An Exploratory Study into the Efficacy of Learning Objects

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Abstract

Learning objects have quickly become a widely accepted approach to instructional technology, particularly in on-line and computer-based learning environments. While there is a substantial body of literature concerning learning objects, very little of it verifies their efficacy. This research investigated the effectiveness of learning objects by comparing learning outcomes using a learning object with outcomes using a traditional textbook-based method of instruction. Participants were 327 undergraduate college students at a traditional public four-year coed institution, a private four-year women's college, a private four-year engineering institution, and a public two-year community college. Through a series of independent samples *t*-tests and Analyses of Variance, results revealed mean scores for the learning object group that were nearly three times higher than the mean scores for the textbook-taught group. Gaming experience, age, gender, and learner preference were evaluated for their potential influence on the results; no statistically significant differences were found, implying that the learning object itself was central to the outcomes achieved. The future of learning objects is bright, and more empirical research is called for in the area of learning object effectiveness.

Introduction

One of the fastest growing trends in instructional design and curriculum development is the proliferation of a fairly recent instructional tool known as a *learning object*. A learning object is a subject matter-specific learning resource or item of content, generally understood to be digital and multimedia-based, which can be reused and–in some cases–combined with other learning objects to form larger pieces of instruction. The upsurge in the development and use of learning objects can be attributed to (a) the digital generation of learners, (b) significant growth in the web-based model of distance education, and (c) economic issues surrounding curriculum development.

Educators have known for some time that the traditional lecture is not a particularly efficient or effective way to impart knowledge (e.g., Anderson & Garrison, 1998). Today, educators are endorsing constructivist-based, learner-centered educational paradigms such as meaningful learning (Jonassen, 2000; Novak, 1998), active learning (Nielsen, 1993), and collaborative learning (Anderson & Kanuka, 1997). However, even given these newer models and instructional structures, educators are now faced with a much greater problem than simply improving upon the traditional lecture format: the dramatic shift in learner characteristics of today's traditional-aged college students.

The Baby Boomers–until now the largest population wave ever–has been eclipsed by what Tapscott (1998) refers to as the Net Generation. He states, "The term *Net Generatio*n refers to the generation of children who, in 1999, will be between the ages of two and twenty-two, not just those who are active on the Internet" (p. 3). Prensky (2001), author of *Digital Natives*, *Digital Immigrants*, describes the never before seen differences between the generation that grew up *with* digital technology (digital natives) and those who grew up *before* these technologies (digital immigrants). Prensky suggests that the implications for educators whose students are digital natives are profound, and that radically new ways to stimulate this generation of students must be developed.

In addition to the need to satisfy the digital generation, academe is embracing learning objects because they are compatible with the continuously growing world of web-based distance education. The digital nature of learning objects makes them easily deliverable via the Internet, which lends itself well to the distance education paradigm.

There is little doubt among today's educators that distance education, particularly the Internet-based on-line formats, is here to stay. By the fall of 1998, 90% of all institutions with enrollments of 10,000 or more and 85% of those with 3,000 or more offered distance education courses (Gibson, 1998). Additionally, distance education has been found to be as effective as, or more effective than, outcomes achieved in a traditional classroom (Moore & Kearsley, 2005; Simonson, 1997). Distance education has established itself as a viable forum for delivering content beyond the classroom, and learning objects are becoming an integral part of that content.

Besides the Net Generation and web-based distance education movement, an even stronger impetus driving the learning objects movement is the economic status of curriculum development. Downes (2000), one of the leading spokespersons in the area of learning objects, bases his vision of the future of learning objects in part on economies of scale. He suggests the rapid proliferation of learning objects and learning object repositories is based, at least in part, on the ever-increasing costs of traditional methods of sharing.

Downes (2000) envisions a future proliferation of cottage industries developing learning materials – specifically, reusable learning objects. This inevitably will conflict with traditional liberal arts education, where traditionally-trained and established professors recreate each course every time they teach it. Downes (2000) believes traditional professors who currently create knowledge and jealously guard its distribution ultimately "will have to redefine their approach or be priced out of existence" (p. 30).

Educators must find new teaching modalities to address today's learner characteristics, manage the increase in on-line courses they are being assigned, and function in a climate of dwindling financial resources and funding. This researcher strongly believes that one of the most promising ways to address these issues is through the use of learning objects.

While learning objects are quickly coming to the forefront of the new methodologies of instruction, particularly in on-line and computer-based learning environments, the literature is sparse relative to their effectiveness. Although some repositories are now using a peer-review process, virtually no studies have assessed the effectiveness of learning objects in the context of student use. In a critical discussion of learning objects, Greenagel (2002) states that it is unknown whether a learning object "has ever resulted in anyone learning anything or subsequently demonstrating any competency" (p. 4). Greenagel also reports that there are no agreed upon standards to measure learning effectiveness. Mohan and Greer (2004) add that "if learning objects are to be successful in e-learning, they must lead to effective learning" (p. 7).

This study investigated the efficacy of learning objects by comparing learning outcomes using a learning object with outcomes using a traditional method of instruction. Because how one defines learning objects is inseparable from how they are applied and evaluated, a working definition of a learning object was essential to this project. The working definition is based on a conceptualization from Mitchell (personal communication, April, 2004), a member of the Indiana Higher Education Telecommunication System Learning Object Taskforce Initiative and faculty at Saint Mary-of-the-Woods College in Indiana, who defines learning objects as "digital resources, pedagogically sound, in small chunks, which meet interoperability standards, and are reusable, self-contained (but can be aggregated), durable (operating system independent), and shared through metatagging." Two additional attributes this researcher included: (a) learning objects must be interactive; and (b) they must contain an assessment component.

The primary research question asked whether interactive learning objects improve learning outcomes as compared to traditional (text- and picture-based) methods of instruction. Secondary research questions included whether level of computer gaming experience, gender, age, or learner preference affected learning outcomes. Because of the paucity of research on this issue, hypotheses of no difference were proposed. Therefore, no significant difference was expected between learning outcomes derived from an interactive learning object as compared to a traditional method of instruction. Similarly, no significant differences were expected between learning outcomes based on level of gaming experience, gender, age, or learner preference.

Method

Participants

Participants were undergraduate college students from four Indiana higher education institutions: a traditional public four-year coed institution, a private four-year women's college, a private four-year engineering school, and a public two-year community college. As suggested by Wiersma and Jurs (1990), the heterogeneity of institutional types improves the design of the study by enhancing validity.

After obtaining permission from the respective institutions' administrators, instructors were contacted to obtain permission to speak to their classes and solicit volunteers. To be eligible to participate, the student's major or minor could not be in accounting or a related area. Participants were randomly assigned to either a control or experimental group of approximately equal size. The data collected were utilized in aggregate, and individual participants were not identifiable.

Instrumentation

The interactive learning object (see Appendix A) utilized in this study was developed by Dr. Jennie Mitchell, CPA, CMA, Saint Mary-of-the-Woods College, for use in an Accounting course. The learning object was altered slightly for this study but was developed for existing curricula using Lectora™ and Flash™ software by this learning object expert.

Prior to collecting data from the actual sample population, a field study was conducted to evaluate the instrumentation. Based on suggestions from participants in the field study, a number of refinements were implemented.

In order to make both learning experiences as equivalent as possible, Blackboard's Learning Content Management System was used to deliver the content in both textbook and learning object formats. The assessment device was administered using Blackboard as well.

The control group received a short lesson in accounting using a traditional text- and picture-based delivery of instruction from an established and current accounting textbook[1]. The experimental group received the equivalent lesson using an interactive learning object that was developed for this content area and is in use with existing curricula. Accounting was chosen because it was assumed that most undergraduate majors were unlikely to have prior expertise in this subject. Permission was obtained from the publisher of the textbook and from the designer/developer of the learning object to utilize their work for this research.

Immediately following the respective lessons in Blackboard, both groups were administered the identical assessment instrument (see Appendix B). The beginning of the assessment included a number of demographic questions, including questions concerning familiarity with accounting and Microsoft Excel™. The demographic section was followed by five problems (also see Appendix B) related to the instructional content, which was to create the formula for calculating payment using Excel. The problems would be difficult to solve without successfully internalizing the concepts in the lesson, or having prior expertise with Microsoft Excel.

Procedures

Data were collected during the Summer 2006 and Fall 2006 semesters. After participants were randomly assigned to either the control or experimental group, they received instruction sheets on accessing Blackboard, which included a unique userid and password. A brief introduction included a somewhat vague explanation of the research (i.e., that two different teaching methods were being compared). The lesson was administered, followed by the survey/assessment device. The control group learned how to create the formula to calculate a loan payment using Microsoft Excel from a section of the abovementioned accounting textbook scanned and loaded into Blackboard; the experimental group learned the identical content using the learning object. At the end of the prescribed time, which was the same for both groups, access to the Blackboard test section was terminated. Participants were thanked for their participation and provided an email address if they were interested in the outcome of the study.

