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Mastering Physics Education

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Mastering Physics Education

A Major Qualifying Project Report
Submitted to the Faculty of the
WORCESTER POLYTECHNIC INSTITUTE
in partial fulfillment of the requirements for the
Degree of Bachelor of Science
in
Physics
by

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APPROVED:

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Physics

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Abstract

The objective of this Major Qualifying Project was to determine any areas for improvement or to find any interesting patterns to make the Mastering Physics software used for the introductory physics classes more effective. This was accomplished by writing a PHP script to analyze the data gathered from the Mastering Physics software. Using this software we were able to easily see some patterns with regards to what conference times appeared to produce the highest grades on the Mastering Physics assignments. This data can be used in the future to help choose more effective conference times for the students.

Chapter I: Introduction

In this project we looked at the current software used to aid in teaching the introductory physics classes, Mastering Physics(<http://www.masteringphysics.com/>). Mastering Physics is an online software tool that allows students to complete homework assignments and receive their results immediately. The software also has the ability to give students hints that help lead them to the correct thought process so that they can solve the problems. The software and assignments can be used to compliment regular assignments or it can be used to introduce new material, which is how it is used at WPI. We looked for any patterns in the data to find ways to make the Mastering Physics experience as useful as possible as a learning tool.

The idea for this project came from many years of hearing students complain about the shortcomings of the current system. Very few students had anything good to say about Mastering Physics, but little in terms of ways to improve it. We surveyed students currently taking an introductory class to gauge their opinion of the software and see what they had to say. We also looked at the data that is gathered by Mastering Physics to see what patterns, if any, we could find between conference groups/assignments/classes.

Chapter II: Method

One of the largest obstacles was getting the data from Mastering Physics into another format that would allow it to be analyzed and to view reports on it in a robust fashion. Mastering Physics offers some reports but they are not very robust and are very cluttered. One of the major areas that the Mastering Physics reporting lacked in was the ability to view the averages without the grades/times/difficulty ratings that were zero. This feature is a very important one as it gives a better idea of how the students that actually took the assignments did.

The solution we developed to provide the reports that we needed was to export all of the data using Mastering Physics software into a CSV file to use in an upload/import into our own MySQL database so we could create our own reports. Then we had to create the database schema (APPENDIX) for the tables so that we could import the data. Next was to write the PHP files that we were going to use for the uploads (APPENDIX). Before we could upload the files we had to sanitize the CSV files first by removing extraneous rows/columns. We did this by removing the first four rows as they were just heading information which would be taken care of in our database. Then we had to remove the last column as it was averages and we would be calculating our own averages and didn't need theirs. Finally we removed the last 2 rows as they were also averages which we did not need.

Now we upload the file using the correct page, times.php, difficulty.php or scores.php. We have the query that needs to be run printed out on the screen so that we can manually run it as there is still some massaging that needs to be done. The final piece of massaging left to the uploaded file is to add an empty column at the beginning of each line so that an auto-incremented value can be added to ensure that each row is unique in the database. Next we added a column to the end of each line of data that has the section that that data is for so that we know what data comes from what class. Then we executed the query so that we could get the data into the database.

Now that the data was in the database it was just simply writing some SQL to generate the reports that we wanted to see. Since we wanted to look at the relationships between the groups and between each assignment we wrote another PHP scrip (APPENDIX) that prints out the query, so that we can save it and it prints out the values so that we could make tables with it.

The final step was to analyze the data and to look for patterns in the results. We did this by comparing the data between different categories and the same classes as well as between different categories and different classes. We also compared the data between the same categories with different classes as well as the same categories with the same classes. We were able to find many interesting and surprising results.

Chapter III: Data

The data we used for our analysis was gathered from two classes regarding mechanics(PH1110A09 and PH1110C09) and one class regarding Electricity and Magnetism(PH1120B09). Each group corresponds to a conference section of the class, PH1120 and PH1110 were larger classes and as such had more conference times.

We compared the results with and without zeros to see what averages were achieved when we discounted the students that did not even attempt the assignments. There were 16 assignments given out each term with roughly 3 a week being assigned. When students completed each assignment they were given the option to give it a difficulty rating from 1(not very difficult) to a 5(very difficult). We were also able to get data regarding the time it took students to complete each assignment. This data is not quite as useful as one might expect due to the method with which it is gathered and how we can't keep track if a student gets up and leaves their computer for a few minutes and then comes back. So while we included the data it should be known that it is the least reliable.

The highest average grades in order of group without zeros was

All		PH1110A09		PH1110C09		PH1120B09	
Group	Scores	Group	Scores	Group	Scores	Group	Scores
3	95.3	5	95.2	5	95.7	9	95.9
5	95.2	3	94.6	3	95.5	3	95.7
14	94.6	11	94.2	4	95.3	14	95.1
2	94.2	14	94.2	6	95.2	6	95.0
7	94.0	10	93.8	7	95.1	12	94.8
6	93.9	2	93.7	2	94.2	5	94.8
10	93.8	1	93.2	0	91.3	2	94.7
12	93.2	7	92.6	1	90.1	13	94.4
4	93.0	0	92.0	8	90.0	7	94.3
11	92.8	6	91.6	9	87.3	8	94.2
13	92.8	12	91.5			0	94.2
0	92.5	13	91.1			10	93.9
1	91.3	9	90.6			4	93.8
9	91.3	4	89.8			11	91.4
8	90.3	8	86.7			1	90.9

The highest average grades in order of groups with zeros

All		PH1110A09		PH1110C09		PH1120B09	
Group	Score	Group	Score	Group	Score	Group	Score
3	93.9	3	93.7	3	95.2	10	92.9
5	92.0	11	93.2	5	94.1	3	92.9
10	91.0	5	92.2	6	91.7	9	92.3
11	88.7	9	89.4	4	90.9	5	89.8
6	88.4	10	89.1	2	88.1	12	87.9
2	87.6	2	88.9	7	84.2	7	87.5
12	87.3	14	88.8	8	81.2	4	86.2
14	87.0	6	87.6	1	80.6	6	85.9
4	86.2	12	86.7	9	75.5	2	85.8
9	85.7	1	85.5	0	72.4	13	85.4
7	85.2	7	83.8			14	85.2
13	84.2	13	82.9			11	84.1
1	82.5	4	81.5			8	82.2
8	79.9	0	79.5			1	81.4
0	76.7	8	76.2			0	78.3

