

An Active Learning Approach to Teaching Variance Analysis to Accounting Students

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ABSTRACT

This paper looks at an activity that breaks the normal classroom teaching pattern (where students are often content to be reluctant, inactive participants in the learning process) with an activity that is likely a new experience for most students – letting the students create and solve their own problems. This is done within a problem structure that allows students to see the framework for the needed information (regardless of the actual numbers) and then allows students to insert their own numbers into the framework and then solve the problem. Not only did this activity create a more interactive, active learning atmosphere during class time where students were much more responsive than usual, students also had more after-class questions than usual since they were asking questions about their own personally-developed problem as opposed to one developed by someone else. While applicable to many subject areas, the topic of standard costing variance analysis is used in this paper. In addition, an example from using this active learning approach in a principles of accounting class is presented.

Keywords: Active Learning; Student-Directed Learning; Standard Costs; Variance Analysis

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Introduction

This paper looks at an activity that incorporates active learning by breaking the traditional classroom teaching pattern (where students can be content to be reluctant, quiet, inactive participants in the learning process), with an activity that is usually a new experience for many students: letting students create and solve their own problems. This activity can be done within a problem structure format for several topics, but the focus for this paper is on standard costing variance analysis, a sometimes difficult topic for principles of accounting students. The reason active learning is beneficial in this approach is that it simulates the implementation and analysis of standard costing by businesses in the real world such that students better synthesize the goals of standard costing and how the variances generated achieve these goals. The problem structure in the standard costing format also shows students that 'accounting' is not just about numbers but, more importantly, about frameworks or systems that are designed to handle whatever numbers might come along. In addition, an example from using this active learning approach in a principles of accounting class is presented.

Active Learning Literature Review

Active Learning encourages student input into the learning process. Being engaged in the topic under discussion not only helps students be more interwoven into the learning process, it also allows students to learn from each other as well as from the person teaching the class. Springer and Borthick (2004) found that students used higher-level thinking skills in the introductory accounting course when working with business simulations they designed. Douglas (2012) found that active engagement by students facilitated their understanding of business law about how a problem unfolds into the various phases of its resolution. Matherly and Burney (2013) found that not only did active learning increase student participation, it also improved students' attitude towards managerial accounting topics in the class that was analyzed in their study. Since active learning focuses on learner-centered instruction and allows for individual differences in learning styles (Strage, 2008), active learning strategies have proven superior to the static lecture-based classroom approach (Burns, Pierson, and Reddy, 2014). For example, Pinder (2013) found that students' knowledge and ability to understand the subject matter increased with active learning. And, Cavanagh (2011) found that all respondents in his study agreed that active learning had helped them maintain interest and attention in the sessions under study. Limbach and Waugh (2010) found that active learning can not only encourage students to engage their higher-level thinking skills, it can also make a course more enjoyable for students (and the professor). In addition, the Accounting Education Change Commission (1990) encouraged that there not only be a focus on teaching the basic concepts, but that there also should be a focus on applying the concepts to the real world. Active learning can be accomplished in many ways. Phillips (2005) lists more than 20 strategies for active learning, including short writing assignments, debates in class (or online), and the use of clickers. The problem structure in the standard costing format in this paper similarly allows students to better model the real-world whereby a business chooses to use standard costing procedures, sets the standards and then measures the variances with actual results for the business.

Learning Objective

The learning objective for this active learning approach to teaching standard costs is to allow students to feel that they have more control over their learning environment than is allowed by working a predetermined problem presented in a textbook. One of the first statements students hear when learning about standard costs is that no one requires a business to implement a standard costing system – Rather, businesses

choose to impose a standard costing system upon themselves for purposes of control. With the predetermined standards, a business has guideposts to measure against as it moves through the future. However, students are never allowed the opportunity to start with no standard costing system and then see what happens when they implement one. This active learning activity is an attempt to shift the controls of the problem format from the professor and/or textbook to the students.

Implementation Guidelines

To give students blank pieces of paper and then instruct them to create their own standard costing problems would definitely be 'problematic,' and would likely be very confusing for the students. However, if the basic elements of standard costing procedures are given to students, they can then see that the objective is to use the framework to solve the problem with whatever the numbers happen to be. For example, in standard costing, students are usually first given the standards that are set for a product at the beginning of the time period under consideration. Then, after time passes, the actual numbers are determined and the differences or variances between the standards and actual numbers are isolated. In textbooks, this is usually done for direct materials, direct labor and manufacturing overhead. To simplify, only direct materials and direct labor are presented here. A normal here-is-the-data-now-work-the-problem format is shown in Exhibit 1 (with the solution). Also shown are the following two reminders to the students: (1) in standard costing variance calculations, the mathematical sign in the answer is dropped and it is replaced with either a Favorable designator (if the actual cost is less than standard) or an Unfavorable designator (if the actual cost is greater than standard) and (2) the Standard Quantity is the standard for one unit times the actual number of units produced (for example, the standard quantity for materials in Exhibit 1 is three pounds times 120 units). In Exhibit 1, several acceptable names for the variances are shown, but in subsequent exhibits, only the Price and Quantity names are used to identify the variances.