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[1] Gross, D., Akaiwa, F., & Nordquist, K. (2006). *Succeeding in business ™ with Microsoft® Office Excel 2003: A problem solving approach.* Boston: Thomson Course Technology.

Completion of the online task took approximately 15 - 30 minutes. To ensure that participation was completely voluntary, if at any time participants decided they did not wish to continue, they were instructed that they could simply exit Blackboard.

Research Design and Statistical Analysis

This study utilized a true experimental, Posttest Only Control Group design. This type of design uses randomly assigned participants to an experimental group or control group, with no pretest (Cherulnik, 1983). Figure 1 illustrates the research design based upon the notation[2] developed by Campbell and Stanley (1966).

FIGURE 1. Posttest only control group design

G_1	R	X	O_1
G_2	R		O_2

The raw data were exported from Blackboard for analysis in SPSS™. To test the primary hypothesis that there was no significant difference between learning outcomes, an independent samples *t*-test was used. To determine if outcomes differed based on the participants' gaming experience, age, or learner preference, one-way Analyses of Variance (ANOVAs) were performed. To determine if outcomes differed based on the participants' gender, an independent samples *t*-test was used.

Results

Demographic Information

A total of 327 students participated in the study. Data indicated that 53.1% of the participants were female, and 46.9% were male. The age of the participants ranged between 17 and 52, which was divided into three groups: 17-22 years old (72.6%); 23-30 years old (15.0%); and over 30 years old (12.4%). The reported hours per week spent participating in computer gaming activities

[2] G = group, R = random assignment X = intervention, O = observation

(e.g., computer games, console games, video games) indicated that 31.4% did not play computer games, 58.0% gamed 10 or fewer hours per week, 5.3% spent 11 – 20 hours in gaming activities, 2.2% spent 21 – 30 hours gaming, and 3.1% gamed more than 30 hours per week.

Comparison of Learning Outcomes

Of the 327 participants, there were 226 valid responses to the assessment problems related to the instructional content: 98 in the control group and 128 in the experimental group. Mean scores for each group are shown in Table 1. Notably, the mean score for the learning object group was nearly three times higher than the mean score for the traditional text-based group.

TABLE 1: Mean Scores Across Groups

Group	*N*	*M*	*SD*
Control	98	1.061	2.025
Experimental	128	2.891	2.398

N = number *M* = mean *SD* = standard deviation

To test the primary hypothesis that there was no significant difference between learning outcomes, an independent samples *t*-test was used to determine if the assessment scores of the experimental and control groups were truly different or whether any observed differences occurred merely by chance. As shown in Table 2, there was a statistically significant difference between the assessment scores of students in the learning object group as compared to the traditional text-based group ($t_{(224)} = -6.073$, $p < .001$). This suggests that the group taught using a learning object performed significantly better than the group taught using textbook materials.

TABLE 2: Test Score Comparison Between Groups

t	*df*	*p*-value	Mean Difference	Std. Error of Difference
-6.073	224	.000*	-1.829	0.301

* $p < .05$

In light of the significant difference in mean assessment scores of the learning object group compared to the textbook group, the secondary research questions were then examined to determine if individual characteristics of the experimental group could have influenced performance. The effects of gaming experience, gender, age, and learner preference were examined.

Gaming Experience

Gaming experience was divided into five levels as shown in Table 3. To determine if assessment scores for the experimental group differed in regard to the participants' gaming experience, a one way ANOVA was performed. As shown in Table 4, results indicate there was no statistically significant difference in the assessment scores across the five levels of gaming experience ($F_{(4,123)} = 2.111$, $p = .083$).

TABLE 3: Gaming Experience – Experimental Group

Time Spent Gaming	*N*	*M*	*SD*
0 hours per week	40	2.13	2.46
1-10 hours per week	71	3.13	2.35
11-20 hours per week	8	4.25	1.75
21-30 hours per week	4	2.50	2.89
>30 hours per week	5	3.80	1.79

TABLE 4. ANOVA Summary Table for Gaming Experience – Experimental Group

Attribute	*F*	*df*	*p*-value
Gaming Experience	2.111	4	0.083

Gender

Gender characteristics for the experimental group are shown in Table 5. To establish if assessment scores of the experimental group varied according to gender, an independent samples *t*-test was performed. Results are shown in Table 6 and reveal no statistically significant difference in the assessment scores across gender ($t_{(126)} = -1.248$, $p = 0.214$).

TABLE 5: Gender – Experimental Group

Gender	N	M	SD
Female	*65*	*2.631*	*2.447*
Male	*63*	*3.159*	*2.336*

TABLE 6: Independent Samples t-test of Gender versus Total Scores

t	df	p-value	Mean Difference	Std. Error of Difference
-1.248	126	0.214	-0.528	0.423

Age

Age was divided into three levels as shown in Table 7. To examine if the assessment scores for the experimental group differed by age, a one way ANOVA was performed. Results are shown in Table 8 and reveal no statistically significant difference in the assessment scores across the three age levels ($F_{(2,125)} = 1.168$, $p = 0.314$).

TABLE 7: Age – Experimental Group

Age	N	M	SD
17 - 22	95	2.705	2.427
23 - 30	22	3.318	2.358
Over 30	11	3.636	2.157

TABLE 8: ANOVA Summary Table for Age – Experimental Group

Attribute	F	df	p-value
Age	1.168	2	0.314

Learner Preference

Learner preference was divided into three levels (see Table 9). To examine if the assessment scores for the experimental group differed with respect to the participants' learner preference, a one way ANOVA was performed. Results are shown in Table 10 and indicate there was no statistically significant difference in the assessment scores across the three different learner preferences ($F_{(2,125)}$ = 1.710, p = .185). These results should mitigate, to some extent, concerns that perhaps some participants from the control group dislike reading online.

TABLE 9: Learner Preference – Experimental Group

Learner Preference	N	M	SD
Using Technology	55	3.16	2.36
Reading/Using Textbook	9	3.78	2.17
Directed Instruction	64	2.53	2.44

TABLE 10: ANOVA Summary Table for Learner Preference – Experimental Group

Attribute	F	df	p-value
Learner Preference	1.710	2	0.185

In addition to the research questions, two other variables were surveyed in the demographic portion of the assessment instrument: accounting experience and expertise with Microsoft Excel, which was used in the instructional module. While these variables were not formulated into hypotheses, substantial experience in either area could impact the results. Therefore, additional analyses were performed for these two variables.

Accounting Experience

Accounting experience was divided into four levels (see Table 11). To examine if assessment scores for the experimental group differed according to accounting experience, a one way

ANOVA was performed. Results of the analysis, as shown in Table 12, revealed no significant difference in assessment scores across the four different experience levels in accounting ($F_{(3,124)}$ = 0.850, p = 0.469).

TABLE 11: Accounting Experience – Experimental Group

Experience Level	N	M	SD
None	27	2.48	2.41
Below Average	54	2.87	2.40
Above Average	44	3.25	2.37
Expert	3	1.67	2.89

TABLE 12: ANOVA Summary Table for Accounting Experience – Experimental Group

Attribute	F	df	p-value
Accounting Exp.	0.850	3	0.469

Expertise with Microsoft Excel

Expertise with Microsoft Excel was divided into four levels (see Table 13). To examine if assessment scores for the experimental group differed with regard to expertise with Excel, a one way ANOVA was performed. Results are shown in Table 14 and indicate there was no significant difference in assessment scores across the four different levels of expertise with Excel ($F_{(3,124)}$ = 1.263, p = .290).

TABLE 13: Expertise with Microsoft Excel – Experimental Group

Experience Level	N	M	SD
None	9	3.33	2.50
Below Average	47	2.40	2.46
Above Average	64	3.23	2.87
Expert	8	2.50	2.67

TABLE 14: ANOVA Summary Table for Expertise with Excel – Experimental Group

Attribute	F	df	p-value
Expertise w/ Excel	1.263	3	0.290

Discussion

The results of this study corroborate the small amount of existing information concerning learning object effectiveness (Christiansen & Anderson, 2004; Mason, Pegler, & Weller, 2005). An independent samples *t*-test showed that the learning object (experimental) group performed significantly better than the textbook-taught (control) group on a set of five problems participants were asked to solve upon completion of their respective lessons. This outcome was somewhat unexpected, partly due to a telephone conversation with the Director of Member Services at MERLOT (Multimedia Educational Resource for Learning and Online Teaching) – one of the largest learning object repositories. During this conversation, it was suggested that "compared head-to-head," a learning object very likely would *not* significantly improve learning outcomes over more traditional instructional delivery methods (F. McMartin, personal communication, October 14, 2005). This study showed much more positive results regarding learning object-based outcomes than was suggested at that time.