The average grade for each assignment without zeros

All		PH1110A09		PH1110C09		PH1120B09	
Assignment	Score	Assignment	Score	Assignment	Score	Assignment	Score
2	96.5	2	98.0	2	98.3	3	96.6
8	96.0	8	97.0	8	97.8	16	96.2
3	94.9	14	94.3	12	96.8	12	96.1
10	94.3	6	93.9	6	95.8	10	96.1
12	94.1	3	93.7	10	94.8	13	95.9
4	93.3	9	92.4	3	93.8	1	95.6
5	93.3	11	92.4	4	93.6	5	94.4
1	93.2	4	92.2	9	93.0	4	94.2
9	92.9	5	92.2	5	92.9	11	93.9
11	92.8	10	92.2	1	92.6	9	93.9
6	92.6	1	91.3	11	91.6	2	93.7
14	92.4	12	91.2	15	91.4	8	93.8
16	92.4	16	92.2	14	91.1	7	93.4
7	90.9	7	91.2	13	89.8	14	92.4
13	90.8	15	88.6	16	88.7	15	92.0
15	90.7	13	86.8	7	88.5	6	89.2

The average grade for each assignment with zeros was

All		PH1110A09		PH1110C09		PH1120B09	
Assignment	Scores	Assignment	Scores	Assignment	Scores	Assignment	Scores
2	91.8	2	95.6	2	92.8	1	92.9
3	91.1	8	92.9	8	89.3	3	92.5
1	89.8	3	91.4	1	87.8	5	89.6
8	89.7	6	91.1	4	87.5	13	88.8
4	88.4	4	88.7	6	86.7	12	88.5
5	88.0	14	88.2	3	86.5	4	88.0
6	87.9	1	87.6	5	86.4	11	87.5
12	87.1	7	87.5	10	86.1	2	86.5
11	85.9	11	87.4	12	85.9	8	86.1
9	84.7	9	86.9	15	82.3	16	86.1
10	84.7	5	86.5	11	80.5	10	85.9
14	84.6	12	85.8	9	79.6	9	85.4
13	84.0	10	82.0	13	79.2	14	85.0
7	83.4	13	81.6	7	78.5	6	84.1
16	81.3	16	78.2	14	78.0	7	83.0
15	78.1	15	77.2	16	77.9	15	75.8

The average grade for each assignment grouped by time of conference without zeros

All		PH1110A09		PH1110C09		PH1120B09	
Time	Scores	Time	Scores	Time	Scores	Time	Scores
11	95.3	11	94.6	2	95.7	3	95.9
9	94.2	2	94.2	11	95.5	11	95.7
3	93.9	12	93.8	1	95.3	9	94.8
12	93.8	9	93.7	3	95.2	1	94.7
2	93.8	8	92.5	9	94.2	8	94.3
8	93.4	10	92.4	10	91.8	0	94.2
1	93.1	0	92.0	0	91.3	12	93.9
0	92.5	1	90.9	4	87.3	10	93.3
10	92.5	3	90.6			2	91.4
4	87.3						

The average grade for each assignment grouped by time of conference with zeros

All		PH1110A09		PH1110C09		PH1120B09	
Time	Scores	Time	Scores	Time	Scores	Time	Scores
11	93.9	11	93.7	11	95.2	12	92.9
3	91.1	2	93.2	2	94.1	11	92.9
12	91.0	3	89.4	3	91.7	3	92.3
2	90.5	12	89.1	1	90.9	9	89.8
9	89.0	9	88.9	9	88.1	8	86.0
8	86.4	8	86.9	10	82.0	10	85.6
1	85.0	10	85.4	4	75.5	1	84.7
10	84.3	1	83.9	0	72.4	2	84.1
0	76.7	0	79.5			0	78.3
4	75.5						

TIMES

The average time taken to complete each assignment in order of group without zeros

All		PH1110A09		PH1110C09		PH1120B09	
Group	Time	Group	Time	Group	Time	Group	Time
10	47.59	11	55.99	2	55.40	10	40.54
2	47.43	5	54.75	9	55.08	4	37.85
5	45.85	10	53.79	5	54.39	2	33.87
11	45.38	14	53.45	1	52.82	3	33.28
1	44.27	6	52.49	3	50.74	11	33.00
6	44.01	2	52.38	8	48.53	5	31.79
7	43.70	0	51.00	6	48.33	6	31.29
4	43.50	4	50.67	7	44.39	12	30.51
3	43.47	1	50.63	0	41.71	13	29.76
14	41.43	9	49.45	4	41.14	1	29.53
9	41.39	7	48.14			0	29.41
0	40.73	3	47.57			9	28.59
13	39.26	13	46.39			14	27.59
12	38.69	12	46.06			7	27.27
8	38.50	8	42.25			8	26.64

The average time taken to complete each assignment order by group with zeros

All		PH1110A09		PH1110C09		PH1120B09	
Group	Time	Group	Times	Group	Times	Group	Times
10	45.967	11	55.86	5	53.50	10	40.42
5	45.639	5	53.10	2	51.99	4	35.88
2	44.307	10	51.52	3	50.60	3	32.66
3	43.451	14	50.90	9	47.99	2	30.98
11	43.345	6	50.29	1	47.91	11	30.83
6	41.880	2	49.95	6	46.77	5	30.32
9	41.445	9	48.68	8	44.42	12	28.75
1	40.882	1	47.49	7	40.16	6	28.59
4	40.453	3	47.09	4	39.38	9	27.66
14	38.173	4	46.10	0	34.15	13	27.32
7	36.848	7	44.47			1	27.25
12	36.359	0	44.23			0	25.95
8	35.430	12	43.97			7	25.91
13	35.296	13	43.27			14	25.44
0	34.775	8	38.34			8	23.53

The average time taken to complete each assignment without zeros

All		PH1110A09		PH1110C09		PH1120B09	
Assignment	Time	Assignment	Time	Assignment	Time	Assignment	Time
1	63.50	10	70.13	1	78.99	1	52.75
3	53.77	13	68.87	5	61.27	9	38.86
10	51.24	3	68.69	10	59.55	8	38.60
13	49.64	1	63.92	3	58.14	5	37.47
8	44.78	7	55.35	8	52.83	3	35.93
5	44.61	15	54.46	13	52.46	4	35.32
4	43.53	6	48.26	4	50.28	14	32.21
7	41.81	11	48.15	11	40.23	6	30.18
11	40.98	4	47.23	7	45.61	13	28.54
15	40.67	14	45.64	15	44.43	11	27.64
14	40.14	8	45.59	14	43.78	2	27.53
9	39.45	12	43.37	9	43.24	10	26.81
6	38.80	2	40.69	2	43.02	7	25.74
2	36.34	5	40.65	6	37.54	12	24.85
12	34.72	9	37.51	12	36.54	15	24.37
16	23.41	16	26.82	16	30.13	16	15.52