Once the basics of standard costing in the textbook have been covered, a good review problem such as the Hi-Class Plastiques Company illustration (shown in Exhibit 1) can be used as a handout problem for students to either work in class or do as homework and then review in class before they create their own problem. A framework for students to use in creating their own problem is shown in Exhibit 2. The two reminders that were mentioned in the previous section are also shown in Exhibit 2 (and can be left off, if desired). Including the reminders in the 'create your own problem' format will help students solve the problem and highlights the importance of the information. However, if included, students certainly need to be cautioned that the two reminders will not be on the exam.

Methodology

This has now been classroom tested in several sections of Principles of Accounting II (and has also been used as a refresher in Cost Accounting) over the last five years. The results for a Principles of Accounting II class are shown in Exhibit 3. Each student was given a handout of what is shown in Exhibit 2. A copy of the handout was then shown on a screen using a document camera and something was said in class like, 'This is your company. Consider me to be your hired accountant who has come to do your standard costing variances. Since standard costing is not required, but is chosen by businesses for control purposes, it looks as if your business has grown in size to where you have decided that using standard costing will be helpful.' Students are then directed to look at the first line in Exhibit 2 which states, '____ (Insert your name) Company makes many different products, including its very popular ____.' They are instructed to put their names on the first blank and then are asked what very popular product their company makes. Here it may take some patience and coaxing – the

instructor needs to be comfortable with an extended silence. After a minute or so, if there is no response, something might be said like, 'Well, it's your company and your very popular product – what is it?' If still no response, something might be added like, 'I can't tell you what your popular product might be, it's your business – I'm just the hired help.' By then, someone will say a product – usually so softly I have to ask them to repeat themselves. Figurines, barrels, chairs, coffee mugs and widgets have all been named. In one class, something illegal was first mentioned – which made all of us laugh. I hastily commented, 'An interesting choice – but since the government is currently discouraging sales of these products, perhaps we need a more economically-viable choice.' Widgets were chosen as a less controversial alternative. Once a product has been identified, students are then asked what numbers should be specified for their company. (To make it easier to track the calculations, students were asked not to use the number 'one' and to avoid using a chosen number more than once.) As the numbers were called out by students (still with a little hesitancy at first, but then with more confidence and curiosity), the numbers were written in on the copy projected on the screen. Once the information was selected for both the standards and actual amounts, the variances were calculated. The students went from silent, to hesitant, to engaged, to very responsive – and seemed to enjoy the turn-of-events whereby they were creating the problem and the professor was using their data to determine (with their help) the answers to the problem.

Discussion

The results have been very positive. First, it has made a huge difference in convincing students that standard costing is chosen by companies for control purposes since, for the first time, students actually have the power to set the standards themselves. Additionally, Students have also seen that the framework is solid. It will always give answers, regardless of numbers (even though some of the answers might raise an eyebrow). For example, in Exhibit 3, students set the standards per unit for materials at two pounds at \$7 per pound and then stated that 1,800 pounds of materials were used to produce four units such that the Materials Quantity Variance was

Materials Quantity Variance:

$$\begin{aligned}
 \text{M Quantity Variance} &= \text{Standard Price (Actual Quantity - Standard Quantity)} \\
 &= \$7.00 [1,800 - 2(4)] \\
 &= \$7.00 [1,800 - 8] \\
 &= \$12,544 \text{ Unfavorable}
 \end{aligned}$$

But this is good! It alerts students to the interwoven characteristics of the data. Technically, the answer is correct. But, the question is, why would it take 1,800 pounds of materials if it should have only taken eight pounds? Some variance is expected, but certainly not that much. (In fact, this turned out to be a great place to mention that if this were a test question, the numbers would be changed and another iteration of the data would be run to come up with more plausible numbers.) Another benefit is that students had no problem determining if this variance was Favorable or Unfavorable! There was considerable laughter when many responded, 'Unfavorable.' Another unexpected result also showed up in this class. While students are told in class that many variances are actually zero in the workplace, there seems to always be a variance in the textbook (to show what does happen when a variance does occur). However, with this active learning experience, a variance that was zero showed up (the Labor Quantity Variance in Exhibit 3). Students seemed quite pleased that their efforts were more reflective of the real world and had produced a heretofore unseen zero variance. Students also began to see that the framework for solving an accounting problem deserves a separate focus from whatever numbers may relate to the problem itself. In addition, as previously mentioned, students gained some insight into how exam questions are developed.