In regard to the secondary research questions, it seemed reasonable to assume that the more time spent engaged in gaming activities, the likelier it would be that the participant would embrace a learning object-type instructional modality and perform at a higher level than those who had little or no gaming experience. Somewhat surprisingly, this did not turn out to be the case; there was no statistically significant difference in assessment scores across the five levels of gaming experience used in the study.

Gender was seen as a potential factor affecting learning outcomes for several reasons. First, women generally perform better than men in school (McCornack & McLeod, 1988), so it was possible that gender would be as much of a contributing factor on the assessment scores as the instructional modality. Second, evidence suggests that women perform better than men on conventional paper-pencil tests, but men do better on computer-based tests (Horne, 2007). Third, while the number of female gamers is steadily increasing (Jenkins, 2006), males overall still spend more time gaming than women (ESA, 2007; Schott & Horrell, 2000), which might give males an advantage when learning objects are used. Interestingly, this did not turn out to be the case; there was no statistically significant difference in assessment scores across gender.

With regard to age, it seemed reasonable to assume that traditional college-age (17-22 year old) participants would be more likely to embrace a learning object-based methodology since most have been immersed in technology all their lives. Conversely, older participants could possibly be at a disadvantage because of their comparatively lower levels of exposure to technology. The assumption once again proved incorrect as age did not affect learning outcomes, even though nearly three quarters of the participants were 17-22 years old.

Learner preference was examined to see if participants might be predisposed to a particular method of instruction by preference/learning style, which could positively or adversely affect the assessment outcome, depending upon which group they were in. While it might be argued that some of the participants from the control group dislike reading online, these results would indicate that very likely this did not affect outcomes, as again, there was no statistically significant difference in assessment scores according to this variable. Nonetheless, additional studies should be done.

In addition to the secondary research questions, two other variables were explored: accounting experience and expertise with Microsoft Excel. Given that the content of the lesson was to learn how to create the formula to calculate a payment using Excel, it was reasonable to assume that knowledge of either of these subjects could account for higher assessment scores. However, statistical analyses revealed no significant differences in assessment scores according to accounting experience or expertise with Excel. These results were not surprising, as only three participants (1.3%) out of the 226 valid respondents rated themselves as being experts in accounting; similarly, only nine participants (3.9%) rated themselves as having Excel expertise.

The fact that the variables were not found to significantly impact learning outcomes suggests that the learning object modality did account for the superior performance by the experimental group. Still, there are some limitations associated with the study. For instance, the sample size may affect the generalizability of the results. Additionally, the findings may not necessarily transfer to other educational environments or content areas. The following section will address these issues.

Implications for Practice

The results of this study have implications for educators, instructional designers, and curriculum developers. At the very minimum, those in the field of education should consider incorporating learning objects into their respective learning environments, particularly web-based or distance environments. Embracing and implementing learning objects could help educators achieve the kinds of outcome goals desired and being mandated as the focus on outcomes-based education continues to increase (Fusarelli, 2004). Additionally, educators who are not currently using learning objects might want to consider their implementation to supplement the instruction of specific concept(s) they repeatedly have found difficult to convey through traditional methods.

There are also implications for learning objects in the area of simulations and gaming in education. Using this study's working definition of a learning object, simulations would unquestionably qualify as such, as would game-based instruction, depending upon the length of the game. Dede (2005) feels this kind of educational approach would attract today's learners, whom he describes as "Internet-shaped learners" who are "active seekers of information, judging among competing opinions" (p. 3).

One last implication of an object-based, digital entity that can be shared, reused, and combined with other such entities (which also has implications concerning the economic issues surrounding curriculum development) is that these objects have the potential to facilitate previously nonexistent synergies and collaborative efforts among educators, both within and across disciplines. Is it possible to develop courses based on learning objects? According to Christiansen and Anderson (2004), whose research involved three case studies, a learning object approach "shows promise for future course design" (p. 35). The learning object is a powerful new paradigm for instructional design and curriculum development, and its potential has yet to be fully tapped.

Implications for Research

A number of research activities are recommended to further the scholarly investigation of learning object effectiveness. Obviously, the first would be to replicate the current study in order to verify that the outcomes found here are repeatable. Second, it would be interesting to determine if the effectiveness of learning objects holds across a broad range of groups. Would improved outcomes also be observed among graduate students, grade school children, or the training of military personnel? Also of interest is whether the use of learning objects with special education populations could more effectively convey topics or concepts that are consistently difficult for students with special needs to grasp.

Another issue to evaluate is whether improved outcomes are in any way tied to the subject matter being presented through learning objects. According to learning object experts at the MERLOT learning object repository, a learning object can be created for virtually any concept in any discipline (G. Hanley, personal communication, September 19, 2005; F. McMartin, personal communication, October 14, 2005). It would be interesting to determine whether certain disciplines have higher success rates with learning objects than others. If a number of different areas of study and content areas had success rates similar to that of the current study, it would augment our ability to generalize about the effectiveness of learning objects.

Another implication is the possible relationship between learning objects and short- or long-term retention rates. At this writing, only one such study exists. According to Bernstein and Meizlish (2003), an experimental group receiving instruction through a simulation (a category of learning object) was found to demonstrate better understanding of the concepts taught than the control group when administered a posttest three years after the instruction.

Finally, the role of the teacher during classroom-based use of learning objects also should be explored. In a traditional face-to-face environment, the teacher-learner dynamic could play an important role in the acceptance of–and success with–the instructional technology. There is evidence from a large study initiated by Apple Classrooms of Tomorrow that indicates students are only engaged by technology as a teaching tool when the teacher is proficient with the technology and enthusiastic about its use (Barron, Harmes, Kalaydjian, & Kemker, 2003).

The Future of Learning Objects

While there are always obstacles to overcome with any new instructional technology, the future of learning objects is bright. Future research will need to provide data to justify the use of learning objects across multiple teaching environments and disciplines. This, in turn, will provide the rationale for much needed funding for the construction of learning objects as well as instructional design support for the professionals using them. It is unlikely that learning objects will replace textbooks, and certainly they will never replace teachers; therefore, professional development will be an important component in the successful implementation of this instructional technology. Hopefully, this study contributes to the body of literature that will eventually elucidate the effectiveness of learning objects and facilitate their successful use in the field of education.

