Association for Information Systems
AIS Electronic Library (AISeL)

AMCIS 2004 Proceedings

Americas Conference on Information Systems (AMCIS)

December 2004

A Spreadsheet Solution to Black Box Accounting

Richard Grenci
John Carroll University

Anthony Grenci
Clarion University of Pennsylvania

A Spreadsheet Solution to Black Box Accounting

Richard T. Grenci
John Carroll University
RGrenci@JCU.edu

Anthony F. Grenci
Clarion University of Pennsylvania
AGrenci@Clarion.edu

ABSTRACT

In this research, we look at the problem of tax accounting, fraught with countless rules, but simplified by powerful software solutions. As a pedagogical problem, questions arise as to the most effective means for teaching the tax accounting student. We develop the position that the technology solution lies not in the use of tax software but more so in the use of spreadsheet software. Fitting to a constructivist perspective on learning, spreadsheets allow for the assimilation of building blocks of information that provide a basis for constructing knowledge of a concept.

Keywords

Accounting curriculum, Accounting software, Spreadsheet analysis.

INTRODUCTION

The pros and cons of computer-assisted learning can be illustrated by the ongoing debate over calculator usage. While educators and students increasingly use calculators in the classroom (Dossey and Mullis 1997, and Shaughnessy et al. 1998), opponents of the practice point to problems created by a reliance on calculated solutions that downplays the understanding and context of the calculations (e.g., Klein and Cicci 2001). In fact, a study of college undergraduates revealed that students lacked confidence in their estimation skills and were reluctant to question seemingly incorrect calculator results (Glasgow and Reys 1998). A recent article in the Wall Street Journal (Golden 2000) examined the implications of calculators as exemplified by a fifth grade math class that used them as a substitute for memorizing mathematics tables. To emphasize the cons of such a black box approach, the article concludes with a situation where one student used the calculator while shopping. When asked for the sum of a 50-cent item and a $1.25 item, the student forgot to enter a decimal point in the calculator and replied, “Fifty-one dollars and 25 cents.”

Such problems motivate arguments against the “black box” approach to computer-assisted learning in which computational processes (and even output) are not entirely understood by the user. As a pedagogical problem, questions arise as to the most effective means for using technology to construct understanding. In this research, we look at the specific problem of understanding tax accounting, fraught with countless rules, but simplified by powerful software solutions. We develop the position that the technology solution lies not in the use of tax software but more so in the use of spreadsheet software that can provide a contextual solution and a constructivist approach to building knowledge.

SPREADSHEET SOLUTIONS

Out of context and/or lacking knowledge of underlying relevant theories, calculations can produce spurious results, with or without the help of human error. The same problem can be more exaggerated in the domain of computer programmed calculations in which the method of computation also can be hidden from the user. A recent case study (Elger 2003) examined online calculators for life insurance needs and compared the results to those made via an electronic spreadsheet. Based on conceptual foundations and using a specific case, a spreadsheet was used to calculate life insurance needs of $985,000 and $375,000 for a husband and wife respectively. Comparatively, eleven top-ranked online life insurance calculators produced needs estimates ranging from $75,000 to $2.7 million for the husband and $0 to $2.3 million for the wife. The variations were attributed to differences in conceptual approaches as well as the user’s lack of understanding of assumptions and definitions. Ultimately, without knowledge of the conceptual bases of the online calculations, the results had little informative value.

In the above example, the spreadsheet approach allowed best for the detailed comprehension of the conceptual methods and assumptions of the problem, thus producing a more informative result as compared to the pre-programmed approach. Various articles have demonstrated the ability for spreadsheets to be applied to different contexts as a learning tool for investigating mathematical concepts, from statistical analyses in the natural and social sciences (Kugler, Hagan and Singer

2003), to construction cost estimation in engineering (Nassar 2002), to simulation (Grossman 1999) and financial analyses (Taggart 1999) in business. However, many of these case studies and examinations glance over what is perhaps the most important spreadsheet capability that serves as a major enabler of learning.