Student Comments

A short questionnaire was handed out in each class and collected from accounting students to gather their input on the active learning 'create your own problem' experience. The following are some of the comments:

- 'It was very interesting to see the problems set up where we could put in any numbers. It felt more real-life than just doing homework for class.'
- 'It really helped me to understand the concept and put everything together.'
- 'When we are able to work our own problem and plug in our own numbers, it helps us remember where the numbers come from and where they go.'
- 'I thought it really helped to work a problem through in class starting from nothing.'
- 'Allowing students to produce their own problems allows them to view how their "random" inputs affect the outcome of the problem.'
- 'I believe that whenever the entire class got involved with making up numbers and placing them into a framework, we all understood the material much better. I think this is because we can see where the numbers came from, so we have a better idea of what to do with them.'
- 'The problem in class was greatly beneficial to my understanding of the material – creative, hands-on exercise and thus memorable.'
- 'It was a helpful tool to study from, creating my own problem and being able to solve it, and working on it until it was clear.'
- 'This type of problem was a plus because it was self-created and easier retained.'
- 'The worksheet gave me the chance to look at standard costing without any numbers. It kind of gave me a way to remember it and plug in the numbers when presented with them.'
- 'Making up the numbers makes it much easier to trace the numbers through all parts of the problem.'
- 'It helps see the step-by-step process. It was beneficial in studying for the test and seeing a real-life example. It helped with all other standard costing problems we've encountered.'
- 'It was a huge plus. There are a lot of numbers involved, and when we make them up, somehow it becomes much easier to follow.'
- 'This was a positive experience because it teaches students important accounting processes without the stress of getting the correct numbers.'
- 'It was helpful in getting a better understanding of where the numbers come from and why they are used.'

Summary and Conclusions

This paper presented an active learning approach whereby students 'created their own problem' in the standard costing area of principles of accounting. Comments from students showed that their taking a more active role in the learning process was viewed very positively. Such a procedure not only breaks the normal teacher-to-student delivery pattern often encountered in the classroom, it also gives students a feeling of a little more control over their learning environment. Students also had a more positive attitude about standard costing since they no longer were just informed that businesses choose to use standard costing, but the students, themselves, chose to implement and use standard costing. By starting with only a framework and developing their own problem, students had to employ critical thinking/analytical skills to 'think' their way through their problem and, in the end, see the total picture of how all the variances interact with the preset plan and the actual results. Students also gained insight into how problems are developed and discovered the difference between the framework used to solve standard costing problems and the numbers in the problems themselves. This activity not only created a more interactive, active learning atmosphere during class time where students were much more responsive than usual, students also had more after-class questions than usual since they were asking questions about their own personally-developed problems as opposed to those developed by someone else. In addition, the first time this was done in class, so many students asked for an extra blank copy of the framework after class (so they could reinsert the numbers created in class and then work the problem again on their own) that I now go ahead and hand out two copies of the framework to each student when the topic is first introduced.

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**EXHIBIT 1
TRADITIONAL STANDARD COSTING PROBLEM (WITH SOLUTION)**

Hi-Class Plastiques Company makes many different products, including its very popular plastic lawn chairs. The standards for direct materials and direct labor for one chair are as follows:

Direct Materials	3 pounds	at \$2 per pound	= \$ 6
Direct Labor	½ hour	at \$8 per hour	= 4
			\$ 10

The following are the actual results for the month of May:
 Chair materials purchased: 400 pounds at \$1.95 per pound for a total price of \$780.
 Chair materials issued to production: 380 pounds.
 Direct labor hours used to make chairs: 70 hours at \$8.20 per hour for a total price of \$574.
 Number of chairs produced: 120.

The direct materials and direct labor variances would be calculated as follows:

Materials Price Variance (isolated at time of purchase):
 M Price Variance = Actual Quantity purchased (Actual Price – Standard Price)
 = 400 (\$1.95 - \$2.00)
 = \$20 Favorable

[Reminder: In cost variance calculations, the mathematical sign in the answer is dropped and is replaced with either a Favorable designator (if actual is less than standard) or an Unfavorable designator (if actual is greater than standard).]