The average time taken to complete each assignment with zeros

All		PH1110A09		PH1110C09		PH1120B09	
Assignment	Time s	Assignmen t	Time	Assignmen t	Time	Assignmen t	Time
1	61.60	3	67.76	1	75.51	1	51.58
3	52.32	13	64.78	5	57.76	5	35.83
10	46.81	10	63.15	10	55.66	8	35.78
13	46.25	1	62.35	3	55.47	9	35.64
5	42.43	7	53.55	8	49.35	3	34.79
8	42.18	15	47.53	4	48.03	4	33.28
4	41.68	6	46.87	13	47.82	14	29.93
7	39.35	11	46.01	11	44.88	6	28.81
11	38.30	4	45.83	7	42.05	13	26.67
6	37.06	8	43.80	2	41.23	11	26.20
14	36.96	14	42.61	15	40.51	2	26.18
9	36.52	12	41.10	14	39.01	10	24.56
15	35.84	2	39.90	9	38.92	7	23.35
2	35.09	5	38.82	6	34.74	12	23.29
12	32.54	9	35.82	12	33.58	15	21.03
16	20.52	16	23.06	16	26.50	16	14.00

The average time taken to complete each assignment grouped by time of conference with zeros was

All		PH1110A09		PH1110C09		PH1120B09	
Time	Time s	Time	Time s	Time	Time s	Time	Time s
4	47.99	2	55.86	2	53.50	12	40.42
2	46.73	12	51.52	9	51.99	8	33.43
12	45.97	9	49.95	11	50.60	11	32.66
9	44.09	8	49.60	4	47.99	2	30.83
11	43.45	3	48.68	3	46.77	9	30.32
8	41.51	11	47.09	10	44.16	3	27.66
3	41.04	1	45.70	1	39.38	10	27.30
10	38.93	10	45.31	0	34.15	1	26.22
1	36.34	0	44.23			0	25.95
0	34.78						

The average time taken to complete each assignment grouped by time of conference without zeros was

All		PH1110A09		PH1110C09		PH1120B09	
Time	Time	Time	Time	Time	Time	Time	Time
e	s		s		s		s
4	55.08	2	55.99	9	55.40	12	40.54
2	47.79	12	53.79	4	55.08	8	35.86
12	47.17	8	52.71	2	54.39	11	33.28
9	46.52	9	52.38	11	50.74	2	33.00
8	44.28	0	51.00	10	48.58	9	31.79
11	43.86	3	49.45	3	48.33	0	29.41
3	42.12	1	48.65	0	41.71	10	29.10
10	41.99	10	48.28	1	41.14	1	28.82
0	40.70	11	47.57			3	28.59
1	39.00						

DIFFICULTY

The average rating for difficulty without zeros was

All		PH1110A09		PH1110C09		PH1120B09	
Group	Difficulty	Group	Difficulty	Group	Difficulty	Group	Difficulty
p	y		y		y		y
11	2.07	11	2.14	1	2.13	11	2.00
1	2.01	9	2.13	2	1.97	10	1.90
10	1.92	8	2.13	9	1.93	4	1.84
9	1.91	4	2.11	3	1.90	1	1.82
13	1.90	1	2.03	0	1.88	13	1.80
0	1.88	6	2.01	7	1.87	5	1.76
4	1.87	13	2.00	5	1.83	0	1.75
8	1.83	0	2.00	8	1.77	6	1.74
2	1.83	10	1.93	6	1.76	2	1.71
6	1.83	7	1.89	4	1.64	12	1.71
5	1.79	14	1.83			9	1.67
7	1.79	2	1.83			3	1.66
3	1.78	12	1.83			8	1.62
12	1.77	3	1.78			7	1.61
14	1.72	5	1.77			14	1.61

The average rating for difficulty grouped by group with zeros was

All		PH1110A09		PH1110C09		PH1120B09	
Group	Difficulty	Group	Difficulty	Group	Difficulty	Group	Difficulty
11	2.00	11	2.13	1	1.92	10	1.90
10	1.87	9	2.11	3	1.89	11	1.86
1	1.83	8	1.93	2	1.85	4	1.75
9	1.82	4	1.92	5	1.79	1	1.68
3	1.76	6	1.91	6	1.70	5	1.67
13	1.76	1	1.89	9	1.68	13	1.65
4	1.74	13	1.86	7	1.67	3	1.63
6	1.73	10	1.85	8	1.60	12	1.61
5	1.73	3	1.76	4	1.56	9	1.61
2	1.72	7	1.75	0	1.52	6	1.58
12	1.68	2	1.75			2	1.57
8	1.66	12	1.75			0	1.54
7	1.65	0	1.74			7	1.53
14	1.61	14	1.74			14	1.47
0	1.60	5	1.71			8	1.43

The average rating for difficulty for each assignment grouped by assignment without zeros was

All		PH1110A09		PH1110C09		PH1120B09	
Assignment	Difficulty	Assignment	Difficulty	Assignment	Difficulty	Assignment	Difficulty
7	2.48	7	2.93	7	2.71	1	2.14
13	2.23	5	2.64	13	2.52	3	2.11
9	2.23	15	2.63	15	2.40	9	2.07
5	2.20	13	2.47	5	2.30	4	2.06
15	2.15	9	2.36	9	2.24	14	1.94
14	1.97	12	2.14	14	1.97	10	1.89
1	1.86	14	2.00	11	1.91	7	1.88
4	1.83	6	1.89	12	1.85	2	1.84
12	1.77	11	1.87	6	1.72	13	1.80
11	1.77	1	1.72	4	1.68	5	1.69
3	1.76	4	1.70	1	1.65	8	1.67
10	1.74	10	1.70	10	1.62	11	1.57
6	1.60	3	1.55	3	1.54	15	1.49
2	1.43	16	1.44	16	1.31	12	1.35
8	1.37	2	1.22	8	1.31	16	1.23
16	1.33	8	1.11	2	1.14	6	1.22

The average rating for difficulty for each assignment grouped by assignment with zeros was

