

# The Effect on Achievement of Using Emerging Technology in the Managerial Accounting Course

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## Abstract

Emerging technology gives us the ability to harness the power of the computer as a tool to improve student achievement. A comprehensive managerial accounting case-study, Light (Building Block of Accounting – A Managerial Perspective, *I See The Light*), has been created using these emerging technologies to create the following: a unique case for each student, an artificial intelligent grading modular, a twenty-four hours a day, seven days a week high speed feedback modular capable of providing unlimited feedback, all with no additional instructor resources. We can now provide students with an internet leaning tool never before possible. Based on previous studies, this tool may be able to improve students' attitude and performance. In this study, students downloaded Light from an internet site, <http://www.cybertext.com>, worked at their own pace and uploaded an answer sheet whenever they wanted feedback. Cybertext graded the students' solution every time they uploaded their work to the server, keeping the latest score as the case study score. A multiple regression analysis of the final exam score on the case study score and the number of uploads the students used was analyzed. This study rejected the null hypothesis stating that this case study has no affect on the student's performance in the final exam score, concluding that it has statistically significant effect on the student's performance in the course's final exam.

## Introduction and Literature Review

Technology creates an environment in which activities can be changed. Ehrmann (2001) indicated that technology by itself does not enhance learning; tools must be created which can harness the new technology. Computer based case studies, which have harnessed the technology of their time, have been successfully used in accounting over the last few decades. Friedman (1980) applied it to solving problems in Intermediate Accounting, Rushinek & Rushinek (1984) have applied it to Modeling, to CAD-CAM (1987), to financial planning (1988), and to the health care industry (2000). The unique aspect of the present study is the automated grading of multiple case studies uploads to a web server.

Rushinek, Rushinek & Stutz (1983) have demonstrated that Computer Based Training (CBT) can improve students' attitudes and performances. This case dealt with "Systems Quality Control through Measuring Users' Attitudes for Acquisition, Implementation,

Maintenance and Modification Decisions: An Empirical Analysis of Management by Exception," which is closely related to our current study of Managerial Accounting. Gelinas, Levy and Thibodeau concluded that successful integration of information technology requires its incorporation throughout the objectives of the course. Likewise, Rushinek, Rushinek, and Stutz (1985) studied the "Relationship of Computer Users' Performance to their Attitudes toward Interactive Software." In this study, students control the number of times that they upload the case to the web server. Due to the sense of control that the students have they should experience a gain in performance.

Rushinek and Rushinek (1986) show that "What Makes Users" of computer systems "happy," is a sense of control. The students' ability to upload their work to the server provides them with a sense of control that should enhance motivation and eventually performance.

Rushinek and Rushinek (1990) show how "Control through Standard Costs and Variance Analysis" affects "Performance Evaluation." Rushinek and Rushinek show the same pattern in the "Health Care Delivery and Professional Effectiveness" as it relates to "Surgical Performance & Decision Making", our current study applies the same principles to students' performance in the final exam of Managerial Accounting classes. This has been especially prominent in computer based training or computer assisted instructions. For example, Rushinek and Rushinek show that "User Participation in the Development of an Interactive Computer Assisted Instructional Task improves their performance and attitudes. "The Effects of Computer Assisted Instruction upon Computer Facility and Instructor Ratings," may also be positive due to the students' improved attitude and motivation (Rushinek and Rushinek, November 1981).

Based on these theories, this study sets the hypothesis that this case study will have a positive effect on the performance of students on the final exam. Or alternatively, the null hypothesis, the case study has no effect on the overall final exam score will be rejected at the .05 level of statistical confidence.

### **The Instrument**

Light (Building Block of Accounting – A Managerial Perspective, *I See The Light*) is a comprehensive managerial accounting case covering the major topics in a traditional managerial accounting class. Throughout the case, the owner of a children's lamp manufacturing company requests information from the students based upon last year's financial information and projected cost increases for the upcoming year. The students deliverables include: projected variable and fixed costs, cost volume relationships at different levels of net income, detailed budgets with changes in raw material and finished goods inventories, process costing, job order costing, variance analysis and capital budgeting.

