homework grades in the OC, the difference between 1.6% and 2% were seen as insignificant. Despite my initial fears that there would be a significant learning curve for the students in the OC, I felt enough time was spent in class preparing them for the online homework. Although there were moments of troubleshooting, the OC began the quarter with strong completion rates which never dipped below the 52.9% mark. Similarly, the PC began the grading period with strong completion rates, but as the quarter progressed, a steady, near constant decline in these rates occurred. This decline was not present in the OC, and this was exemplified by the fact that there were two assignments that were below the 48% mark in the PC.

There was also a discrepancy in the final grades for both classes. Because a portion of these final, quarterly grades were directly influenced by how well a student did on his/her homework, the results should be seen as significant and not thrown out. However, there was no apparent trend between the homework grades and the final grades.

Despite the relatively minor variation of homework completion rate and grades, there seemed to be a clear discrepancy between the participation of the two classes. This could indicate one of two things: Either the online homework provided a much weaker platform for

students to spring from when discussing concepts in class or homework and classroom participation aren't closely related.

Limitation

A larger sample size would have helped solidify these findings, and further studies are suggested before drawing any firm conclusions in regards to the link between homework type and in class student participation.

Recommendation

As online homework significantly impacts on student performance, it is recommended this web-based method of collecting assignments can be utilized within the classroom, both for the environmental and time-saving advantages. As we are provided with more and more technological tools within the classroom, this information enables teachers throughout the country to use less paper, and therefore produce less waste in and out of the classroom, all without hindering student learning.

REFERENCES

Alhami, I. & Alsmadi I. (2011 October). Automatic Code Homework Grading Based on Concept Extraction. *International Journal of Software Engineering and Its Application, 5*(4), 77-84.

Anderson, K. (2012, January 19). The Hidden Expense of Energy—Print is Costly, Online Isn't Free. *The Scholarly Kitchen*. Retrieved on April 27, 2013 at: http://scholarlykitchen.sspnet.org/2012/01/19/the-hidden-expense-of-energy-costs-print-is-costly-online-isnt-free/

Arasasingham, R.D., Martorell, I., & McIntire, T.M. (2011). Online Homework and Student Achievement in a Large Enrolment Introductory Science Course. *Journal of College Science Teaching, 40*(6), 70-79.

Barack, L. (2005). Digital Divide. *School Library Journal. June, 24*.

Doorn, D., Janssen, S., & O'brien, M. (January 2010). Student Attitudes and Approaches to Online Homework. *International Journal for the Scholarship of Teaching and Learning, 4*(1).

European Paper and Packaging Industries. (2011). *Myths and Realities*. Paper Online. Retrieved from: http://www.paperonline.org/myths-and-realities

Hakverdi-Can, M., & Sonmez, D. (2012, December). Learning How to Design a Technology Supported Inquiry-based Learning Environment. *Science Education International, 23*(4), 338-352.

Hoffman, R., & McGuire, S.Y. (2010). Learning and Teaching Strategies. *American Scientist, 98*, 378-382.

Hong, E., Wan, M., & Peng, Y. (2011). Discrepancies between Students and Teachers Perceptions of Homework. *Journal of Advanced Academics, 22*(2), 280-308.

Hoskins, S.G., & Stevens, L.M. (2009). Learning our L.I.M.I.T.S.: less is more in teaching science. *Adv. Physio Education, 33*, 17-20.

Johnson, B. (2011, February 23). *Paper and pencil curriculum: How much do you rely on it?* Edutopia. Retrieved from: http://www.edutopia.org/blog/paperless-schools-techology-ben-johnson

Kupetz, A. H. (2008, February). Is the Paperless Classroom Possible? *BizEd*, 36-40.

Poon, C., Toh, F., & Tan, A. (2010). Bees in the news: connecting classroom science to real-life issues. *Science Scope, summer*.

Richards-Babb, M., Drelick, J., Henry, Z., & Robertson-Honecker, J. (2011). Online Homework, Help or Hindrance? What Students Think and How They Perform. *Journal of College Science Teaching, 40*(4), 81-93.

Schmidt, P.R. (1999, April). KWLQ: Inquiry and literacy learning in science. *The Reading Teacher, 52*(7).