All		PH1110A09		PH1110C09		PH1120B09	
Assignment	Difficulty	Assignment	Difficulty	Assignment	Difficulty	Assignment	Difficulty
7	2.32	7	2.83	7	2.49	1	2.09
5	2.09	5	2.52	13	2.29	3	2.04
13	2.07	13	2.31	15	2.20	4	1.95
9	2.06	15	2.29	5	2.16	9	1.91
15	1.90	9	2.25	9	2.00	14	1.80
14	1.81	12	2.03	14	1.75	2	1.75
1	1.81	14	1.86	11	1.70	10	1.73
4	1.75	6	1.84	12	1.69	7	1.70
3	1.71	11	1.79	4	1.60	13	1.68
12	1.66	1	1.68	6	1.59	5	1.61
11	1.65	4	1.65	1	1.57	8	1.54
10	1.59	3	1.53	10	1.51	11	1.49
6	1.52	10	1.52	3	1.47	15	1.30
2	1.37	16	1.29	8	1.21	12	1.27
8	1.28	2	1.19	16	1.17	6	1.16
16	1.20	8	1.06	2	1.09	16	1.10

The average rating for difficulty for each assignment grouped by time of conference with zeros

All		PH1110A09		PH1110C09		PH1120B09	
Time	Difficulty	Time	Difficulty	Time	Difficulty	Time	Difficulty
2	1.93	2	2.13	11	1.89	12	1.90
12	1.87	3	2.11	9	1.85	2	1.86
3	1.80	1	1.86	2	1.79	9	1.67
11	1.76	12	1.85	10	1.73	8	1.66
9	1.76	8	1.82	3	1.70	11	1.63
8	1.74	10	1.79	4	1.68	3	1.61
10	1.71	11	1.76	1	1.56	10	1.61
1	1.68	9	1.75	0	1.52	0	1.54
4	1.68	0	1.74			1	1.53
0	1.60						

The average rating for difficulty for each assignment grouped by time of conference without zeros

All		PH1110A09		PH1110C09		PH1120B09	
Time	Difficulty	Time	Difficulty	Time	Difficulty	Time	Difficulty
2	1.99	2	2.14	9	1.97	2	2.00
4	1.93	3	2.13	4	1.93	12	1.90
12	1.92	0	2.00	10	1.92	8	1.78
0	1.88	1	1.99	11	1.90	9	1.76
8	1.86	8	1.94	0	1.88	0	1.75
10	1.86	12	1.93	2	1.83	10	1.72
3	1.85	10	1.92	3	1.76	1	1.69
9	1.85	9	1.83	1	1.64	3	1.67
1	1.82	11	1.78			11	1.66
11	1.78						

Chapter IV: Analysis

After collecting all of the data and analyzing it some very interesting patterns can be noticed. One of the most striking facts that can be gleaned from the data is the correspondence between time of conference and the average grade achieved on the mastering physics assignments. There is one time that clearly outperforms all others across all 3 terms, the 11am conference time. On the other hand there are also a few time slots that perform very poorly across all 3 terms, namely the 10am conference slot. The only time to perform worse than the 10am slot was the 4pm conference time, but that conference was only held in one of the 3 terms so there is not as much data there as for the other times.

Another interesting pattern that emerged was between the assignment number, term, class and average score achieved on the assignment. When you look at the grades on each assignment including all zero grades in both PH1110 classes you get pretty much what one would expect, the higher averaging assignment are predominantly the first 7 assignments and the lower averaging are the last 8. But for PH1120 there is a different story; there are far more assignments that occurred later in the term in the top half of the higher averaging assignments. When you look at the average scores on each assignment without counting all of the zero grades, a different pattern emerges. There are far more of the later half assignments in the top half of the highest grades, but still the lower average grades are still predominantly from the second halves assignments.

A similar pattern holds true for the average difficulty as reported by the students for the assignments for each term. For the PH1110 classes as expected the higher numbered assignments were rated as being more difficult, but once again the PH1120 assignments were reversed in their rating. The predominance of the first half of the assignments were rated as being more difficult than the second half.

Surprisingly enough there did not seem to be any correlation between the difficulty of the assignment as reported by students and the grade received when compared with time taken for each assignment. It almost appears that the harder the assignment was the less time the students took on it, of course there are some exceptions to this. Assignment 13 had one of the highest difficulty ratings while also taking a more than average time to complete and students performed very poorly compared to the other assignments. This is interesting as it implies that the more difficult the assignment is instead of the students taking a longer time to complete it to achieve a good grade they are willing to sacrifice the grade for less time spent on the assignment. While it may seem counterintuitive, if the problems were easier perhaps the students would get more out of them because they would be willing to spend the time to actually solve the problem and in doing so actually learn the material.

One expected result that we see is in the grades received on each assignment when we include the scores of 0. The decline in grades is very dramatic and the assignments are split almost exactly in half, with the largest difference being 12.6 points, from a 90.7 to a 78.1, in assignment 15. This is most likely due to the students not finding a need to actually complete the assignments and therefore deciding it is not worth their time. The steady decline in grades over the duration of the course leads us to this conclusion.

Additional patterns emerge when you view the grades received compared with time taken and difficulty when grouped by conference time. An interesting one being the 1pm conference time, they had one of the lower grade averages, when you only consider grades above a 0, yet they spent the least amount of time and found the assignments to be very easy.

One of the more interesting findings is one regarding the average grade received on each assignment when the scores of 0 were and were not included. When you look at the average grade without zeros you see that the lowest is a 90.7. From this, it appears that those who actually take the time to do the assignments do very well on them.

Some interesting patterns emerge as well between the two classes, PH1110 and PH1120. The average time taken to complete each assignment between the two classes was drastic, with the PH1120 assignments taking much less time on average to complete. In addition to taking less time to complete the students found the PH1120 work to be easier. The average difficulty for the A and C term PH1110 classes was 1.96 and 1.87 with the PH1120 class having a difficulty rating of only 1.75, excluding all values of 0.

There was not enough data to feasibly determine if there was any discrepancy between the perceived average difficulty by the groups between the two classes, but there was a sharp contrast between the time taken on each assignment by each group between the the PH1110 and PH1120 classes. The PH1110 A&C groups averaged 50.33 and 49.25 on each assignment while the PH1120 groups averaged 31.39 minutes on each assignment (times were calculated using only values greater than 0).

The lower perceived difficulty and shorter time spent on each assignment by each group between the two classes also appears to be correlated to the average grade received by each group. For the PH1110 A&C term classes the average grades received by each group were 92.32 and 92.97 and the average grade received by each group for the PH1120 class was 94.21, excluding all values of 0.

One of the issues that we ran in to was the fact that Mastering Physics had just recently upgraded their system and had no historic data that we could use. This limited us to the three terms that this project

took place over. While we were able to gather enough data to make some conclusions, had we had more historic data or more time to conduct the project over we may have been able to see other patterns that developed, or seen that some of the patterns we think we saw were in fact just anomalies.