### **Emerging Technology**

Through the use of emerging technology, there are important previously unavailable activities, which together enhance the learning experience. These include:

- Unique case for each student
- Artificial intelligent grading modular
- Immediate feedback 24/7
- Unlimited feedback

- No additional instructor resources

### **Unique Case for Each Student**

Traditionally students would purchase practice sets in the bookstore along with their textbooks. Mass production required that all the practice sets were identical. With the use of emerging technology the Light is available over the Internet. When the students register, the generating modular creates a unique case for each student. The Light's historical information is the same for all the students and is based upon information from a real lamp manufacturer. There are over sixty variables in the case. The generating modular seeds the selection process from the registration information. This uniqueness discourages students from copying other students' work. While any computer could be used to create the unique case the emerging technology, the universal availability of the internet, makes it feasible to deliver the unique case to the student in an acceptable time span, at an acceptable price.

### **Artificial Intelligent Grading Modular**

The case builds upon itself, from the simple to the more complex. In Part 1 of the case, the students are given historical data and unique projected increases for the upcoming year. Based upon that information they have to determine the total variable and total fixed costs for the following year. As illustrated in [Exhibit 1](#), Part 2 requires the students to use the total variable and total fixed costs, previously calculated in Part 1, to calculate the contribution margin (Sales – Total Variable Cost). The artificial intelligence built into the grading module gives the student credit for mastering topics based upon earlier incorrect answers, rather than just using a static answer key. For example, a student could be asked to determine the total variable cost and the contribution margin when the variable manufacturing costs were \$20.00, the variable selling costs were \$10.00 and the selling price was \$45.00. If the student incorrectly answered that the total variable cost was \$20.00 instead of \$30.00 and the contribution margin was \$25.00 instead of \$15.00 (\$45.00-\$30.00) the traditional answer key would score both answers incorrect. The artificial intelligence in the Light's grading module would score the \$20.00 total variable cost incorrect while using it to determine that the contribution margin of \$25.00 (\$45.00-\$20.00) was now the correct answer.

### **Immediate Feedback Twenty-Four Hours A Day, Seven Days A Week**

In the traditional environment the instructor would collect all of the cases at the end of the semester. The student would receive feedback once, at the end of the semester. With the emerging technology the server grades the cases. Since the server is always available, students can obtain feedback on demand. The speed of transmitting the upload has been increased and transmittal errors decreased by transferring a small 24K answer file instead of the whole case. As shown in [Exhibit 2](#), when the student wants to upload they click on a textbox, "Press Here To Create Your Answer File" on the "Instruction" sheet of the Excel workbook. The answer file is created and saved in the format LL#####ANS.xls on the directory chosen by the student. As Exhibit 2 shows, a message box confirming the successful creation and the location of the answer file is produced. After the answer file is created the student logs on to the Cybertext website and as illustrated in [Exhibit 3](#) uploads their answer file. [Exhibit 4](#) illustrates the feedback form that is produced by Cybertext and displayed when the Light is uploaded and automatically graded. The student reviews and prints the feedback form.

### **Unlimited Feedback**

The students control the number of times they rework the Light and upload the answer sheet to the Cybertext server. The server grades the case and provides feedback to the student. The last upload is stored on the server and the last score is referred to as the Light Score. The number of times each student uploads to the web server is calculated and referred to as the Web Upload Factor.

### **No Additional Instructor Resources**

In the traditional, hand-graded environment, the instructor receives all cases on the last day of class. If the student's work was perfect then their work compared directly to the "official" answer sheet. As soon as one error was made, the rest of the answer sheet was worthless. It is virtually impossible to follow all of the errors unless the grader reread the entire case, duplicating every error. Under those circumstances, it would be humanly impossible to grade a unique student's case five or ten times and definitely not two hundred times. The emerging technology of internet servers permits the students' cases to be graded over and over without human interaction.

### **The Study**

#### **Data Collection and Sample Selection**

Appendix A shows the data that has been collected including the student's first name, last name, ID, final exam score, instructor name, GPA previous semester, GPA subsequent, course grade, Light Score and Web Upload Factor. Out of a total of 402 students in multiple managerial accounting classes, 34 have been excluded since they did not do the case study. Of the remaining 365 students in the sample 56 students did not take the final exam. The number of students that missed the final reduced the sample size to a total of 309 students.