Stopher, J. (2010, September 10). Parents embrace online learning. Pearson: Always Learning.

Yager, R.E., Choi, A., Yager, S.O., & Akcay, H. (2009). Comparing Science Learning Among 4th-, 5th-, and 6th-Grade Students: STS Versus Textbook-Based Instruction. *Journal of Elementary Science Education, 21*(2), 15-24.

APPENDICES

Appendix 1. An example of homework for both test groups

Paper:

Ecology HW 7.3 "Head Above Water"

*Name*_____
*Date*_____
*Period*_____

Read the article and answer the following questions.

____ 1.) What is the main focus of the article?

a.) Global warming is creating more Hurricanes throughout the world.
b.) Water levels are rising due to global warming, causing problems for islands in the Indian Ocean.
c.) Maldivian government is fighting global warming by creating green jobs.
d.) Dudes working on their statistics course underwater.

____ 2.) What is going to happen to the Maldivian people in the year 2100?

a.) They will be a separate nation from their parent government in Samoa.
b.) The people are going to throw a party for the 100th anniversary of their country.
c.) The Maldivian people will have to relocate because their islands will be under water.
d.) Their population will continue to grow as they make money on ecotourism.

____ 3.) How high are waters today, compared to 100 years ago?

a.) 0.13 inches
b.) 13 feet
c.) 8 inches
d.) 16 feet

____ 4.) Why do higher temperatures cause sea levels to rise?

a.) Warm water takes up more space than cold water.
b.) Warmer water has a higher pH which corrodes beaches.
c.) Warm water evaporates less frequently than cold water.
d.) Higher temperatures do not cause a rise in sea levels.

____ 5.) What is the Maldivian government doing about this problem?

a.) Effort to slash emissions within its country.
b.) Making a plea to other countries to cut their emissions.
c.) Building a wind farm that will power their capital city.
d.) All of the above.

OCEANS

Head Above Water

A sinking island nation sets an example by cutting emissions.

By Mirva Lempiainen

This wasn't your typical cabinet meeting. Sure, the Maldivian president and 11 ministers were all there, gathered around tables. But instead of suits they had donned diving gear, and they were sitting on the seafloor, signing an SOS note.

The plea for help was part of a stunt last fall to draw attention to the plight of this Indian Ocean country of nearly 1,200 coral islands. The United Nations estimates that rising sea levels may make the Maldives—whose average height is about five feet above the watermark—uninhabitable by 2100, leaving its 360,000 citizens among the world's first environmental refugees.

To protect their home, Maldivians are taking measures to go carbon-neutral by 2020. "There is no higher ground we can move to," says Abdul Ghafoor Mohamed, the country's ambassador to the United Nations. "There is no safe island within the archipelago."

Rising water levels threaten

other island nations, too, including Fiji and Samoa. Residents of Papua New Guinea's Carteret Islands, which are expected to be completely uninhabitable by 2015, have already started to move to the main island of Bougainville, and the entire populace will be relocated within five years. By 2050 there will be at least 25 million climate refugees, the International Organization for Migration reports. "Small island nations are going to be destroyed by global warming," says Joseph Romm, founder of the blog Climateprogress.org and a climate expert at the Center for American Progress, a think tank. Low-lying coastal areas of Bangladesh, Vietnam, the Netherlands, San Francisco Bay, and Florida are also at risk.

Globally, sea level climbed .13 inches per year from 1993 to 2008. Waters today are nearly eight inches higher than they were a century ago, and more than two inches higher than 16 years ago. Higher temperatures cause sea level to rise because warmer water takes up more space than cold, and because of runoff from melting glaciers and ice sheets.

The Maldives government is moving forward with its effort to slash emissions. This past November the country signed an agreement for a 75-megawatt wind farm that will power the capital, Male, and a number of tourist resorts, and cut a quarter of the country's CO_2 emissions. "We can make our country carbon-neutral, island by island, and use this as a symbolic model for other countries," says Mohamed.

Maldivians are hoping other nations will follow suit to ensure global temperatures don't rise more than 1.5 degrees. The world didn't settle on a binding agreement at the climate meetings in Copenhagen last December. But the Maldivians are already looking to the next talks in Mexico in the fall, where they may carry out new attention-grabbing stunts.