The scripts that I wrote have been commented thoroughly and completely so that any future work that might be done in this area can use them to save on time. Also if work is done on this in the future hopefully they will be able to get access to historic data so their sampling size will be somewhat more reasonable so that the conclusions they draw will have more substance behind them. It would also be interesting to see what if any changes occur if the results found here are implemented. Hopefully even with our limited data set the results we found hold true and some benefit can be passed on to the students.

Chapter V: Conclusion

In analyzing this data we came upon some important conclusions, namely which times appeared to be best suited to hold conferences during, and conversely which ones appeared to be the least effective. Another interesting pattern we found was between the grades achieved on each assignment with relation to when in the term the assignment was, we found that for the PH1120 class the later in the term the assignment was the better students did on it.

The biggest issue hindering this project was the lack of data with which to analyze. If any work is done on this in the future hopefully those individuals don't run in to the same issue regarding Mastering Physics having just undergone a recent upgrade and subsequently having no historic data.

Appendix

1 TABLE SCHEMATA FOR IMPORTS

Below is the SQL that is needed to create the tables that we were going to store our data in.

```
CREATE TABLE `masteringphysics`.`scores` (  
  `scoresId` INTEGER(10) UNSIGNED NOT NULL AUTO_INCREMENT,  
  `firstName` VARCHAR(225) DEFAULT NULL,  
  `lastName` VARCHAR(225) DEFAULT NULL,  
  `studentId` VARCHAR(45) DEFAULT NULL,  
  `loginName` VARCHAR(225) DEFAULT NULL,  
  `email` VARCHAR(225) DEFAULT NULL,  
  `groups` VARCHAR(5) DEFAULT NULL,  
  `intro` VARCHAR(1) DEFAULT NULL,  
  `assignment1` INTEGER UNSIGNED DEFAULT NULL,  
  `assignment2` INTEGER UNSIGNED DEFAULT NULL,  
  `assignment3` INTEGER UNSIGNED DEFAULT NULL,  
  `assignment4` INTEGER UNSIGNED DEFAULT NULL,  
  `assignment5` INTEGER UNSIGNED DEFAULT NULL,  
  `assignment6` INTEGER UNSIGNED DEFAULT NULL,  
  `assignment7` INTEGER UNSIGNED DEFAULT NULL,  
  `assignment8` INTEGER UNSIGNED DEFAULT NULL,  
  `assignment9` INTEGER UNSIGNED DEFAULT NULL,  
  `assignment10` INTEGER UNSIGNED DEFAULT NULL,  
  `assignment11` INTEGER UNSIGNED DEFAULT NULL,  
  `assignment12` INTEGER UNSIGNED DEFAULT NULL,  
  `assignment13` INTEGER UNSIGNED DEFAULT NULL,  
  `assignment14` INTEGER UNSIGNED DEFAULT NULL,
```

```
`assignment15` INTEGER UNSIGNED DEFAULT NULL,  
`assignment16` INTEGER UNSIGNED DEFAULT NULL,  
`chapter2` INTEGER UNSIGNED DEFAULT NULL,  
`chapter3` INTEGER UNSIGNED DEFAULT NULL,  
`chapter4` INTEGER UNSIGNED DEFAULT NULL,  
`chapter5` INTEGER UNSIGNED DEFAULT NULL,  
`chapter6` INTEGER UNSIGNED DEFAULT NULL,  
`chapter7` INTEGER UNSIGNED DEFAULT NULL,  
PRIMARY KEY (`scoresId`)  
)  
ENGINE = InnoDB;
```

```
CREATE TABLE `masteringphysics`.`times` (  
  `timesId` INTEGER(10) UNSIGNED NOT NULL AUTO_INCREMENT,  
  `firstName` VARCHAR(225) DEFAULT NULL,  
  `lastName` VARCHAR(225) DEFAULT NULL,  
  `studentId` VARCHAR(45) DEFAULT NULL,  
  `loginName` VARCHAR(225) DEFAULT NULL,  
  `email` VARCHAR(225) DEFAULT NULL,  
  `groups` VARCHAR(5) DEFAULT NULL,  
  `intro` VARCHAR(1) DEFAULT NULL,  
  `assignment1` INTEGER UNSIGNED DEFAULT NULL,  
  `assignment2` INTEGER UNSIGNED DEFAULT NULL,  
  `assignment3` INTEGER UNSIGNED DEFAULT NULL,  
  `assignment4` INTEGER UNSIGNED DEFAULT NULL,  
  `assignment5` INTEGER UNSIGNED DEFAULT NULL,
```

```
`assignment6` INTEGER UNSIGNED DEFAULT NULL,  
`assignment7` INTEGER UNSIGNED DEFAULT NULL,  
`assignment8` INTEGER UNSIGNED DEFAULT NULL,  
`assignment9` INTEGER UNSIGNED DEFAULT NULL,  
`assignment10` INTEGER UNSIGNED DEFAULT NULL,  
`assignment11` INTEGER UNSIGNED DEFAULT NULL,  
`assignment12` INTEGER UNSIGNED DEFAULT NULL,  
`assignment13` INTEGER UNSIGNED DEFAULT NULL,  
`assignment14` INTEGER UNSIGNED DEFAULT NULL,  
`assignment15` INTEGER UNSIGNED DEFAULT NULL,  
`assignment16` INTEGER UNSIGNED DEFAULT NULL,  
`chapter2` INTEGER UNSIGNED DEFAULT NULL,  
`chapter3` INTEGER UNSIGNED DEFAULT NULL,  
`chapter4` INTEGER UNSIGNED DEFAULT NULL,  
`chapter5` INTEGER UNSIGNED DEFAULT NULL,  
`chapter6` INTEGER UNSIGNED DEFAULT NULL,  
`chapter7` INTEGER UNSIGNED DEFAULT NULL,  
PRIMARY KEY (`timesId`)  
)
```

```
ENGINE = InnoDB;
```

```
CREATE TABLE `masteringphysics`.`difficulty` (  
  `difficultyId` INTEGER(10) UNSIGNED NOT NULL AUTO_INCREMENT,  
  `firstName` VARCHAR(225) DEFAULT NULL,  
  `lastName` VARCHAR(225) DEFAULT NULL,  
  `studentId` VARCHAR(45) DEFAULT NULL,
```

