

Results of Testing with students from Columbus Public Schools and Hilliard City Schools

The test administered is included in the Edheads Simple Machines Teacher's Guide under the 'Printable Activities' section, known as the *Pre and Post-tests*.

The test was designed to determine the level of knowledge students had in:

1. recognizing a picture of a simple machine – **Page One**
2. recognizing the definition of a simple machine – **Page Two**
3. recognizing an example or application of a simple machine – **Page Three**

The test was administered to all test classes either immediately prior to using the site or the class period before (in some cases, this was the hour before, in others the day before). Students were told that the test was NOT for a grade, but were asked to do their best on it. This was to allay fears and alleviate frustrations for students that had not previously had any instruction on simple machines.

After using the site for a range of 10 to 40 minutes (students at the lower time range were only allowed to explore one "room"), the students were given the post-test either immediately following use of the site or in the class period after. For both pre and post tests, teachers were specifically instructed NOT to "teach to the test" or give instructions above and beyond logistical ones, such as time remaining to finish the test or clarification of instructions for each section. Approximately 325 students took both the pre and post-tests. These students were in grades 2 through 6. The majority had NOT had any simple machines instruction during the same school year. A minority of students tested had had instruction on simple machines during the early part of the school year, but none had any instruction within four months of the pre-test being administered.

Tests were scored by participating teachers and Edheads personnel. Questions that were skipped or left blank were counted as wrong. All tests were entered into a database that recorded right or wrong answers for each question. After a single use of the site (using one room or all rooms) students showed a 10.64% improvement in scores. The average score on the pre-test was 14.31 answers correct or 71.05% correct. The post-test average score was 16.34 answers or 81.69% correct. Average improvement was 2.03 questions answered correctly or 10.69% improvement. Participating teachers agreed that further use of the site would most likely improve scores further, and ALL students indicated a willingness to continue using the site, many asking for the URL to use at home or requesting the opportunity to further explore the site during class time or during study periods or free times during the day.

The results of the testing were very interesting comparing answers page by page. For **Page One**, many students confused the Inclined Plane and the Lever. Lower scoring students added Wedge into the confusion, with many missing all three. There was some justification for confusing the Wedge and Inclined Plane, as the graphics were similar. Teachers that had approved the test

realized after we began administering it that the Inclined Plane could be mistaken for the Wedge, if the student went too fast and didn't directly compare the two pictures, A and C. None of the participating teachers could understand the confusion with the Lever graphic, G, however, and believed this to be due to a true lack of understanding.

For **Page Two**, ESL students scored almost universally low and students in grades 2 and 3 scored significantly lower than those in grades 4 and 5. The majority of these lower scores can be directly attributed to lack of reading skills and/or comprehension abilities. The students that got the majority of these questions correct still tended to confuse Inclined Plane and Lever. This page was also interesting in that a number of students got the Screw confused with Inclined Plane or Lever, but scored relatively well on the Wedge. A further unexpected result was the small number of students that got 100% of these questions correct, but did very poorly on pages 1 and 3. Very few teachers anticipated this result or could explain it.

Page Three, where students were asked to match the name of a simple machine to an application of it brought further interesting results. There were students that did very poorly on pages one and two but got 100% of these questions correct. Interestingly enough, many students stumbled on Wheel and Axle on this page, confusing it with the example of the Wedge and Lever. Inclined Plane seemed to be much better understood on this page than on previous pages, although it is clearly the most misunderstood of the simple machines.

Results of testing by page and question (numbers indicate the % of correct answers):

	Page One							Page Two							Page Three					
Pre-Test	Pulley	Gear	W&A	Wedge	Incl. PI.	Lever	Screw	W&A	Pulley	Lever	Gear	Wedge	Screw	Incl. PI.	Incl. PI.	W&A	Wedge	Pulley	Screw	Lever
	89.39	81.67	81.67	60.13	61.09	65.92	94.21	76.53	87.14	65.27	76.85	72.35	68.81	65.92	76.53	65.92	59.16	85.85	73.31	53.38
Post-Test	Pulley	Gear	W&A	Wedge	Incl. PI.	Lever	Screw	W&A	Pulley	Lever	Gear	Wedge	Screw	Incl. PI.	Incl. PI.	W&A	Wedge	Pulley	Screw	Lever
	96.83	86.97	86.27	74.65	66.90	77.11	97.89	90.14	93.31	74.30	81.69	77.82	78.52	70.42	80.63	78.17	76.41	92.96	86.27	67.61
% Improvement	7.44	5.30	4.60	14.52	5.81	11.20	3.68	13.61	6.17	9.02	4.84	5.47	9.71	4.51	4.11	12.25	17.24	7.11	12.96	14.23

While the vast majority of students improved on the post-test, there did seem to be one student in every class that scored the same or 5-10 % lower (1-2 questions more wrong) than on the pre-test. Interestingly enough, all of these students were females. One male student scored the same on both pre-and post-tests. Again, we don't necessarily have an explanation for this, but thought it an interesting fact.

And the most misspelled simple machine? Pully...er...pulley, followed closely by weel and axl.