

The Acceptability and Effectiveness of Textbook Material Revised Using Instructional Design Criteria

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Abstract. If instructional designers are to achieve widespread success by reaching large numbers of students, they have to develop learning materials that are not only effective in producing the desired learning outcomes but are also accepted and used by teachers. In this study, a list of standard instructional design revisions (techniques that are frequently used by designers) were identified. The effects a number of these standard revisions (applied to a chapter from a commercial textbook) had on teachers' adoption attitudes and student performance were investigated. Teachers who reviewed the modified chapter were no more or less willing to use it than teachers who reviewed the original version. However, the instructional design revisions did significantly improve student performance. The implications of the results of the study for instructional design practice and future research are discussed.

Introduction

There are two basic approaches to the design of print instructional materials: the traditional method and the instructional design method. The traditional approach is the one commonly used by commercial publishing companies. In this method most of the author's attention is paid to the content of the book. Assumptions about what content should be presented are the textbook writer's guidelines. The standard editing and graphic design procedures of the publisher determine how the content

will be communicated. These procedures usually take the form of "tried and true" principles that are based on artistic judgments and marketing considerations rather than on scientific knowledge about the learning process. Most print materials used by teachers are developed in the traditional way.

Unlike the traditional approach used in the design of most commercial textbooks, instructional design focuses on the characteristics of the material that produce learning. Typically, a development team is guided in its work by the instructional designer's knowledge of instructional design principles derived from learning theory and research and also from data collected from learners who have used the material. In general, instructional designers consider learner data the primary source of information on which to base the design of instructional materials.

Will a traditional textbook that is revised using instructional design criteria (design principles derived from learning theory and research) be used by teachers? If so, what will be the effects on student performance? Commercial publishers have not shown much interest in either question. While instructional designers strive to find answers to the question of improved student performance they too have not shown much interest in the first question. Yet, designers should be concerned about teachers' adoption attitudes because if designers' revisions affect teachers' attitudes negatively, the materials may not be adopted by teachers and used by students. Either designers will have to find alternatives that are both instructionally effective and acceptable to teachers, or teachers' attitudes must be changed. On the other hand, if instructional designers' revisions have neutral or positive effects on teachers' attitudes any problems associated with adoption may be beyond the designer's control. In this case, instructional designers, confident that their efforts do not have a

negative effect on teachers' willingness to use their materials, can continue to focus most of their attention on improving student performance.

Purpose of the Study

The major purpose of this study was to answer the following questions:

1. Do teachers who review traditional textbook material that was revised using instructional design criteria have significantly different attitudes toward adopting the material from teachers who review the original, unrevised version?
2. Is traditional print instructional material that was revised using instructional design criteria more effective with learners than the original, unrevised version?

The effects of student reading ability on posttest performance, the amount of time it took to complete each chapter, and the posttest were also examined.

Method

Subjects

The teacher and student participants in the study were from St. Petersburg Vocational-Technical Institute in St. Petersburg, Florida. Fifty-six teachers were in the teacher sample. Seventy-four students participated in the study; they represented most of St. Petersburg Vo-Tech's 45 vocational programs, and all read at an eighth grade level or higher. Most of the teacher and student subjects were involved in classes characterized primarily by self-paced instruction.

All of the teachers were expected to teach entrepreneurship, the subject of the instructional material selected for the study. Seventy-seven percent of the teachers reported they had spent no time teaching entrepreneurship, and only eight percent reported spending more than 20 hours. None of the teachers had ever reviewed or used the version of the material he or she was assigned in the study.

Each teacher participant was asked to provide at least one student who met two criteria: (a) not be enrolled in a business management program and (b) be able to read at an eighth grade level or higher. Forty five students had worked in a small business, 13 in their families' businesses. Since the students were randomly assigned to the two versions of the material, any effects of previous knowledge of the subject on the results were controlled.

Instructional Materials

Two sets of instructional material were used in this study. One was a chapter taken from a commercial textbook entitled *Small Business Management* (Pickle & Abrahamson, 1981). The other was a modified version of the chapter which incorporated standard instructional design revisions.

A panel of nine instructional designers was formed to review the original version of the instructional material and to recommend revisions that would make the chapter more effective in teaching the objectives of the lesson. The recommended revisions were selected from a list of 94 standard instructional design techniques that had previously been identified by the same instructional design panelists as effective ways to supply Gagne's (1977) events of instruction. The panelists consisted of four professors/practitioners and five practitioners. All panelists were experienced in using Gagne's events of instruction to design print material. The revisions were made in the original textbook chapter by the researcher and validated by the panelists. A comparable page from the original textbook and the modified version can be seen in Figures 1 and 2.