`loginName` VARCHAR(225) DEFAULT NULL,
`email` VARCHAR(225) DEFAULT NULL,
`groups` VARCHAR(5) DEFAULT NULL,
`intro` VARCHAR(1) DEFAULT NULL,
`assignment1` INTEGER UNSIGNED DEFAULT NULL,
`assignment2` INTEGER UNSIGNED DEFAULT NULL,
`assignment3` INTEGER UNSIGNED DEFAULT NULL,
`assignment4` INTEGER UNSIGNED DEFAULT NULL,
`assignment5` INTEGER UNSIGNED DEFAULT NULL,
`assignment6` INTEGER UNSIGNED DEFAULT NULL,
`assignment7` INTEGER UNSIGNED DEFAULT NULL,
`assignment8` INTEGER UNSIGNED DEFAULT NULL,
`assignment9` INTEGER UNSIGNED DEFAULT NULL,
`assignment10` INTEGER UNSIGNED DEFAULT NULL,
`assignment11` INTEGER UNSIGNED DEFAULT NULL,
`assignment12` INTEGER UNSIGNED DEFAULT NULL,
`assignment13` INTEGER UNSIGNED DEFAULT NULL,
`assignment14` INTEGER UNSIGNED DEFAULT NULL,
`assignment15` INTEGER UNSIGNED DEFAULT NULL,
`assignment16` INTEGER UNSIGNED DEFAULT NULL,
`chapter2` INTEGER UNSIGNED DEFAULT NULL,
`chapter3` INTEGER UNSIGNED DEFAULT NULL,
`chapter4` INTEGER UNSIGNED DEFAULT NULL,
`chapter5` INTEGER UNSIGNED DEFAULT NULL,
`chapter6` INTEGER UNSIGNED DEFAULT NULL,
`chapter7` INTEGER UNSIGNED DEFAULT NULL,

```

PRIMARY KEY (`difficultyId`)
)
ENGINE = InnoDB;

ALTER TABLE `masteringphysics`.`difficulty` ADD COLUMN `section` VARCHAR(63) DEFAULT
null AFTER `chapter7`;

ALTER TABLE `masteringphysics`.`scores` ADD COLUMN `section` VARCHAR(63) DEFAULT null
AFTER `chapter7`;

ALTER TABLE `masteringphysics`.`times` ADD COLUMN `section` VARCHAR(63) DEFAULT null
AFTER `chapter7`;

ALTER TABLE `masteringphysics`.`scores` ADD COLUMN `time` VARCHAR(2) NOT NULL AFTER
`section`;

ALTER TABLE `masteringphysics`.`difficulty` ADD COLUMN `time` VARCHAR(2) NOT NULL
AFTER `section`;

ALTER TABLE `masteringphysics`.`times` ADD COLUMN `time` VARCHAR(2) NOT NULL AFTER
`section`;

```

THE PHP FILES NECESSARY FOR THE UPLOAD INTO THE MySQL DB

File Name: dbConnectMQP.php

```

<?php
//create a mysql connection so that we can access the data in the mysql database
$link = mysql_connect('localhost', 'mp', 'mp');
if (!$link)
{
    die('Could not connect: ' . mysql_error());
}
//select the appropriate database
mysql_select_db ('masteringphysics');
?>

```

File Name: Times.php

```
<?php
```

```
include 'dbConnectMQP.php';
```

```
//If the form/page has been submitted than we should run the code below
```

```
if(isset($_POST['submit']))
```

```
{
```

```
    //Make sure the file is in the correct format for upload
```

```
    if($_FILES["uploadFile"]["type"]== 'text/csv' || $_FILES["uploadFile"]  
["type"]=='application/vnd.ms-excel' || $_FILES["uploadFile"]["type"]=='text/comma-separated-values' ||  
$_FILES["uploadFile"]["type"]=='application/csv' || $_FILES["uploadFile"]["type"]=='application/excel '  
|| $_FILES["uploadFile"]["type"]=='application/vnd.msexcel')
```

```
    {
```

```
        move_uploaded_file($_FILES["uploadFile"]["tmp_name"], 'uploadtimes.csv');
```

```
        //Save the file locally so that we can upload it into MySql
```

```
    }
```

```
//This query imports the data into the database
```

```
$query = "
```

```
    LOAD DATA LOCAL INFILE 'C:/Program Files/Apache Software  
Foundation/Apache2.2/htdocs/uploadtimes.csv'
```

```
    INTO TABLE times
```

```
    FIELDS TERMINATED BY ','
```

```
    ENCLOSED BY '\"'
```

```
    LINES TERMINATED BY '\n'
```

```
";
```


//We echo out the query so that we can manually run the query after we do some more sanitizing of the uploaded file.

```
echo $query;
```

```
//This query fixes the data so that all of the groups are numbers and not letters
```

```
$query = 'UPDATE times SET groups = 0 WHERE groups = "zero";
```

```
mysql_query($query);
```

```
}
```

```
?>
```

```
<html>
```

```
<head>
```

```
<title>Upload File</title>
```

```
</head>
```

```
<body>
```

```
<!-- below is the form that accepts a csv file as input to upload into the database -->
```

```
<form action="<?php echo basename(__FILE__);?>" method="post" enctype="multipart/form-data" >
```

```
<div style="color: red; font-weight: bold; text-align: center;">Make sure to remove all average/total columns as well as all headers before uploading files.</div>
```

```
<table style="margin: auto;">
```

```
<tr>
```

```
<td style="text-align: center;">Upload a File</td>
```

```
</tr>
```

```
<tr>
```

```
<td><input type="file" name="uploadFile" id="uploadFile" /></td>
```

```
</tr>
```

```
<tr>
```

```
<td style="text-align: center;"><input type="submit" name="submit" value="Upload" id="submit" style="margin: auto;" /></td>
```

```
</tr>
</table>
</form>
</body>
</html>
```