#### **Methods and Analysis**

[Table 1](#), the Summary Output, describes the Regression Statistics. This includes the Multiple R, 0.142104407, or 14.21%, and its R Square 0.020193663, or 2.02%. This shows that the Light Score explains about 2 percent of the variance in the final exam score. The Adjusted R Square, 0.0137897, adjusted for Standard Error of 13.8463822, shows that it may be even lower than 2%, for the observations of 309 students. These 309 students have taken both the case study and the final exam.

[Table 2](#), the ANOVA, Analysis of Variance, shows the df, (Degrees of Freedom) the F Statistic and the Significance F, which is the statistical significance. Regression shows that we have two independent variables, their F-Statistic is equal to 3.153307187 and it is statistically significant at the .05 level, which is greater than the Significance F level of 0.044101906. Accordingly, we reject the null hypothesis that states that the students' performance on the Light has no effect on the final exam score, at the .05 level of statistical significance.

The second part of the table reveals the following variables: Coefficients, Standard Error, t Stat, P-value, Lower 95%, Upper 95%, Lower 95.0% and Upper 95.0%. It reports the Light Score Coefficient of 0.072028467. The positive sign of this indicates that the score in the case study has a positive influence on the final exam score. The t Stat of Light Score of 1.481960849 and its P-value of 0.139379756 by itself is not

statistically significant at the 10% level of statistical significance. Therefore, we may not reject the null hypothesis that states that the Light Score by itself explains the performance in the final exam of the course. In contrast with the Light Score, the Web Upload Factor is different.

While the Light Score by itself is not statistically significant at the 10% level, the Web Upload Factor is significant at this level. The Web Upload Factor has a positive Coefficient of 0.048627667, which shows that like the Light Score it has a positive influence on the Final Exam Score for the entire course. Unlike the Light Score, it is also significant at the 10% level of statistical significance due to its higher value of the t Stat of 1.737318012, and its respective value of P-value of 0.083337214, which is lower than 10% and therefore significant statistically at the 10% level of statistical significance.

### **Interpretation of the Results**

The overall model is statistically significant, yet the Light Score by itself is not. The Web Upload Factor is statistically significant. This may be due to the fact that the final exam does not cover exclusively and completely the material that the Light covers. The final exam of the course covers material from the textbook, which may not be perfectly correlated to the material in the Light. The disadvantage of this is that the coefficient may not be statistically significant by itself. The advantage is that the case study is more generic and matches all the textbooks rather than being tied to any specific textbook. As a result, instructors can use a variety of textbooks and still use the same case study..

The Web Upload Factor may be significant due to the fact that it demonstrates the motivation of the students to improve their performance in the course. It is possible that highly motivated students do well in the case study, and also study more and perform better on the final exam. The Web Upload Factor may also be an indication of how many times the students worked each of the problems. After working a problem three or four times, the student may have learned the essence of the material being tested. Thus transferring this knowledge to a higher score on the final exam.

[Table 3](#) shows the RESIDUAL OUTPUT, and the PROBABILITY OUTPUT. It includes the Observation, Predicted Final Exam Score, Residuals, Standard Residuals, Percentile, and the Final Exam Score. [Table 3](#) shows the bottom 10, the middle 10 and the top 10 performers in the semester, and their related prediction statistics. [Table 3](#) shows that the worst performer in the semester had a score of 28 on the final exam. The top performer on the test had a score of 100, or 100%. It also shows that the bottom forecasting errors are positive (positive residuals), while the middle and the top are negative.

The [Normal Probability Plot](#) reveals that the Final Exam Scores cluster around the 10%, 50% and 100% percentile. The [Uploads Line Fit Plot](#) shows that most students uploaded less than 50 times, while a few uploaded more than 100 times. Likewise, the [Predicted Final Exam Scores thin line](#) cuts in the middle of the Final Exam Score line, explaining graphically the significance of the coefficient of the number of Uploads. It clusters around the value of 1 indicating that many students uploaded only once.