Instrument

A five-point Likert-type scale, the Instructional Materials Acceptance Questionnaire (IMAQ), was developed to measure the degree to which teachers agreed or disagreed with 25 statements describing behaviors that reflect teachers' willingness to use or not use instructional material. The face validity of the IMAQ was established by asking teachers from the target population to review every item on the questionnaire and indicate whether it represented an adoption, rejection, or information-seeking behavior. Coefficient alpha was used to estimate the reliability. Alpha was .95 (n=25).

A criterion-referenced (objectives-based) test was developed to measure

student performance on the verbal information objectives and the intellectual skills objectives of the instruction. The test was validated by a professor of measurement evaluation and two instructional designers. Coefficient alpha was used to estimate the reliability of the 90-item test. Alpha was .96 (n=74).

Procedure

The Instructional Materials Acceptance Questionnaire was completed by the 56 postsecondary vocational instruc-

tors. None of the teachers had ever reviewed either version of the instructional material before participating in the study. All of the teachers convened at one time in a large classroom. Twenty-seven teachers were randomly assigned to the group that reviewed the revised version, and 29 teachers were randomly assigned to the group that reviewed the original, unmodified chapter.

The 74 vocational students convened

CHARACTERISTICS THAT CONTRIBUTE TO BUSINESS SUCCESS

Extensive research has been conducted in an attempt to identify the personality characteristics that contribute to business success. To date, no general agreement has resulted from this search. One research study of 97 small business managers did produce a correlation of .63 between success and five general characteristics: (1) drive, (2) mental ability, (3) human relations ability, (4) communications ability, and (5) technical knowledge.² (See Fig. 1-2.)

DRIVE

In general terms, drive is a person's motivation toward a task. It is comprised of such personality traits as responsibility, vigor, initiative, persistence, and

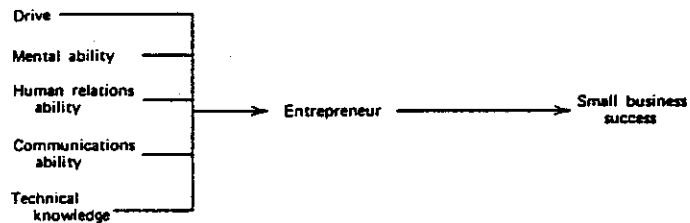


Figure 1-2 Contributors to small business success.

ambition. An entrepreneur must exert considerable effort in establishing and managing his/her small business. The manager who works hard planning, organizing, coordinating, and controlling his/her small business is more likely to have a successful business than the manager who is lax and haphazard.

Of course, many entrepreneurs work long hours in their businesses at menial tasks, such as cooking in a restaurant, and still do not succeed because they fail to perform the more difficult management functions of planning, organizing, directing, and controlling. In fact, some small business managers perform menial chores in order to avoid managerial tasks because they feel inadequate or lack the knowledge necessary for functioning as an effective manager. By staying busy in the menial tasks, they convince themselves they don't have time to perform many management functions. It is not unusual to hear such comments as "I know I should be doing that, but I just don't have time."

MENTAL ABILITY

Mental ability that contributes to the success of the small business entrepreneur-manager consists of overall intelligence (IQ), creative thinking ability, and analytical thinking ability. Small business managers must be reasonably intelligent, able to adapt their actions to the needs of the business in various situations (creative thinking), and able to engage in analysis of various problems and situations in order to deal with them (analytical thinking). (See Fig. 1-3.)

Figure 1. Original version.

in two sessions held one day apart. Half of the students met the first day, and the other half met the next day. Thirty-six students were randomly assigned to the group given the revised chapter, and 38 students were randomly assigned to the group given the original, unmodified chapter. The two groups were homogeneous in reading ability. The students were allowed as much time as they needed during the day to read and study the chapter and take the test. They were not allowed to view the other version of the chapter during the experiment.

Statistical Analyses

A series of t tests were used to test the hypotheses on teachers' adoption attitudes, student time spent on the book, and student time spent on the test. A t test was also used to determine whether the two groups differed significantly in reading ability. The students' scores on the Gates-MacGinitie Reading Tests were used in this test. As Table 1 indicates, the variance estimates for the groups were homogeneous.

A two-way analysis of variance was used to test the hypotheses concerning student performance on the posttest.