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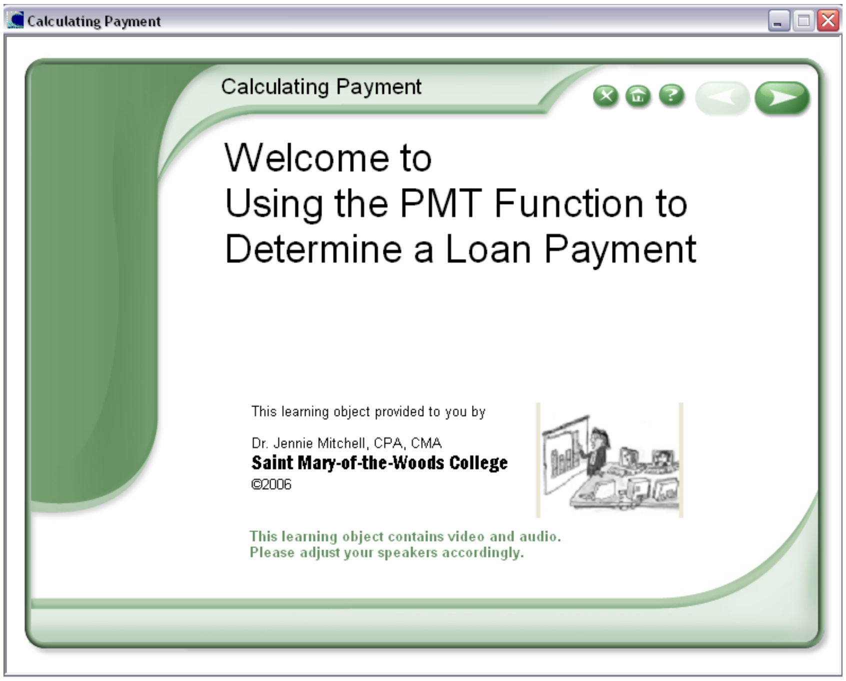
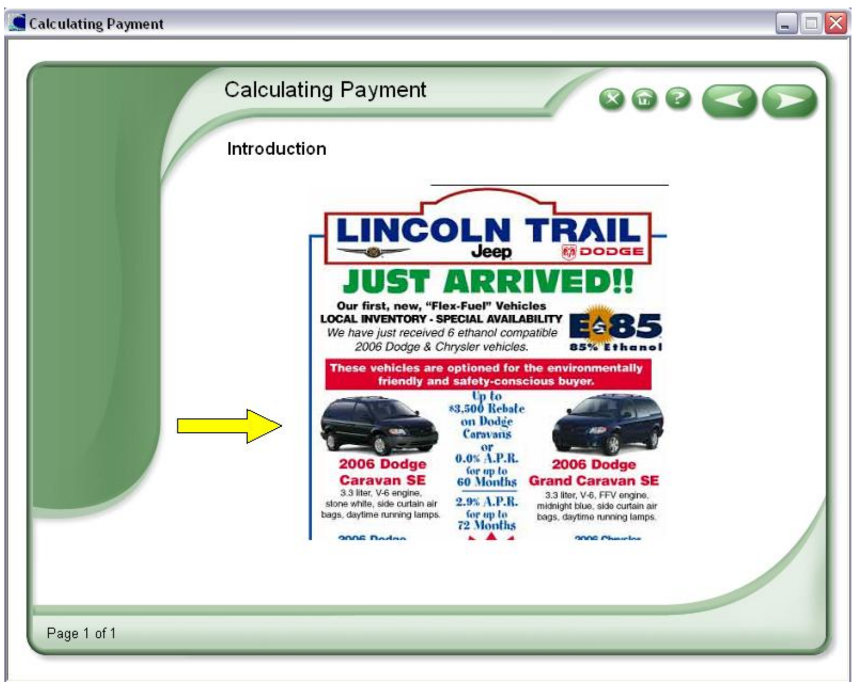
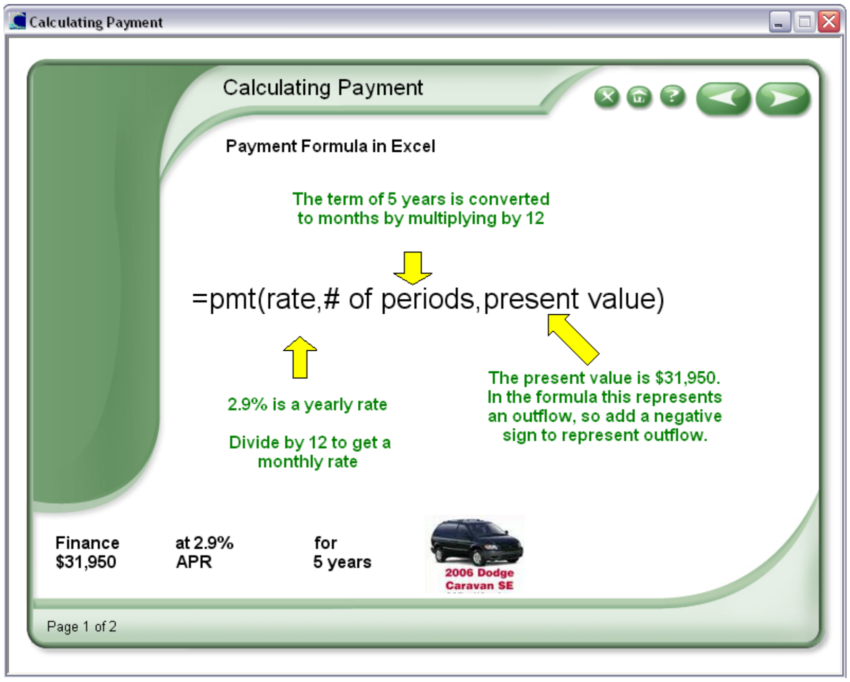
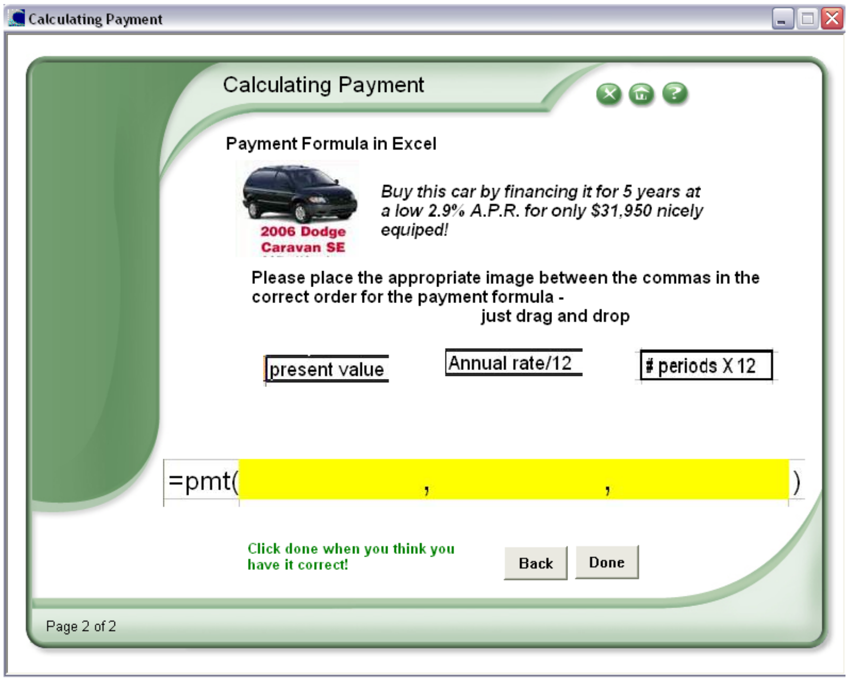
APPENDIX A: Screen Captures of the Learning Object Slides

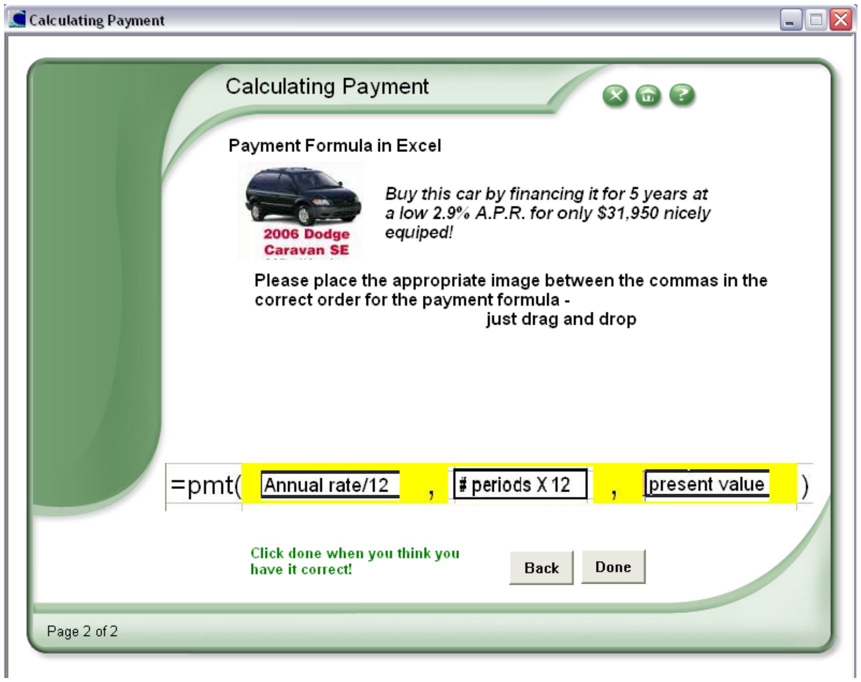
(Developed by Dr. Jennie Mitchell, CPA, CMA)