File Name: Scores.php

```
<?php
include 'dbConnectMQP.php';

//If the form/page has been submitted then run the code below
if(isset($_POST['submit']))
{
    //Make sure the file is in the correct format for upload
    if($_FILES["uploadFile"]["type"]=='text/csv' || $_FILES["uploadFile"]
["type"]=='application/vnd.ms-excel' || $_FILES["uploadFile"]["type"]=='text/comma-separated-values' ||
$_FILES["uploadFile"]["type"]=='application/csv' || $_FILES["uploadFile"]["type"]=='application/excel '
|| $_FILES["uploadFile"]["type"]=='application/vnd.msexcel')
    {
        move_uploaded_file($_FILES["uploadFile"]["tmp_name"], 'uploadscores.csv');

        //Save the file locally so that we can upload it into MySQL
    }

    //This query imports the data into the database. Make sure that you change the local directory in
this query to the correct directory on your computer where the file is stored.

    $query = "
```

```
LOAD DATA LOCAL INFILE 'C:/Program Files/Apache Software  
Foundation/Apache2.2/htdocs/uploadscores.csv'
```

```
INTO TABLE scores
```

```
FIELDS TERMINATED BY ','
```

```
ENCLOSED BY '\"
```

```
LINES TERMINATED BY '\n'
```

```
";
```

```
//We echo out the query so that we can manually run the query after we do some more sanitizing  
of the uploaded file.
```

```
echo $query;
```

```
//This query fixes the data so that all of the groups are numbers and not letters
```

```
$query = 'UPDATE scores SET groups = 0 WHERE groups = "zero";
```

```
mysql_query($query);
```

```
}
```

```
?>
```

```
<html>
```

```
<head>
```

```
<title>Upload File</title>
```

```
</head>
```

```
<body>
```

```
<!-- below is the form that accepts a csv file as input to upload into the database -->
```

```
<form action="<?php echo basename(__FILE__);?>" method="post" enctype="multipart/form-data" >
```

```
<div style="color: red; font-weight: bold; text-align: center;">Make sure to remove all average/total  
columns as well as all headers before uploading files.</div>
```

```
<table style="margin: auto;">
```

```
<tr>
```

```

        <td style="text-align: center;">Upload a File</td>
    </tr>
    <tr>
        <td><input type="file" name="uploadFile" id="uploadFile" /></td>
    </tr>
    <tr>
        <td style="text-align: center;"><input type="submit" name="submit" value="Upload"
id="submit" style="margin: auto;" /></td>
    </tr>
</table>
</form>
</body>
</html>

```

File Name: Difficulty.php

```

<?php
include 'dbConnectMQP.php';

//If the form/page has been submitted then run the code below
if(isset($_POST['submit']))
{
    //Make sure the file is in the correct format for upload
    if($_FILES["uploadFile"]["type"]== 'text/csv' || $_FILES["uploadFile"]
["type"]=='application/vnd.ms-excel' || $_FILES["uploadFile"]["type"]=='text/comma-separated-values' ||
$_FILES["uploadFile"]["type"]=='application/csv' || $_FILES["uploadFile"]["type"]=='application/excel '
|| $_FILES["uploadFile"]["type"]=='application/vnd.msexcel')
    {

```

```
        move_uploaded_file($_FILES["uploadFile"]["tmp_name"], 'uploaddifficulty.csv');

        //Save the file locally so that we can upload it into MySQL
    }

    //This query imports the data into the database

    $query = "

        LOAD DATA LOCAL INFILE 'C:/Program Files/Apache Software
Foundation/Apache2.2/htdocs/uploaddifficulty.csv'

        INTO TABLE difficulty

        FIELDS TERMINATED BY ','

        ENCLOSED BY '\"

        LINES TERMINATED BY '\n'

        ";

    //We echo out the query so that we can manually run the query after we do some more sanitizing
of the uploaded file.

    echo $query;

    //This query fixes the data so that all of the groups are numbers and not letters

    $query = 'UPDATE difficulty SET groups = 0 WHERE groups = "zero"';

    mysql_query($query);

}

?>

<html>

<head>

<title>Upload File</title>

</head>

<body>
```

```

<!-- below is the form that accepts a csv file as input to upload into the database -->
<form action="<?php echo basename(__FILE__);?>" method="post" enctype="multipart/form-data" >
<div style="color: red; font-weight: bold; text-align: center;">Make sure to remove all average/total
columns as well as all headers before uploading files. </div>
<table style="margin: auto;">
    <tr>
        <td style="text-align: center;">Upload a File</td>
    </tr>
    <tr>
        <td><input type="file" name="uploadFile" id="uploadFile" /></td>
    </tr>
    <tr>
        <td style="text-align: center;"><input type="submit" name="submit" value="Upload"
id="submit" style="margin: auto;" /></td>
    </tr>
</table>
</form>
</body>
</html>

```

2 SCRIPT TO DISPLAY DATA FROM THE DATABASE

File Name: data.php

```

<?php
include 'dbConnectMQP.php';
//This decides if it should only look for 1 section or use both PH1110 sections for the query
if(!isset($_POST['mechanics']))
{

```

```

        $section = ((strlen($_POST['section'])) ? addslashes($_POST['section']) : NULL);
    }
else
{
        $section = 'PH1110A09" OR section = "PH1110C09';
    }

//This sets the other variables that can be used for the query
$zero = (($_POST['zero'] != 1) ? 0 : NULL);
$group = addslashes($_POST['group']);
$table = addslashes($_POST['table']);

//If the form/page has been submit then run the code below
if(isset($_POST['submit']))
{
        //This is the generic query that is used to get the data, it dynamically changes based on what input
        is given to it so that any possible outcome can be gathered using the same query.

        $query = 'select b.* FROM
    (
    SELECT AVG(aveTime) AS average, a.' . $group . ' FROM
    (
    SELECT AVG(assignment1) AS aveTime, groups, 1 AS assignment, time FROM ' . $table . ' WHERE
    TRUE ' . ((isset($section)) ? 'AND section = "' . $section . '"' : '') . ' ' . ((isset($zero)) ? 'AND assignment1
    <> ' . $zero : '') . ' GROUP BY groups, section

    UNION

    SELECT AVG(assignment2) AS aveTime, groups, 2 AS assignment, time FROM ' . $table . ' WHERE
    TRUE ' . ((isset($section)) ? 'AND section = "' . $section . '"' : '') . ' ' . ((isset($zero)) ? 'AND assignment2
    <> ' . $zero : '') . ' GROUP BY groups, section

    UNION

```

```
SELECT AVG(assignment3) AS aveTime, groups, 3 AS assignment, time FROM ' . $table . ' WHERE
TRUE ' . ((isset($section)) ? 'AND section = "' . $section . "" : ") . "' . ((isset($zero)) ? 'AND assignment3
<> ' . $zero : ") . ' GROUP BY groups, section
```

UNION

```
SELECT AVG(assignment4) AS aveTime, groups, 4 AS assignment, time FROM ' . $table . ' WHERE
TRUE ' . ((isset($section)) ? 'AND section = "' . $section . "" : ") . "' . ((isset($zero)) ? 'AND assignment4
<> ' . $zero : ") . ' GROUP BY groups, section
```