### **Summary, Conclusions, and Implications**

In summary, we have tested and rejected the main null hypothesis that the Light case study has no effect on students' performance in the final exam of a Managerial

Accounting class. We also found that the number of Web Uploads has a higher statistical significance compared to the Light Score. We suspect that that may be due to the correlation or lack of correlation between the textbook and the case study material. This can be easily tested in the future by changing the correlation between the case study material and the contents of the textbook.

Our conclusion is that the trend to integrate the computer assisted instruction, spread sheet analysis, and web server based grading is going to increase due to the positive affect on students' performance. Furthermore, since multiple uploads improve performance and do not require additional instructor resources, instructors may be more likely to use it, promoting student mastery of the material.

The implication of the results of this study is that more resources should be devoted to evaluating the effect of such Light training methods in order to further improve their academic effectiveness as well as its cost effectiveness. As software becomes more internet compliant such applications will be much more robust and much easier to develop and use. Therefore, we expect them to grow exponentially with the growth of the Internet.

Try it for free?

If you want to try the case yourself, simply go to [www.cybertext.com](http://www.cybertext.com), select Book List and then select Building Blocks of Accounting- A Managerial Perspective and you will be able to download the application by using the username "MF5678" and the password "1234". To have the work graded return to the same page.

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**Exhibit 2**  
**Creating The Answer Workbook**

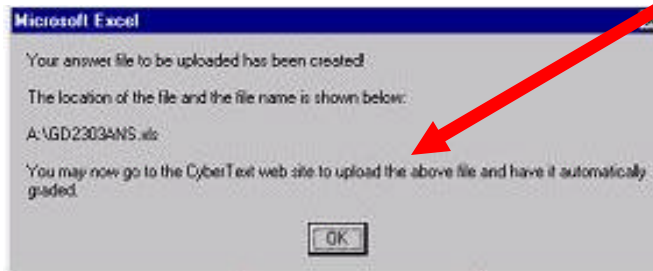
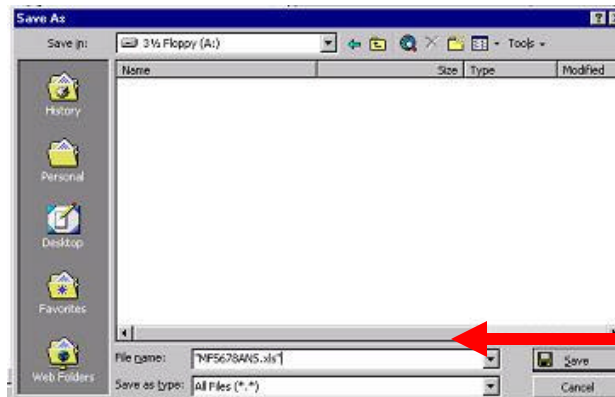
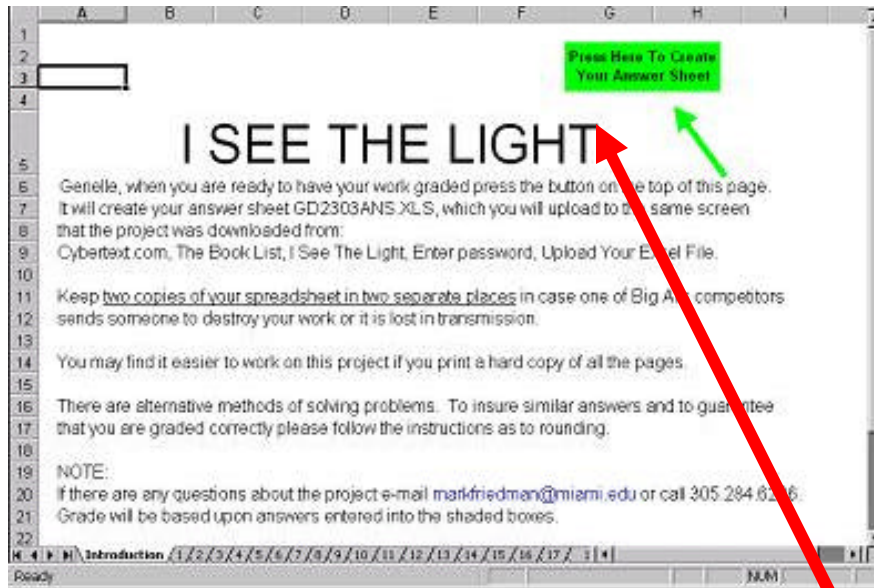