Not only does a spreadsheet provide for a contextual and observable approach to making calculations, it also enables in-depth what-if analyses (Moursand 1999, and Neuwirth 1996), which can provide an important dimension to the investigation and comprehension of a concept and its implications. For example, a recent case study (Thomas 2003) describes the successful use of spreadsheets to learn cost-volume profit (CVP) analysis with the incorporation of what-if and sensitivity analyses as a key component of the learning process. The benefits of a spreadsheet approach are emphasized as compared to the manual method of CVP analysis featured in almost all introductory management accounting texts. Thus, spreadsheets can offer pedagogical advantages over manual calculations as well as over pre-programmed software solutions.

TECHNOLOGY IN ACCOUNTING EDUCATION

The role of accounting software solutions as an educational tool continues to fuel debate. On one hand, accounting and tax software are "becoming a college tradition," with their benefits being tied to the marketability of having experience with different packages (Nacinovich 1998). On the other hand, the integration of enterprise-level financial software (such as SAP) into accounting curricula has proven to be difficult with "few guarantees of success" (David, MacCracken, and Reckers 2003). Ultimately, both of these positions can be reconciled by the fact that one argument is based on marketability while the other is based on pedagogy. As a pedagogical problem, the question remains whether accounting software packages offer value-added benefits to classroom learning.

Studies of the use of accounting expert systems (ESs) have shown that hand calculations result in a better transfer of expertise (e.g., Murphy 1990; Rose and Wolfe 2000) despite the ability of ESs to explain the calculations. However, these and other studies (e.g., Rose and Wolfe 2000; Odom and Dorr 1995) show that ESs can improve the transfer of expertise via continuous explanations throughout the process as opposed to providing explanations at the end of the process. These studies provide a constructivist basis that can be used in the context of this research to posit a higher pedagogical value to constructing spreadsheet solutions as compared to employing expert-based tax software packages.

Constructivist theories of learning propose that knowledge is constructed via the assimilation of information. Taking the perspective that information is learned in a hierarchical structure where a broader concept is built on the basis of more detailed concepts, educational technology should be employed to successively develop a concept from more detailed information (Morgan 1996).

CASE IN POINT: TAX ACCOUNTING

In a constructivist manner of developing the underlying details that are necessary to understanding a concept, spreadsheets can offer better technological support for learning foundational concepts such as those taught in an introductory tax accounting class. As opposed to tax software packages, spreadsheets require the construction of calculations, thus providing a vehicle for analyzing and understanding the factors that underlie tax calculations. The following case provides examples of tax concepts that may be more explicitly analyzed and understood via spreadsheet solutions.

Simplified Perceptions of Marginal Tax Rates

Tax professionals have been known to offer explanations in line with the following generalization: With maximum federal marginal tax rates of 35% (for 2003), an extra $1,000 of income will result in a minimum $650 increase in net pay, and a $1,000 deduction will save a maximum $350 of taxes. This explanation would be correct if marginal tax rates were applied to Taxable Income (TI) and if tax credits were not affected. However, changes to TI often differ from the amount of the additional income or deduction; and it is possible for an additional $1,000 of income or deduction to increase or decrease a tax liability by more than $1,000. Although such cases may be somewhat exceptional, due to phase-outs and other aspects of the tax code, it is quite common for an additional $1,000 of income or deduction to result in a change to taxes that is, as a percentage, larger than the marginal tax rate. Extra income or deduction affects not only TI but also Adjusted Gross Income (AGI) and tax credits; and it is the change to AGI that often affects one or more phase-outs. The phase-outs in turn cause an increase or decrease in the amount allowed for certain tax deductions or tax credits, thus causing the exaggerated impact on TI and ultimately on taxes.

Examples

Following are just two examples of how additional revenues or deductions can result in a change to taxes that is greater than the expected change that would have been caused by simply multiplying the marginal tax rate by the additional revenue or deduction.