Weebly:

7.3 Head Above Water
10/14/2011 15 Comments

Click on the link below and read the article. Answer the following questions.

eco_hw_7.3_head_above_water.pdf
Download File

____ 1.) What is the main focus of the article?

a.) Global warming is creating more Hurricanes throughout the world.

b.) Water levels are rising due to global warming, causing problems for islands in the Indian Ocean.

c.) Maldivian government is fighting global warming by creating green jobs.

d.) Dudes working on their statistics course underwater.

____ 2.) What is going to happen to the Maldivian people in the year 2100?

a.) They will be a separate nation from their parent government in Samoa.

b.) The people are going to throw a party for the 100th anniversary of their country.

c.) The Maldivian people will have to relocate because their islands will be under water.

d.) Their population will continue to grow as they make money on ecotourism.

____ 3.) How high are waters today, compared to 100 years ago?

a.) 0.13 inches

b.) 13 feet

c.) 8 inches

d.) 16 feet

____ 4.) Why do higher temperatures cause sea levels to rise?

a.) Warm water takes up more space than cold water.

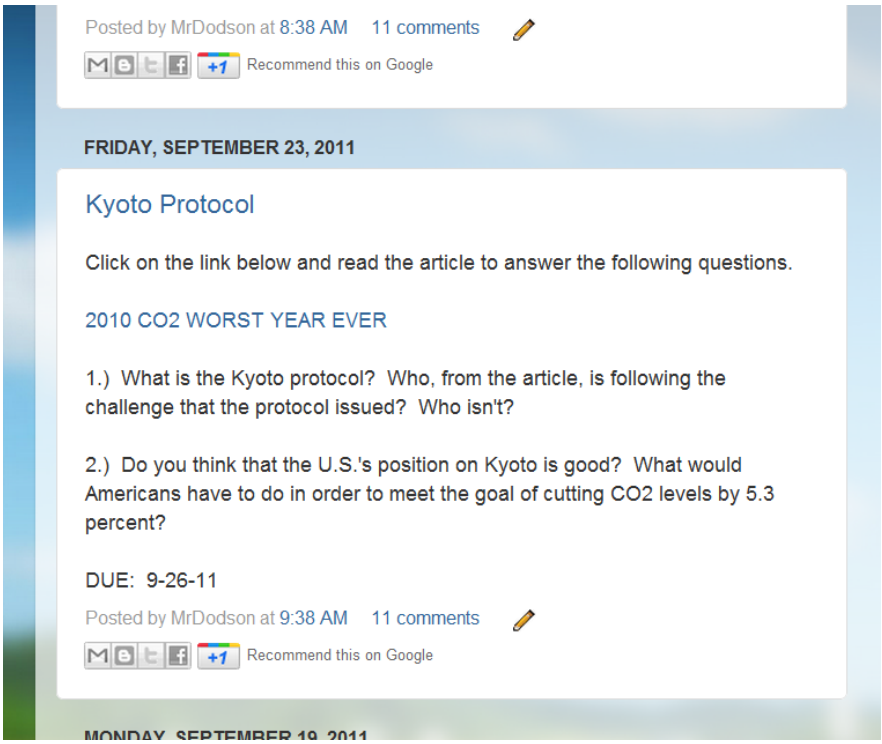
b.) Warmer water has a higher pH which corrodes beaches.

c.) Warm water evaporates less frequently than cold water.

d.) Higher temperatures do not cause a rise in sea levels.

____ 5.) What is the Maldivian government doing about this problem?

Blogger:



Appendix 2. Subject material covered over the course of the study

- Introduction to Environmental Science
  - Environmental Problems
  - Parts of an ecosystem
  - Review of basic ecological principles
- Climate
  - The atmosphere
  - Factors that affect climate
  - Atmospheric pollutants/Greenhouse gases
  - Ozone layer