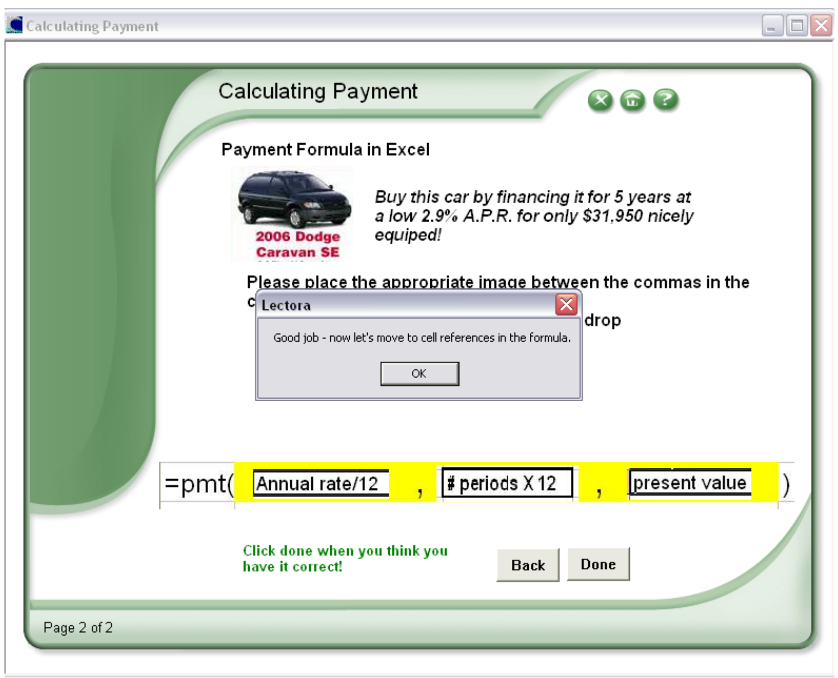


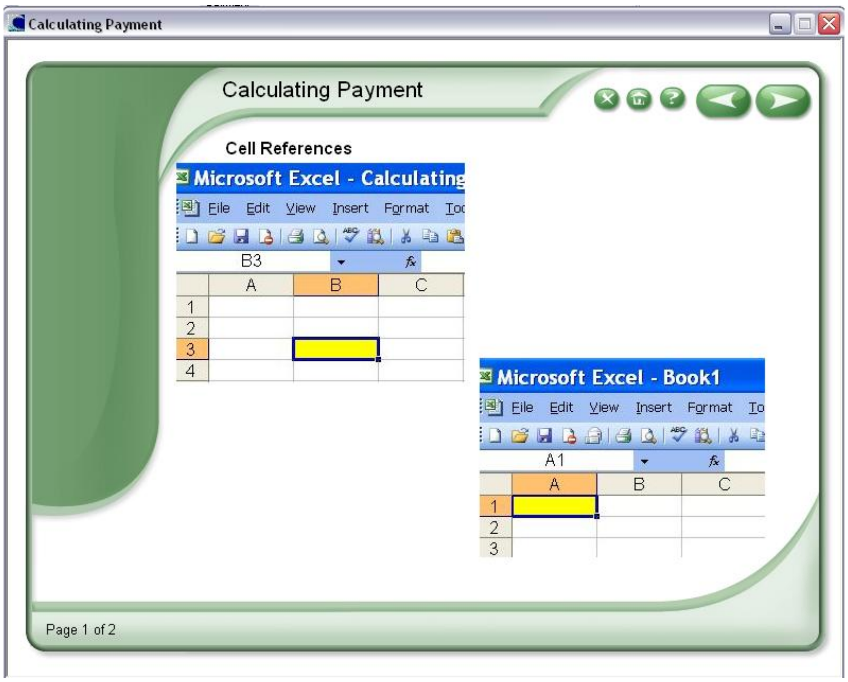


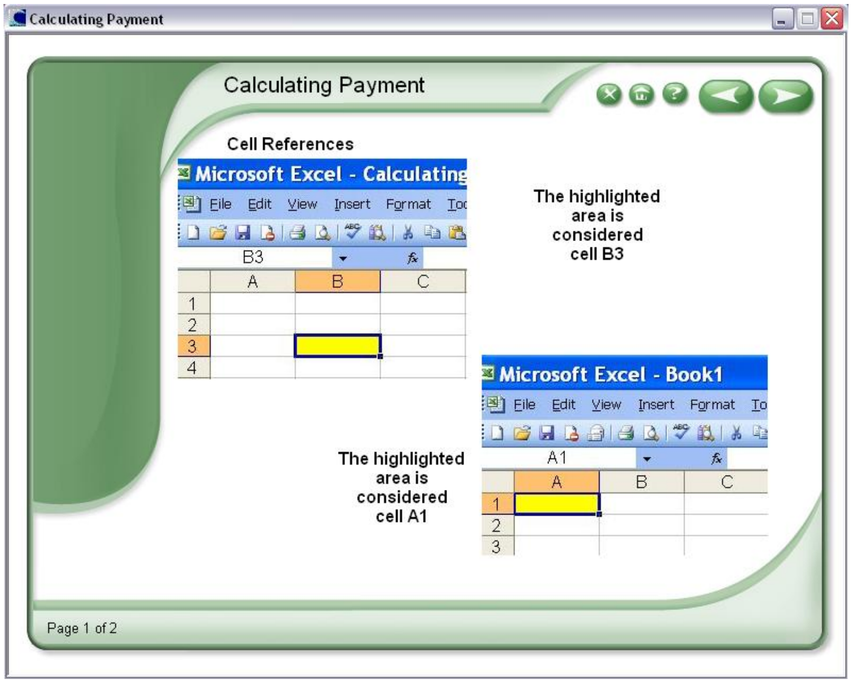

Calculating Payment
Calculating Payment
Payment Formula in Excel
The term of 5 years is converted to months by multiplying by 12
=pmt(rate,# of periods,present value)
2.9% is a yearly rate
Divide by 12 to get a monthly rate
The present value is $31,950. In the formula this represents an outflow, so add a negative sign to represent outflow.
Finance $31,950
at 2.9% APR
for 5 years
2006 Dodge Caravan SE
Page 1 of 2

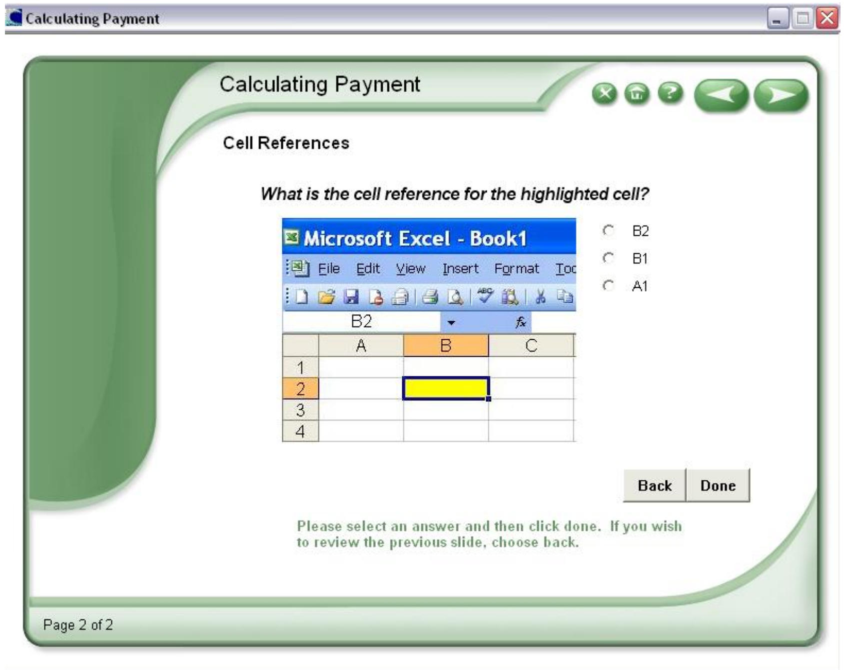

Calculating Payment
Calculating Payment
Payment Formula in Excel
2006 Dodge Caravan SE
Buy this car by financing it for 5 years at a low 2.9% A.P.R. for only $31,950 nicely equiped!
Please place the appropriate image between the commas in the correct order for the payment formula - just drag and drop
present value
Annual rate/12
periods X 12
=pmt(, ,)
Click done when you think you have it correct!
Back
Done
Page 2 of 2

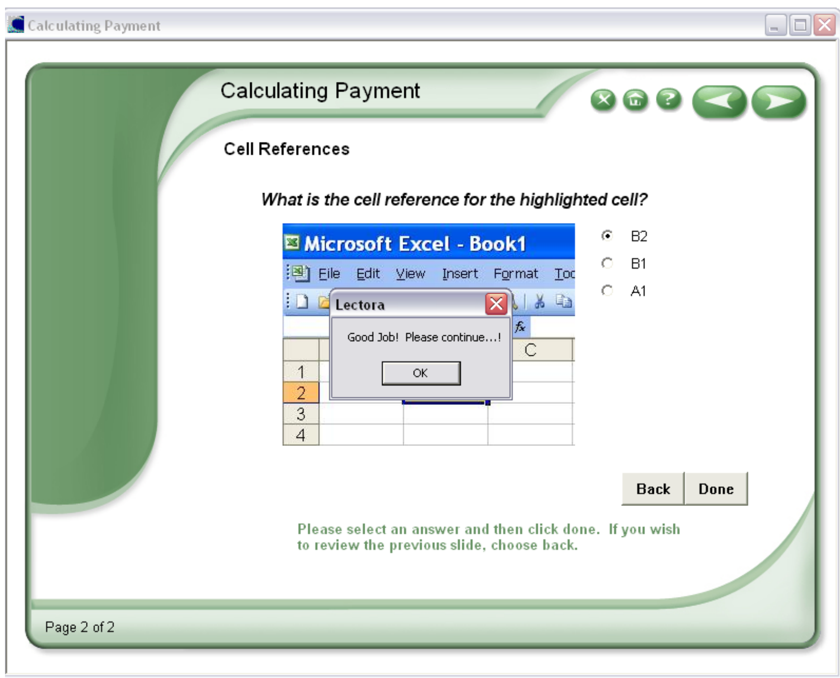

Calculating Payment
Calculating Payment
Payment Formula in Excel
2006 Dodge Caravan SE
Buy this car by financing it for 5 years at a low 2.9% A.P.R. for only $31,950 nicely equiped!
Please place the appropriate image between the commas in the correct order for the payment formula - just drag and drop
=pmt(
Annual rate/12
,
periods X 12
,
present value
)
Click done when you think you have it correct!
Back
Done
Page 2 of 2