Fact Pattern Before Additional $1,000 of income:	
AGI (after $1,400 each IRA contributions)	$29,600
Standard Deduction	-9,500
Personal Exemptions	-6,100
Taxable Income	14,000
Income Tax	1,404
Retirement Savings Contribution Credit	-1,400
Tax Liability	4

Fact Pattern After Additional $1,000 of income:	
AGI (after $1,400 each IRA contributions)	$30,600
Standard Deduction	-9,500
Personal Exemptions	-6,100
Taxable Income	15,000
Income Tax	1,554
Retirement Savings Contribution Credit	-560
Tax Liability	996

Table 1. Additional Revenue Resulting in Above-Marginal-Rate Taxes

Assume two taxpayers are Married Filing Jointly with no dependents and have a TI of $14,000 after contributing $1,400 each into a traditional IRA. These taxpayers would be in the 15% marginal tax bracket, and an additional $1,000 of income could be expected to increase income tax liability by $150 ($1,000 * 0.15). However, an additional $1,000 of income would cause an additional $992 ($996 - $4) in tax liability, which translates to a marginal tax rate on the additional income of more than 99% (see Table 1). The increased AGI caused the allowed Retirement Savings Contribution Credit percentage to drop from 50% down to 20% because AGI crested $30,000 and the credit was partially phased out. The income tax on taxable income increased by $150 (from $1,404 to $1,554), which is the anticipated increase of additional income times the marginal tax rate; but it does not take into account the change in the Retirement Savings Contribution Credit.

Fact Pattern Before Additional $1,000 of deduction:	
AGI	$42,000
Standard Deduction	-4,750
Personal Exemptions	-3,050
Taxable Income	34,200
Income Tax	5,366
Lifetime Learning Credit	-1,800
Tax Liability	3,566

Fact Pattern After Additional $1,000 of deduction:	
AGI	$41,000
Standard Deduction	-4,750
Personal Exemptions	-3,050
Taxable Income	33,200
Income Tax	5,116
Lifetime Learning Credit	-2,000
Tax Liability	3,116

Table 2. Additional Deductions Resulting in Above-Marginal-Rate Tax Savings

Assume a taxpayer is filing Single with no dependents, has a TI of $42,000, has paid $10,000 in tuition, and is eligible for the Lifetime Learning Credit. This taxpayer is in the 25% marginal tax bracket, so an additional $1,000 of deduction could be expected to decrease income tax liability by $250 ($1,000 * 0.25). However, the additional $1,000 of deduction would cause a reduction in taxes of $450 ($3,566 - $3,116), which translates into a marginal tax rate on the additional deduction of 45% versus the 25% marginal tax bracket the taxpayer expects (see Table 2). The decreased AGI caused the Lifetime Learning Credit to be fully allowed. Before the additional deduction, 10% of the credit was disallowed due to a phase-out caused by AGI being in excess of $41,000. The income tax on TI decreased by $250 (from $5,366 to $5,116), which is the anticipated decrease of the additional deduction times the marginal tax rate; but it does not take in account the change in the Lifetime Learning Credit.

CONCLUSION

In the above scenarios, a simplified generalization results in the treatment of tax calculations as a black box that takes a marginal tax rate and multiplies it by the income. Although accountants should have a better understanding of the relationships involved in calculating taxes, focusing only on the marginal tax rates and the brackets that determine them can result in an oversimplification of the relationships. Other factors such as phase-outs and tax credits may not be explicitly considered unless the details of the calculations and a more comprehensive set of financial assumptions are known and understood.

Tax software packages could account for all of the phase-outs and limits as described above. However, there is a problem with using a comprehensive software solution as an educational tool to teach foundational concepts. The tax software would automatically account for phase-outs and limits and thus would not result in the explicit learning of those factors. On the other hand, with simple functions such as LOOKUP, IF, MIN and MAX, etc., a spreadsheet could be constructed to account for the same functionality. The mere exercise of constructing a spreadsheet would allow students to assimilate details pertaining to phase-outs and other limits, and thus would assist them with constructing relevant tax knowledge. Perhaps most importantly, spreadsheets allow for ready what-if analyses so that the tax implications of various changes in income can be better investigated and understood.