Materials Quantity (or Usage or Efficiency) Variance:
 M Quantity Variance = Standard Price (Actual Quantity issued – Standard Quantity)
 = \$2.00 [380 - 3(120)]
 = \$40 Unfavorable

(Reminder: The Standard Quantity is the standard for one times the actual number of units produced.)

Labor Price (or Rate) Variance:
 L Price Variance = Actual Quantity (Actual Price – Standard Price)
 = 70 (\$8.20 - \$8.00)
 = \$14 Unfavorable

Labor Quantity (or Usage or Efficiency) Variance:
 L Quantity Variance = Standard Price (Actual Quantity – Standard Quantity)
 = \$8.00 [70 - ½ (120)]
 = \$80 Unfavorable

**EXHIBIT 2
'CREATE YOUR OWN' STANDARD COSTING PROBLEM FOR STUDENTS**

____ (Insert your name) Company makes many different products, including its very popular _____. The standards for direct materials and direct labor for one _____ are as follows:

Direct Materials	_____ pounds	at _____ per pound	= _____
Direct Labor	_____ hours	at _____ per hour	= _____

The following are the actual results for the month of May:

Materials purchased: _____ pounds at _____ per pound for a total price of _____.
 Materials issued to production: _____ pounds.
 Direct labor hours used: _____ hours at a price of _____ per hour for a total price of _____.
 Number of units produced: _____.

The direct materials and direct labor variances would be calculated as follows:

Materials Price Variance (isolated at time of purchase):
 M Price Variance = Actual Quantity purchased (Actual Price – Standard Price)
 = _____ (_____ - _____)
 = _____

[Reminder: In cost variance calculations, the mathematical sign in the answer is dropped and is replaced with either a Favorable designator (if actual is less than standard) or an Unfavorable designator (if actual is greater than standard).]

Materials Quantity Variance:
 M Quantity Variance = Standard Price (Actual Quantity issued – Standard Quantity)
 = _____ (_____ - _____)
 = _____

(Reminder: The Standard Quantity is the standard for one times the actual number of units produced.)

Labor Price Variance:
 L Price Variance = Actual Quantity (Actual Price – Standard Price)
 = _____ (_____ - _____)
 = _____

Labor Quantity Variance:
 L Quantity Variance = Standard Price (Actual Quantity – Standard Quantity)
 = _____ (_____ - _____)
 = _____

**EXHIBIT 3
RESULTS FROM PRINCIPLES OF ACCOUNTING – 'CREATE YOUR OWN'
STANDARD COSTING PROBLEM FOR STUDENTS**

Principles – Section 1. ____ (Insert your name) Company makes many different products, including its very popular _____ widgets. The standards for direct materials and direct labor for one widget are as follows:

Direct Materials	_____2_____ pounds	at _____\$7_____ per pound	= _____
Direct Labor	_____3_____ hours	at _____\$15_____ per hour	= _____

The following are the actual results for the month of May:

Materials purchased: _____2,000_____ pounds at _____\$5_____ per pound for a total price of _____\$10,000_____.
 Materials issued to production: _____1,800_____ pounds.
 Direct labor hours used: _____12_____ hours at a price of _____\$16_____ per hour for a total price of _____\$192_____.
 Number of units produced: _____4_____.

The direct materials and direct labor variances would be calculated as follows:

Materials Price Variance (isolated at time of purchase):
 M Price Variance = Actual Quantity purchased (Actual Price – Standard Price)
 = 2,000 (\$5 - \$7)
 = _____\$4,000 F_____

[Reminder: In cost variance calculations, the mathematical sign in the answer is dropped and is replaced with either a Favorable designator (if actual is less than standard) or an Unfavorable designator (if actual is greater than standard).]

Materials Quantity Variance:
 M Quantity Variance = Standard Price (Actual Quantity issued – Standard Quantity)
 = _____\$7_____ (_____1,800_____ - _____8_____)
 = _____\$ 12,544 U_____ (2 x 4)

(Reminder: The Standard Quantity is the standard for one times the actual number of units produced.)

Labor Price Variance:
 L Price Variance = Actual Quantity (Actual Price – Standard Price)
 = _____12_____ (_____\$16_____ - _____\$15_____)
 = _____\$12 U_____

Labor Quantity Variance:
 L Quantity Variance = Standard Price (Actual Quantity – Standard Quantity)
 = _____\$15_____ (_____12_____ - _____12_____)
 = _____\$-0_____ (3 x 4)