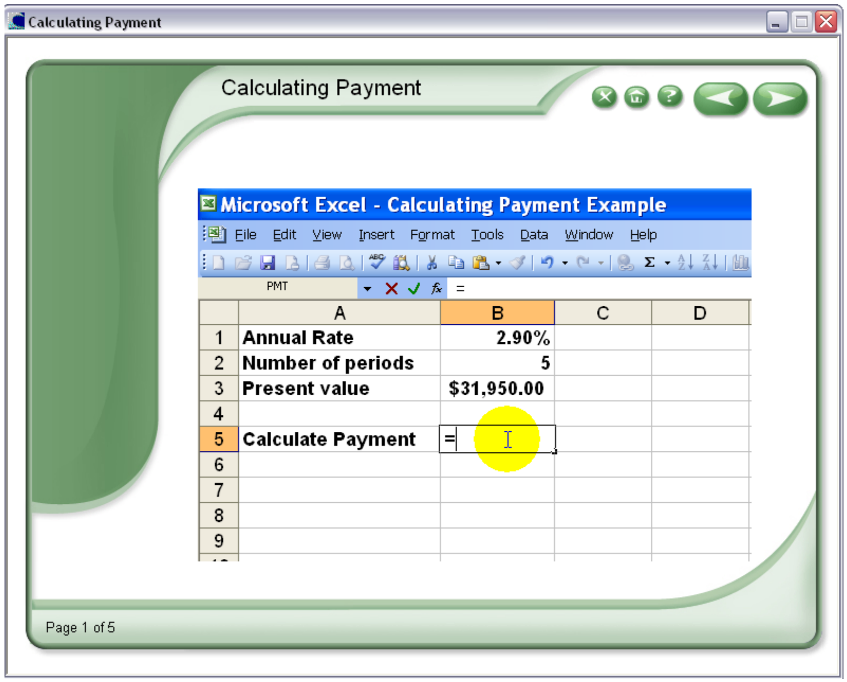

Calculating Payment
Calculating Payment
Payment Formula in Excel
2006 Dodge Caravan SE
Buy this car by financing it for 5 years at a low 2.9% A.P.R. for only $31,950 nicely equiped!
Please place the appropriate image between the commas in the
drop
Lectora
Good job - now let's move to cell references in the formula.
OK
=pmt(
Annual rate/12
,
periods X 12
,
present value
)
Click done when you think you have it correct!
Back
Done
Page 2 of 2

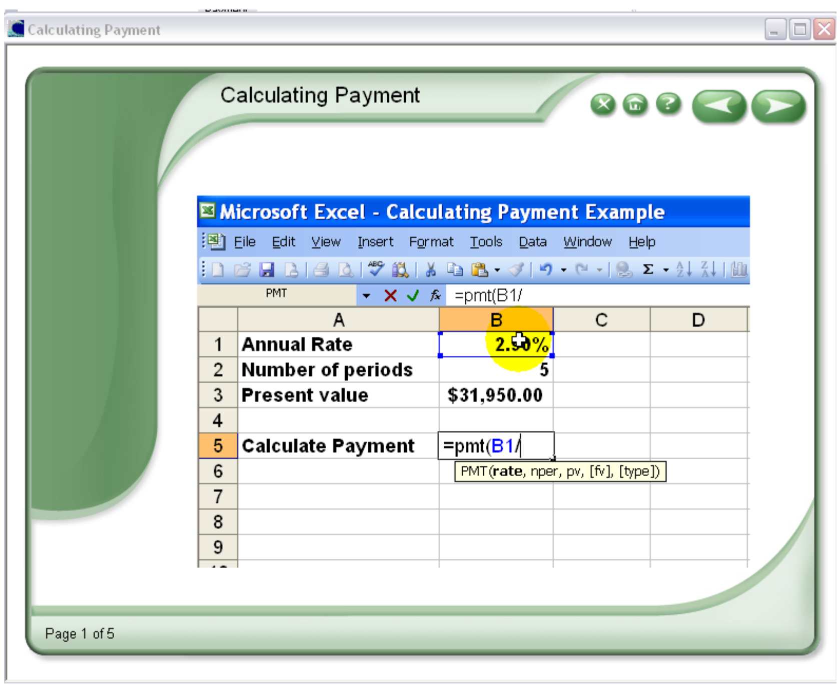

Calculating Payment
Calculating Payment
Cell References
Microsoft Excel - Calculating
File Edit View Insert Format
B3
A B C
1
2
3
4
Microsoft Excel - Book1
File Edit View Insert Format
A1
A B C
1
2
3
Page 1 of 2

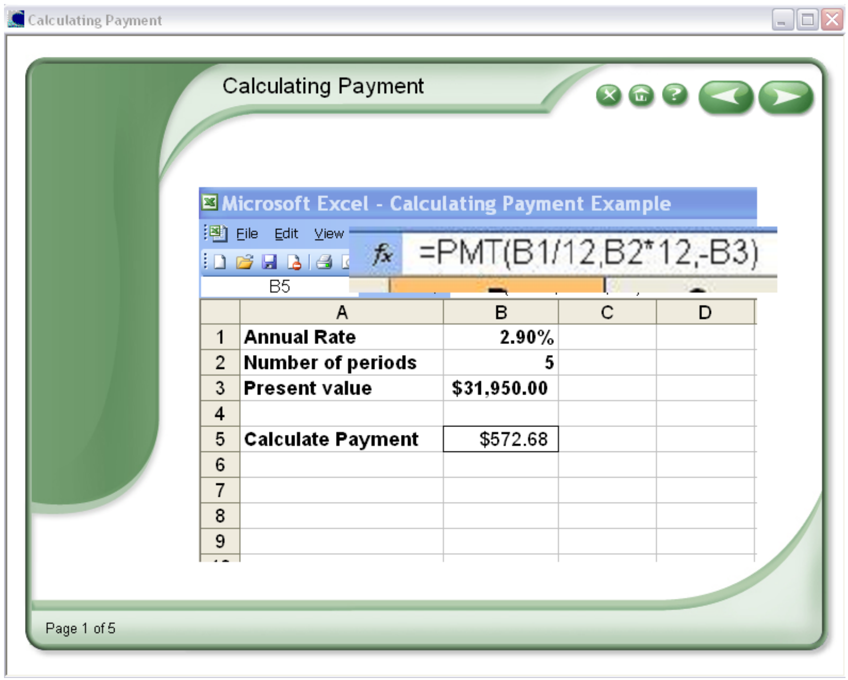

Calculating Payment
Calculating Payment
Cell References
Microsoft Excel - Calculating
File Edit View Insert Format
B3
A B C
1
2
3
4
The highlighted area is considered cell B3
The highlighted area is considered cell A1
Microsoft Excel - Book1
File Edit View Insert Format
A1
A B C
1
2
3
Page 1 of 2

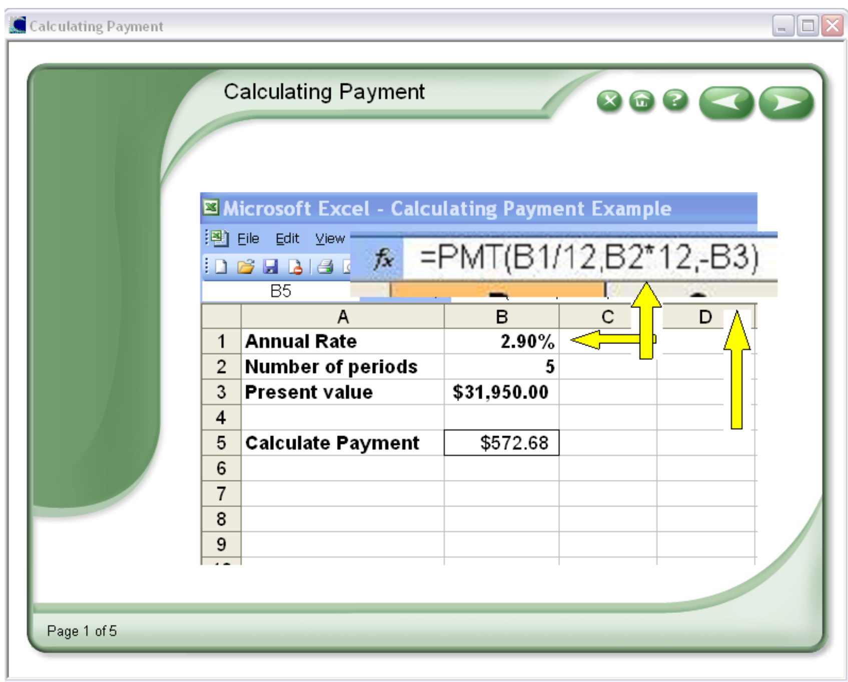

Calculating Payment
Calculating Payment
Cell References
What is the cell reference for the highlighted cell?
Microsoft Excel - Book1
File Edit View Insert Format
B2
A B C
1
2
3
4
B2
B1
A1
Back
Done
Please select an answer and then click done. If you wish to review the previous slide, choose back.
Page 2 of 2