The case described in this paper can provide a basis for developing spreadsheet solutions that will allow for the testing of the usability and implications of employing such solutions as an educational tool.

REFERENCES

1. David, J. S., MacCracken, H. and Reckers, P. (2003) Integrating Technology and Business Process Analysis into Introductory Accounting Courses, *Issues in Accounting Education*, 18, 4, 417-425.
2. Dossey, J. and Mullis, I. (1997) NAEP Mathematics—1990-1992: The National, Trial State, and Trend Assessments. In Results from the Sixth Mathematics Assessment of the National Assessment of Educational Progress, edited by Patricia Ann Kenney and Edward A. Silver. Reston, Va.: National Council of Teachers of Mathematics, 17-32.
3. Elger, J. (2003) Calculating Life Insurance Need: Don't Let the Tools Fool You, *Journal of Financial Service Professionals*, 57, 3, May 2003, 38-41.
4. Glasgow, B. and Reys, B. (1998) The authority of the calculator in the minds of college students, *School Science and Mathematics*, 98, 7, 383-388.
5. Golden, D. (2000) Calculators May Be the Wrong Answer as a 'Digital Divide' Widens in Schools, *Wall Street Journal*, December 15, A1.
6. Grossman, T. (1999) Teachers' Forum: Spreadsheet Modeling and Simulation Improves Understanding of Queues, *Interfaces*, 29, 3, 88-103.
7. Klein, D. and Cicci, F. (2001) Should we curb calculator use by younger students? *American Teacher*, 85, 6, 4.
8. Kugler, C., Hagen, J. and Singer, F. (2003) Teaching Statistical Thinking, *Journal of College Science Teaching*, 32, 7, 434-439.
9. Morgan, T. (1996) Using Technology to Enhance Learning: Changing the Chunks, *Learning and Leading with Technology*, 23, 49-51.

10. Moursand, D. (1999) The Spreadsheet: Why an Award-Winning Idea Worked and What It Can Tell Educators, *Learning and Leading with Technology*, 26, 5, 4-5.
11. Murphy, D. (1990) Expert System Use and the Development of Expertise in Auditing: A Preliminary Investigation, *Journal of Information Systems*, 4, 18-35.
12. Nacinovich, M. (1998) Vendors Go To College, *Accounting Technology*, 14, 10, 26-29.
13. Nassar, K. (2002) Cost Contingency Analysis for Construction Projects Using Spreadsheets, *Cost Engineering*, 44(9), 26-31.
14. Neuwirth, E. (1996) Spreadsheets: Helpful for Understanding Mathematical Structures, *Mathematics Teacher*, 89, 252-254.
15. Odom, M. and Dorr P. (1995) The Impact of Elaboration-Based Expert System Interfaces on De-Skilling, *Journal of Information Systems*, 9, 1, 1-17.
16. Rose, J. and Wolfe, C. (2000) The Effects of System Design Alternatives on the Acquisition of Tax Knowledge from a Computerized Tax Decision Aid, *Accounting, Organizations and Society*, 25, 285-306.
17. Shaughnessy, C., Nelson, J. and Norris, N. (1998) NAEP 1996 Mathematics Cross-State Data Compendium for the Grade 4 and Grade 8 Assessment. Washington, D.C.: National Center for Education Statistics.
18. Taggart, R. (1999) Spreadsheet Exercises for Linking Financial Statements, Valuation, and Capital Budgeting, *Financial Practice and Education*, 102-110.
19. Thomas, M. (2003) Reality 101: Profit Planning with Spreadsheets, *Management Accounting Quarterly*, 5, 1, 45:56.