Exhibit 3

Upload To [www.cybertext.com](http://www.cybertext.com)



- HOME
- NEWS & UPDATES
- THE BOOK LIST
- ACCOUNT SETUP
- INSTRUCTORS ONLY
- ABOUT CYBERTEXT

"I See The Light" -- Managerial Accounting Practice Set

Hello

Click on the button below to make your Excel file for the 'I See The Light' Practice Set. **Please be patient, as the process of making the Excel file can take 20 to 30 seconds.**

**MAKE EXCEL FILE**

**Note:** On the next screen you will be able to download your Excel file. You can then open it using Microsoft Excel 97 or 2000 to work on the 'I SEE THE LIGHT' Excel practice set.

Click on the button below to upload your solution to the 'I See The Light' Practice Set. The file you should upload is the one you created by clicking on the green 'Create Answer File' button on your 'I See The Light' Excel file created using the 'Make Excel File' button above.

**UPLOAD EXCEL FILE**

**Note:** For user name JD1234, the file name should be EXACTLY JD1234ANS.xls



**Exhibit 4**  
**Student Feedback**

**Your file has been uploaded and graded successfully!**

Date/time file was uploaded & graded: 09/12/2002 15:27:52

Note: you had previously uploaded your MF5678ANS.xls file. The previous version has been 'overwritten' by the version you just uploaded!

**Grading results for Chuck Wagon. (Instructor: Smith, Acc212, Sec. GY)**

Number you got correct: 6

Your grade: 7.59

The question numbers with the ones you got correct (score 1) and wrong (score 0) follow:

Question	Score
4.01	1
4.02	1
4.03	1
4.04	1
...	...

**Table 1: Summary Output**

<b>Regression Statistics</b>		
<b>Multiple R</b>	<b>0.142104407</b>	<b>14.21%</b>
<b>R Square</b>	<b>0.020193663</b>	<b>2.02%</b>
<b>Adjusted R Square</b>	<b>0.0137897</b>	
<b>Standard Error</b>	<b>13.8463822</b>	
<b>Observations</b>	<b>309</b>	

**Table 2: ANOVA**

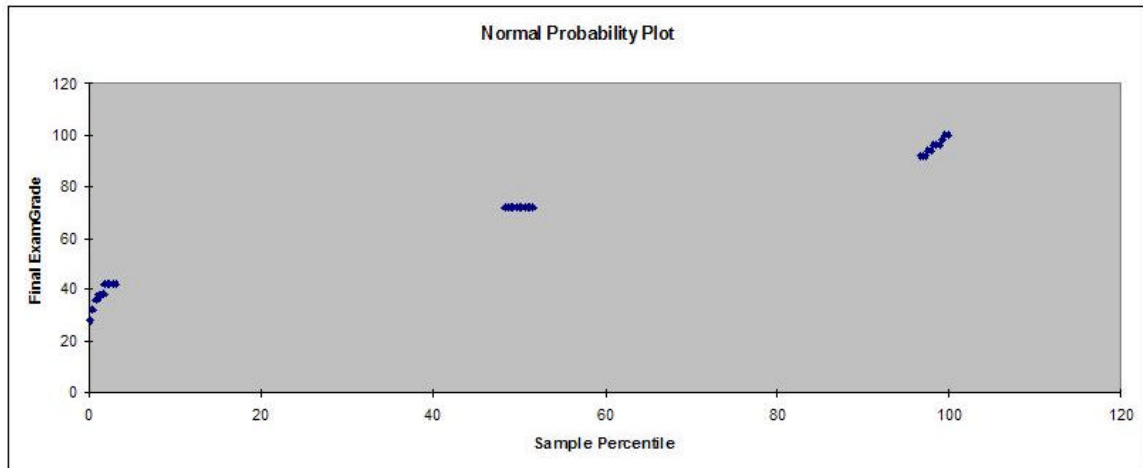
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	2	1209.1186	604.55931	3.1533072	0.0441019
Residual	306	58667.024	191.7223		
Total	308	59876.142			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	62.730577	4.3439253	14.440989	2.093E-36	54.182834	71.27832	54.182834	71.27832
Light grade	0.0720285	0.0486035	1.4819608	0.1393798	-0.0236109	0.1676678	-0.0236109	0.1676678
Uploads	0.0486277	0.0279901	1.737318	0.0833372	-0.0064497	0.103705	-0.0064497	0.103705