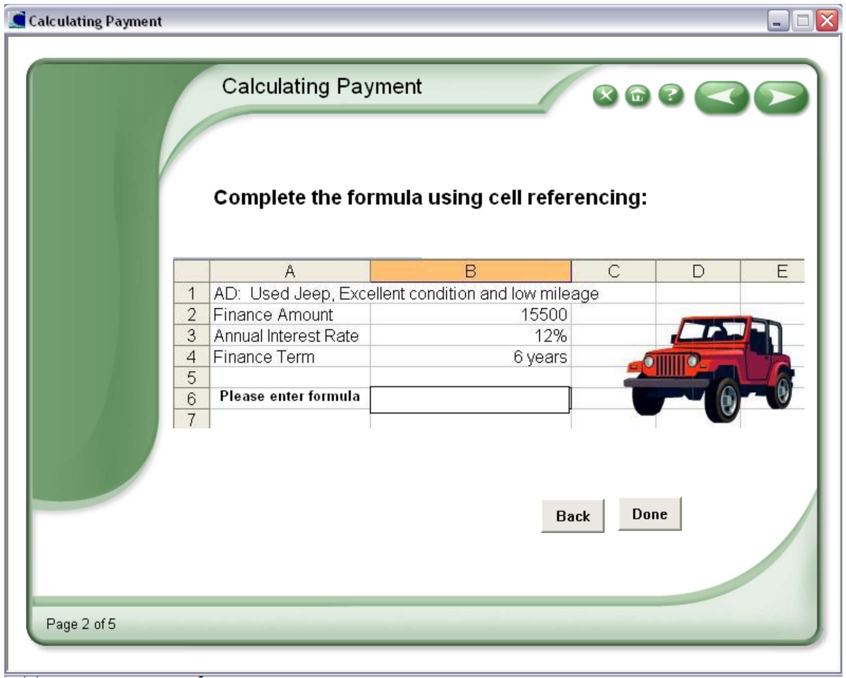

Calculating Payment
Calculating Payment
Cell References
What is the cell reference for the highlighted cell?
Microsoft Excel - Book1
File Edit View Insert Format
Lectora
Good Job! Please continue...!
OK
B2
B1
A1
Back
Done
Please select an answer and then click done. If you wish to review the previous slide, choose back.
Page 2 of 2

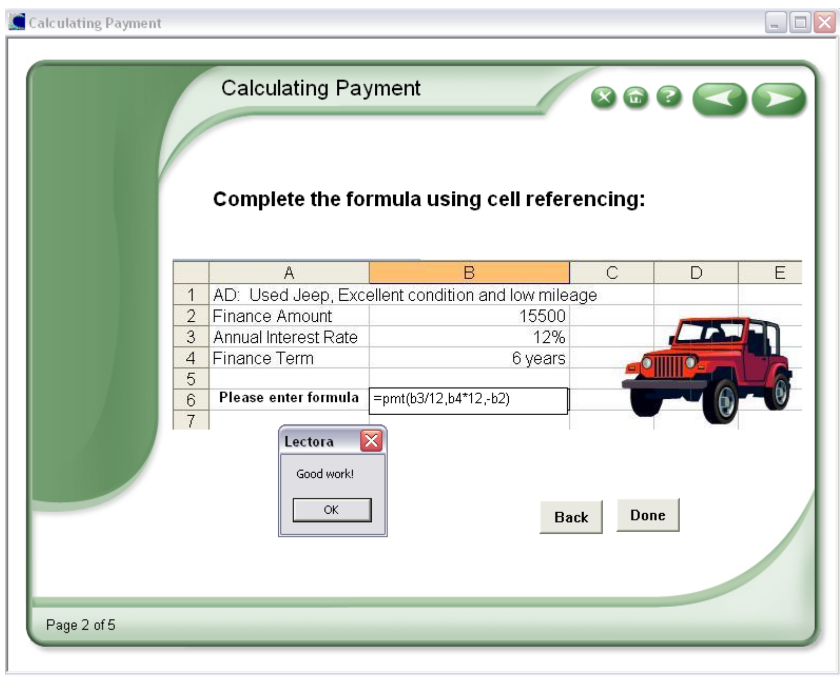

Calculating Payment
Calculating Payment
Microsoft Excel - Calculating Payment Example
File Edit View Insert Format Tools Data Window Help
PMT
=
A B C D
1 Annual Rate 2.90%
2 Number of periods 5
3 Present value $31,950.00
4
5 Calculate Payment =
6
7
8
9
Page 1 of 5

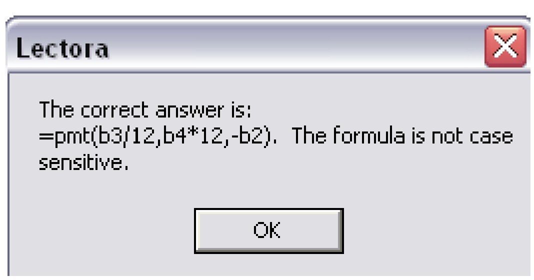

Calculating Payment
Calculating Payment
Microsoft Excel - Calculating Payment Example
File Edit View Insert Format Tools Data Window Help
PMT
=pmt(B1/
A B C D
1 Annual Rate
2 Number of periods 5
3 Present value $31,950.00
4
5 Calculate Payment =pmt(B1/
6 PMT(rate, nper, pv, [fv], [type])
7
8
9
Page 1 of 5


Calculating Payment
Calculating Payment
Microsoft Excel - Calculating Payment Example
File Edit View
=PMT(B1/12,B2*12,-B3)
B5
A
B
C
D
Annual Rate
2.90%
Number of periods
5
Present value
$31,950.00
Calculate Payment
$572.68
Page 1 of 5


Calculating Payment
Calculating Payment
Microsoft Excel - Calculating Payment Example
File Edit View
=PMT(B1/12,B2*12,-B3)
B5
A
B
C
D
Annual Rate
2.90%
Number of periods
5
Present value
$31,950.00
Calculate Payment
$572.68
Page 1 of 5


Calculating Payment
Calculating Payment
Complete the formula using cell referencing:
A
B
C
D
E
1 AD: Used Jeep, Excellent condition and low mileage
2 Finance Amount 15500
3 Annual Interest Rate 12%
4 Finance Term 6 years
5
6 Please enter formula
7
Back
Done
Page 2 of 5


Calculating Payment
Calculating Payment
Complete the formula using cell referencing:
A
B
C
D
E
1 AD: Used Jeep, Excellent condition and low mileage
2 Finance Amount 15500
3 Annual Interest Rate 12%
4 Finance Term 6 years
5
6 Please enter formula =pmt(b3/12,b4*12,-b2)
7
Lectora
Good work!
OK
Back
Done
Page 2 of 5


Lectora
The correct answer is:
=pmt(b3/12,b4*12,-b2). The formula is not case sensitive.
OK

APPENDIX B: The Assessment Device

(Developed by Nicholas W. Farha)

Part 1: Demographic Information

1. Indicate your gender. ☐ Female ☐ Male

2. Indicate your age: ______________

3. **[Control Group Only]**
   If you had a choice, would you prefer to learn by:
   (choose only one)

   ☐ using technology
   ☐ reading/using a text book
   ☐ having someone show you

3. **[Experimental Group Only]**
   If you had a choice, would you prefer to learn by:
   (choose only one)

   ☐ using technology like the piece you just used
   ☐ reading/using a text book
   ☐ directed instruction

4. How would you rate your expertise and/or experience at accounting?

   ☐ none ☐ below average ☐ above average ☐ expert

5. Approximately how many hours in a typical week do you spend gaming – computer games, console games, video games, etc.?