Appendix 3. Grading and Participation of Test Groups

IAP Data - Online vs. Paper Homework

		COMPLETION				COMPLETION	
		Online Class	Paper Class			Online Class	Paper Class
Blogger	1.1	10	18	Blogger	1.1	58.8%	94.7%
	1.1.1	14	18		1.1.1	82.4%	94.7%
	1.2	16	17		1.2	94.1%	89.5%
	1.3	15	15		1.3	88.2%	78.9%
	2.1	13	13		2.1	76.5%	68.4%
	6	14	17		6	82.4%	89.5%
	6.1	12	15		6.1	70.6%	78.9%
Weebly	6.2	11	7	Weebly	6.2	64.7%	36.8%
	7.3	9	9		7.3	52.9%	47.4%
	7.3.1	11	13		7.3.1	64.7%	68.4%
	7.3.2	12	13		7.3.2	70.6%	68.4%
	7.3.3	11	14		7.3.3	64.7%	73.7%
		out of 17	out of 19		**AV**	72.5%	74.1%

		AVERAGE GRADE				AVERAGE GRADE	
		Online Class	Paper Class			Online Class	Paper Class
Blogger	1.1	1.2	1.8	Blogger	1.1	60.0%	90.0%
	1.1.1	0.8	1.8		1.1.1	40.0%	90.0%
	1.2	1.8	1		1.2	90.0%	50.0%
	1.3	1.3	1.3		1.3	65.0%	65.0%
	2.1	1.3	1.3		2.1	65.0%	65.0%
	6	1.3	1.3		6	65.0%	65.0%
	6.1	1.2	1.3		6.1	60.0%	65.0%
Weebly	6.2	0.8	1	Weebly	6.2	40.0%	50.0%
	7.3	1	0.5		7.3	50.0%	25.0%
	7.3.1	1	1.2		7.3.1	50.0%	60.0%
	7.3.2	1.2	0.8		7.3.2	60.0%	40.0%
	7.3.3	1.2	1.3		7.3.3	60.0%	65.0%
		out of 2	out of 2		**AVE**	58.8%	60.8%

IAP Data - Online vs. Paper Homework		
CLASS PARTICIPATION		
	Online Class	Paper Class
Ave. Mark per student	2.4	4.47
FINAL GRADES		
	Online Class	Paper Class
	71.8	62.3

Appendix 4. Active Aspect – Teacher resource that was posted on the school district's website.

Rittman Faculty

I have recently completed a preliminary study about the use of online homework within the classroom. My results indicated that there was not a significant difference in completion rates between online and traditional (paper) homework assignments. I have made it an effort in my classroom to minimize the amount of paper that we use, and in the future I am trying to implement online homework in all of my classes. I am sharing this information with you all so that you can make an informed decision about using paper within the classroom. Below, I have added numerous (free!) websites that can be used for scholastic assignments, research, presentations, and much more. If anyone has any questions about my experiences in utilizing online environments for classroom assignments, feel free to ask.

List of useful, free online resources for the classroom:

Resource	***Location***
Google scholar – A web search engine that provides links to a wide array of scholarly literature. Good starting point for any student research project.	http://scholar.google.com/
OpenOffice – Word processing/publishing/PowerPoint for students that don't have access to these resources at home. Fully convertible into .doc files and can read Microsoft Office.	http://www.openoffice.org/
Weebly – Free website creation, easy design and use. Great for setting up a classroom website.	http://www.weebly.com/
Blogger – Free website creation, I found it less friendly than Weebly, but it is available nonetheless.	http://www.blogger.com/

Jing – Online website that allows users to create images and videos of what you see on your computer screen and share them with students. Good for posting lectures/discussions on class websites for students who have been absent or can be used as a reinforcement tool for students who were present.	http://www.techsmith.com/jing.html
Voicethread – Create videos and post them online. Can be used as an interactive classroom website for students to post videos, music, online lessons, etc.	http://voicethread.com/
YouTube – Place to post class videos or to assign educational student projects.	http://www.youtube.com/
Vimeo – Similar to YouTube, this is another online location to post class videos.	http://vimeo.com/
USGS Education – Great science resource for lesson ideas, videos, online lectures, and a lot more.	http://education.usgs.gov/
Purdue OWL – Provides useful examples and format for both MLA and APA citations. Great resource for students learning citation rules and for examples when assigning class research papers/projects.	http://owl.english.purdue.edu/owl/resource/560/01/