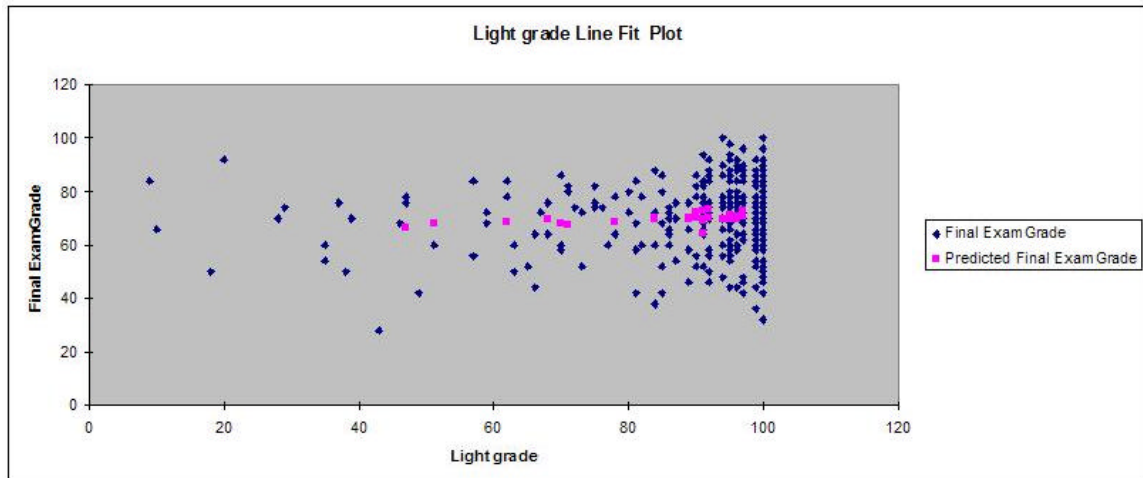
Table 3: Residual Output And Probability Output

Observation	RESIDUAL OUTPUT			PROBABILITY OUTPUT	
	Predicted Final Exam Grade	Residuals	Standard Residuals	Percentile	Final Exam Grade
1	66.164543	11.8354572	0.85755774		28
2	66.504936	9.49506357	0.68798062		32
3	67.960114	-7.9601143	-0.5767633		36
4	68.655172	9.34482788	0.67709505		38
5	69.524992	-5.5249919	-0.4003225		38
6	68.015708	-10.015708	-0.7257048		42
7	67.893226	12.106774	0.87721645		42
8	68.591936	-4.5919359	-0.3327164		42
9	69.315873	2.68412728	0.19448291		42
10	70.434309	17.5656909	1.27275135		42
AVERAGE		3.49391906	0.25315772	1.618123	38.2
150	70.127935	-20.127935	-1.458403	140	72
151	70.322445	-22.322445	-1.6174099	141	72
152	72.170297	1.82970345	0.13257421	142	72
153	73.045595	-3.0455946	-0.2206736	143	72
154	64.608795	27.3912045	1.98467528	144	72
155	68.82263	-16.82263	-1.2189116	145	72
156	69.252975	-17.252975	-1.250093	146	72
157	73.595107	-35.595107	-2.5791027	147	72
158	70.212745	-16.212745	-1.1747214	148	72
159	70.23432	7.76567981	0.56267525	149	72
160	69.576934	12.4230663	0.90013393	150	72
AVERAGE		-6.1841843	-0.4480854	50.161812	72
299	71.176168	14.8238315	1.07408537		92
300	69.910023	-25.910023	-1.8773538		92
301	70.007278	-12.007278	-0.8700073		92
302	70.444927	-10.444927	-0.7568046		94
303	70.931204	5.06879593	0.36726804		94
304	69.982052	-27.982052	-2.0274861		96
305	69.982052	-37.982052	-2.7520527		96
306	70.030679	-0.0306792	-0.0022229		96
307	70.662839	3.33716114	0.24179956		98
308	70.954605	-8.9546049	-0.6488208		100
309	72.802456	1.19754378	0.08677003		100
AVERAGE		-11.370812	-0.8238911	98.381877	95.8