   ☐ 0 ☐ 1 – 10 ☐ 11 – 20 ☐ 21 – 30 ☐ more that 30

6. How would you rate your expertise and/or experience with Microsoft Excel?

   ☐ none ☐ below average ☐ above average ☐ expert

7. Select your school:

   ☐ Indiana State University
   ☐ Saint Mary-of-the-Woods College
   ☐ Rose-Hulman Institute of Technology
   ☐ Ivy Tech Community College

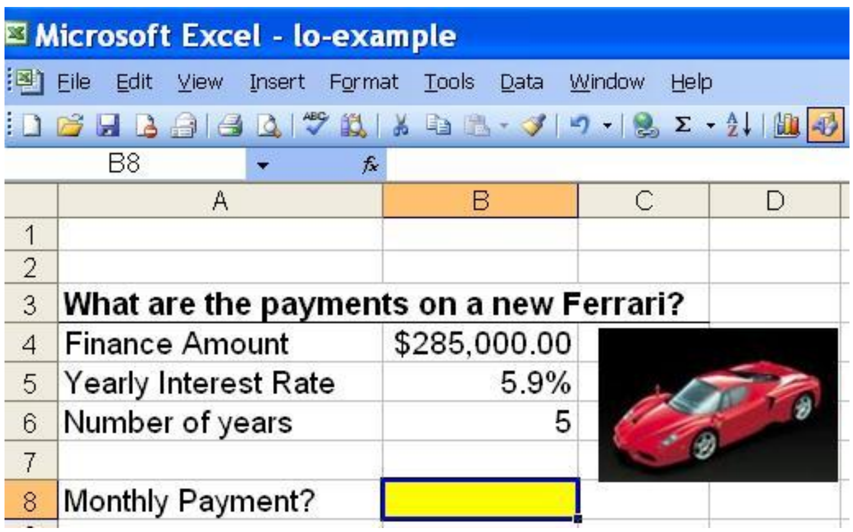
8. Indicate your major: ____

9. Indicate your minor: ____

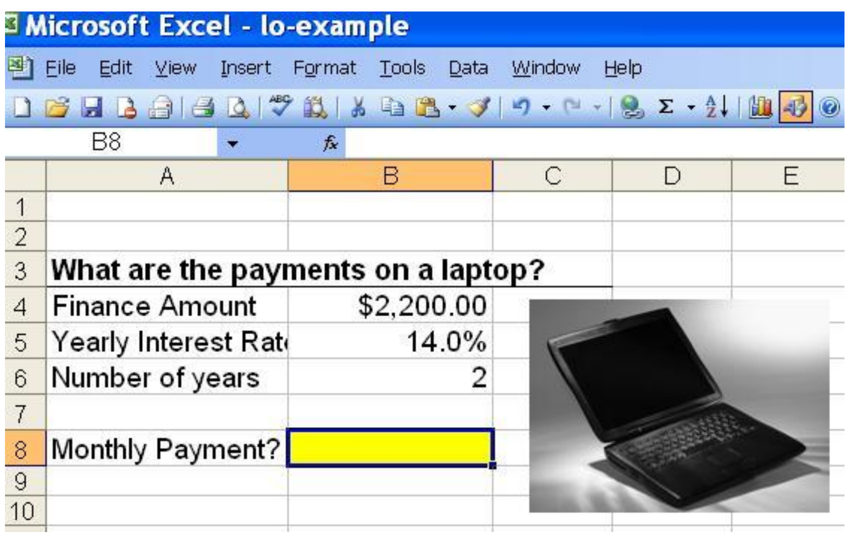
Part 2: Problems

Based on what you just learned, input the correct Excel expression (formula) to calculate the loan payment for each of the problems below. There is only one correct answer for each problem.

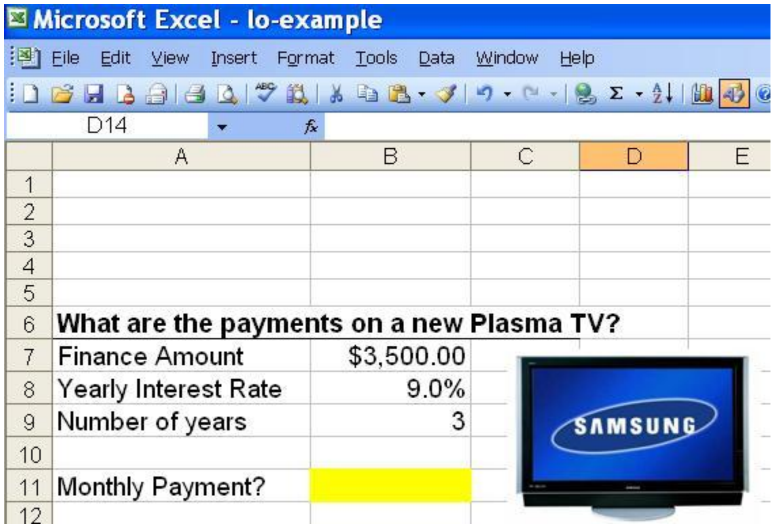
10.



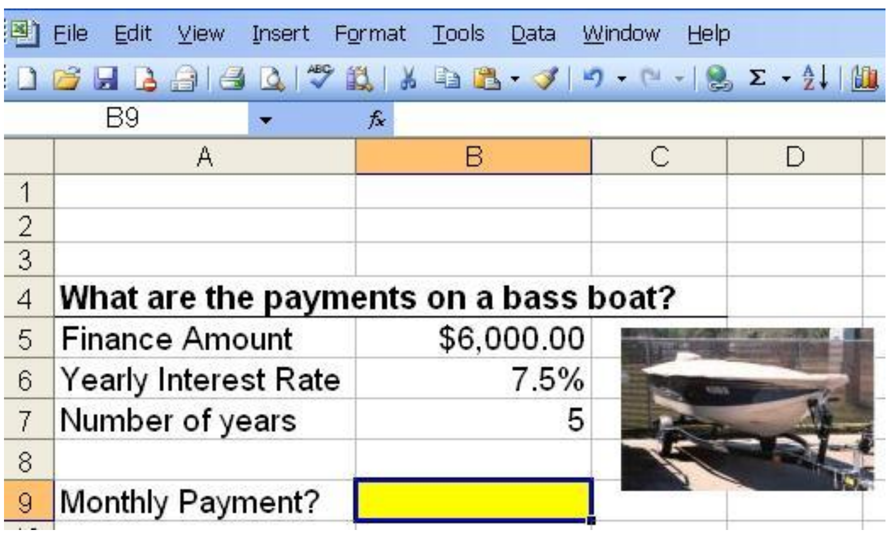
11.



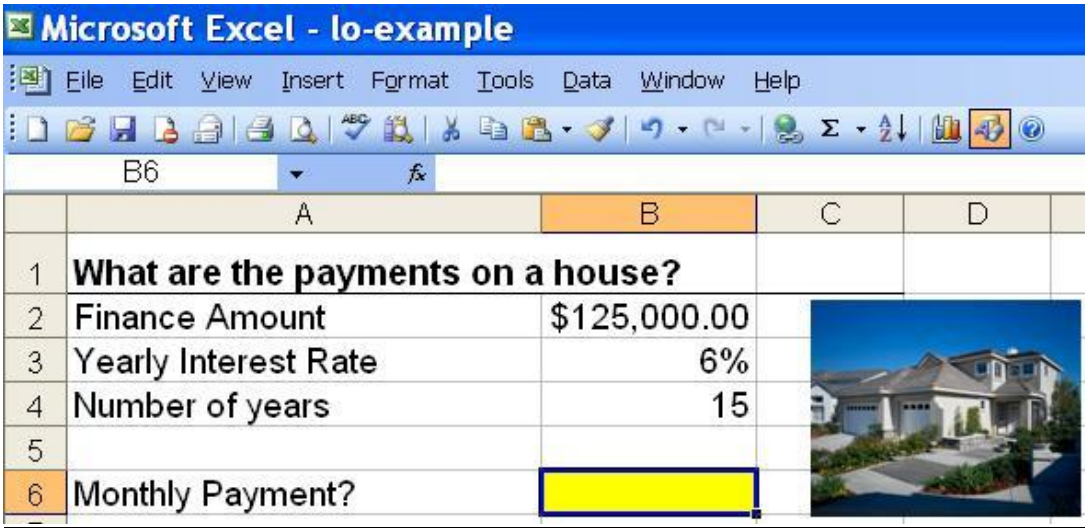
12.


Microsoft Excel - lo-example
File Edit View Insert Format Tools Data Window Help
D14
What are the payments on a new Plasma TV?
Finance Amount $3,500.00
Yearly Interest Rate 9.0%
Number of years 3
Monthly Payment?
SAMSUNG

13.


File Edit View Insert Format Tools Data Window Help
B9
What are the payments on a bass boat?
Finance Amount $6,000.00
Yearly Interest Rate 7.5%
Number of years 5
Monthly Payment?

14.


Microsoft Excel - lo-example
File Edit View Insert Format Tools Data Window Help
B6
A
B
C
D
What are the payments on a house?
Finance Amount
$125,000.00
Yearly Interest Rate
6%
Number of years
15
Monthly Payment?