UNION

```
SELECT AVG(assignment5) AS aveTime, groups, 5 AS assignment, time FROM ' . $table . ' WHERE
TRUE ' . ((isset($section)) ? 'AND section = "' . $section . "" : ") . "' . ((isset($zero)) ? 'AND assignment5
<> ' . $zero : ") . ' GROUP BY groups, section
```

UNION

```
SELECT AVG(assignment6) AS aveTime, groups, 6 AS assignment, time FROM ' . $table . ' WHERE
TRUE ' . ((isset($section)) ? 'AND section = "' . $section . "" : ") . "' . ((isset($zero)) ? 'AND assignment6
<> ' . $zero : ") . ' GROUP BY groups, section
```

UNION

```
SELECT AVG(assignment7) AS aveTime, groups, 7 AS assignment, time FROM ' . $table . ' WHERE
TRUE ' . ((isset($section)) ? 'AND section = "' . $section . "" : ") . "' . ((isset($zero)) ? 'AND assignment7
<> ' . $zero : ") . ' GROUP BY groups, section
```

UNION

```
SELECT AVG(assignment8) AS aveTime, groups, 8 AS assignment, time FROM ' . $table . ' WHERE
TRUE ' . ((isset($section)) ? 'AND section = "' . $section . "" : ") . "' . ((isset($zero)) ? 'AND assignment8
<> ' . $zero : ") . ' GROUP BY groups, section
```

UNION

```
SELECT AVG(assignment9) AS aveTime, groups, 9 AS assignment, time FROM ' . $table . ' WHERE
TRUE ' . ((isset($section)) ? 'AND section = "' . $section . "" : ") . "' . ((isset($zero)) ? 'AND assignment9
<> ' . $zero : ") . ' GROUP BY groups, section
```

UNION

```
SELECT AVG(assignment10) AS aveTime, groups, 10 AS assignment, time FROM ' . $table . ' WHERE
TRUE ' . ((isset($section)) ? 'AND section = "' . $section . "" : ") . "' . ((isset($zero)) ? 'AND assignment10
<> ' . $zero : ") . ' GROUP BY groups, section
```

UNION


```

while($row = mysql_fetch_assoc($result))
{
    echo (($group == 'groups') ? $row['groups'] : (($group == 'time') ? $row['time'] :
    $row['assignment'])) . ', ' . number_format($row['average'],(($table == 'scores s') ? 1 : 2)) . ',';
}
echo '</div><br/><br/>';
}
?>

<html>
<head>
<title>Data</title>
</head>
<body>
<!-- below is the form that allows the user to choose what results they would like to have returned -->
<form method="post" action="<?php echo basename(__FILE__); ?>">
Difficulty: <input type="radio" value="difficulty d" name="table" />
Scores: <input type="radio" value="scores s" name="table" />
Times: <input type="radio" value="times t" name="table" />
<br />
Section: <input type="text" id="section" name="section" />
PH1110: <input type="checkbox" value="1" name="mechanics" id="mechanics" />
<br />
Zeros: <input type="radio" value="1" name="zero" />
No Zeros: <input type="radio" value="0" name="zero" />
<br />
Group By Group: <input type="radio" value="groups" name="group" />
Group By Assignment: <input type="radio" value="assignment" name="group" />

```

Group By time:

<input type="submit" value="submit" name="submit" id="submit" />

</form>

</body>

</html>

STUDENT RESPONSES ABOUT MASTERING PHYSICS

Some of the questions are quite difficult for students to reason out just after a few classes.

Sometimes the mastering physics homework is on something that has been covered yet in class.

I think that it's genuinely helpful. There are drawbacks to both using the book and using mastering physics, but I think that I enjoy using Mastering Physics because of its novelty. I prefer that over web work, personally, because of how Mastering Physics is set up. Most people hate it, and I can get frustrated with hang ups, such as not being helpful or poor organization of presented information, but overall, I think that in some ways it's better than the textbook because of the feedback and the method of teaching.

Mastering physics is helpful to a degree. However, sometimes the problems are hard to understand and I end up resulting to help from peers. Another problem is that once I am done with the Mastering Physics, I forget most of it because I wouldn't normally review an online assignment.

Mastering Physics is really helpful.

It seems to either be ahead of our lectures or behind... we always have to teach ourselves how to do it...

Feedback on book problems is less than useful

Mastering physics is much more complicated than the class is made out to be making it an unnecessary and wasteful tool in learning physics.

It is sometimes not related to what is seen in class

I wish MP would coincide better with the material we are learning. It doesn't seem to cover exactly what we have learned.

Questions/answers should have same variables that are used in the book: e.g. $i(\hat{}), j(\hat{}), k(\hat{})$ in book; $x(\hat{}), y(\hat{}), z(\hat{})$ in MP.

Mastering is helpful in that it, for the most part, gives the equations needed. But it's mostly testing algebra, and how well you can figure out the format, and not the physics. Mastering could be helpful if, and only if, it was integrated into the course more. Even if you get 100s on the Mastering, it doesn't help for the tests.

Need unlimited tries

While I prefer the hint system provided by MP for more difficult questions, the fact that it is coded in Flash makes it extremely unwieldy and difficult to use; it has a rather disturbing ability to drag my machine down to a halt even when nothing else is running, or even cause it to crash.

MP is a wonderful idea, and I like that, but the implementation is disgustingly horrid, and some form of replacement is needed.

MUST HAVE HINTS. Problems without hints are hazardous to my grade's health. I learn very well **WITH** hints.

If it could more directly relate to our tests it would help and if it wasn't so difficult

Mastering Physics is useful for its immediate feedback and is very helpful through its explanations. However, I think it is useful to also have general written homework.

Sometimes just because of little writing or punctuation mistakes the system doesn't accept the answers, that's really annoying. Other than that all the hints and questions are helpful.

Some of the problem sets cover topics that we have not been taught in class

The questions on the test typically come from the summary homework. I don't find mastering physics to be close to or related directly to the summary homework, and therefore it is not as useful.

I do not think there is any educational value to this program. It is simply extra work that is unnecessary. In my 4 years here I have not found a single person that has found this to be helpful. I wonder why it is still being used.

Absolutely sucks in every way shape and form highlight of the break will be never having to do another one. Answers are picky, wrong answer hints are ambiguous, everyone copies so most of the students don't learn anything. 3 x a week for PH1120 on top of everything else is way too much

I just get the hints wrong on purpose. It usually leads me to the correct answer. Not much thinking involved...Stinks when there aren't any hints though. 0.0

I google all of the answers and it is a huge waste of time.

It's entirely useless. After solving the questions I feel as though I haven't learned anything.