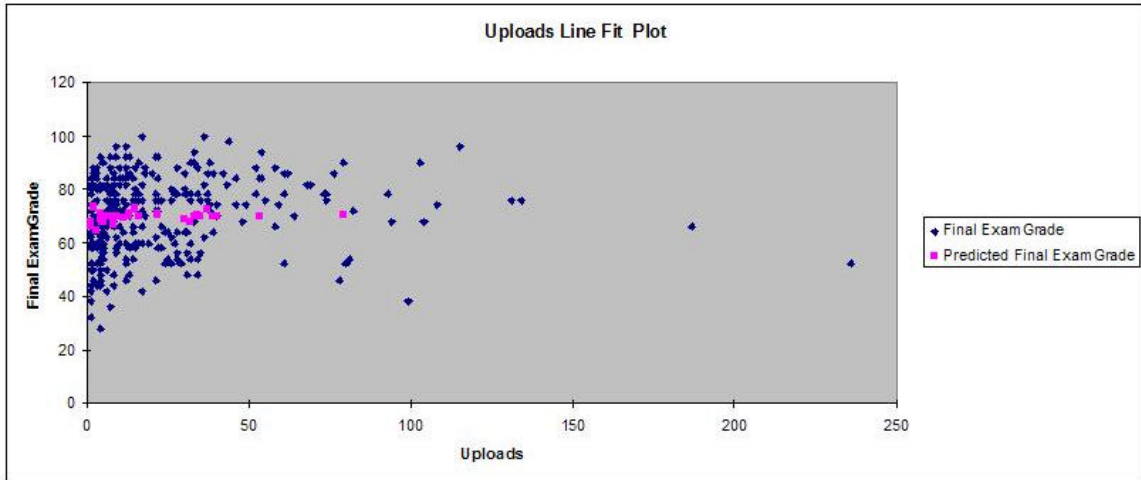
### The Normal Probability Plot



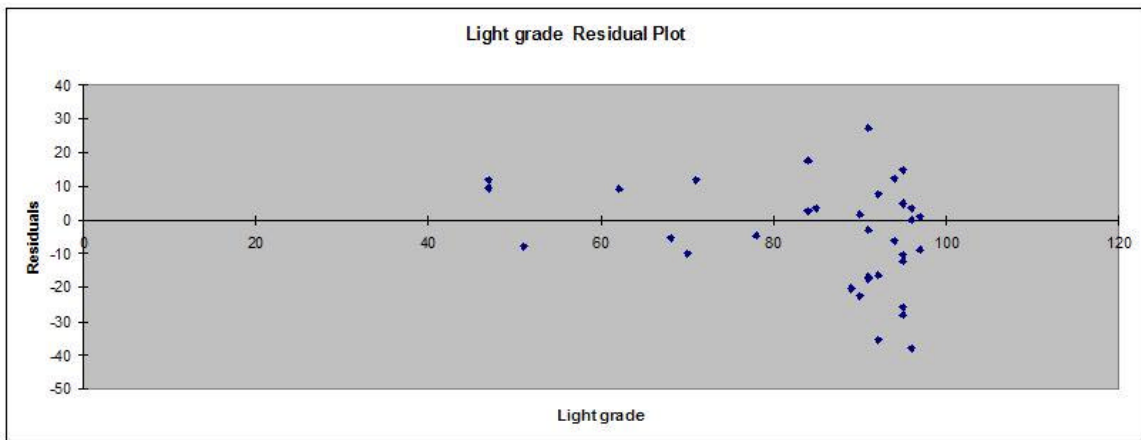
### Light Grade Line Fit Plot



### Uploads Line Fit Plot



### Light Grade Residual Plot



### Uploads Residual Plot