The independent variables were: (a) version of the book (original or modified) and (b) reading ability (high or low). The students were divided into two ability groups: learners with high and low reading abilities. Students who scored above the mean for the total sample on the Gates-MacGinitie Reading Tests were assigned to the high group; students who scored at or below the mean were assigned to the low group. Three separate ANOVAs were run for the three dependent variables: total posttest score, verbal information subscore, and intellectual skills subscore.

WHAT PERSONALITY CHARACTERISTICS CONTRIBUTE TO SMALL BUSINESS SUCCESS?

A great deal of research has been conducted to try to identify the personality characteristics that contribute to small business success. So far, there is no general agreement. One research study of 97 small business managers, however, showed that success is related to five general characteristics: (1) **drive**, (2) **mental ability**, (3) **human relations ability**, (4) **communications ability**, and (5) **technical knowledge**.⁴(See Fig. 1-2.)

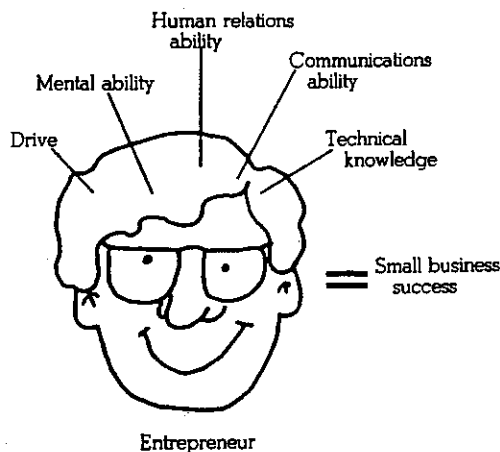


Figure 1-2 Personality characteristics that contribute to small business success

⁴Hal B. Pickle, *Personality and Success: An Evaluation of Personal Characteristics of Successful Small Business Managers*. Small Business Administration, Washington, D.C., 1964.

Drive

In general terms, **drive is a person's motivation toward a task** (how much the person *wants* to do it). Drive includes such personality traits as responsibility, energy, initiative, persistence, and ambition. An entrepreneur must work hard to start and manage his/her small business. A manager who works hard planning, organizing, coordinating, and controlling his/her small business is more likely to have a successful business than a manager who is casual and careless.

Of course, many entrepreneurs work long hours at menial (low level) tasks, such as cooking in a restaurant, and still do not succeed because they fail to perform the more difficult management functions: planning, organizing, directing, and controlling. In fact, some small business managers perform menial chores in order to avoid managerial tasks because they feel inadequate or don't know how to be effective managers. By staying busy at menial tasks, they convince themselves they don't have time to perform management functions. It is not unusual to hear such comments as "I know I should be doing that, but I just don't have time."

Mental Ability

Mental ability consists of overall intelligence (IQ), creative thinking ability, and analytical thinking ability. Small business managers must be fairly intelligent, able to change their actions to meet various situations (creative

Figure 2. Modified version.

Table 1
Means, Standard Deviations, and *t*
Values for Reading Ability

Group	<i>n</i>	<i>M</i>	<i>SD</i>	<i>SE</i>	<i>F</i> ^a	2-Tail Prob.	<i>t</i>	<i>df</i>
1 Revised Book	35	45.26	5.60	.95				
					1.27	.49	.26	68
2 Original Book	35	44.89	6.31	1.07				

Note: Reading scores were not available for four subjects, one in the revised group and three in the original group.

^a*F* test for homogeneity of variance

Results

Teachers' Adoption Attitudes

Teachers in Group 1, the group that reviewed the modified chapter, scored a mean of 55.52 on the Instructional Materials Acceptance Questionnaire, while teachers in Group 2, the group that reviewed the original version, scored a mean of 59.90. On a 25 item scale with item response values ranging from positive (1 point) to negative (5 points), a mean of 50 points indicates that teachers had a slightly positive attitude toward using the material. The difference between the two groups' ratings was not statistically significant. An analysis of teachers' open-ended responses to the question asking what features of the material particularly influenced their feelings about using it or not using it revealed that teachers paid more attention to the content and the visual appearance of the chapter than the features supplying the instructional events.

Student Performance

As indicated in Figure 3, students who received the modified version of the chapter scored higher on the total post-test as well as on the verbal information and intellectual skills subsections than did students who received the original chapter. The results of the three ANOVAs, as shown in Table 2, indicate

there were main effects for version of book and reading ability on all three dependent variables ($p < .001$). There were no significant interactions. As indicated in Figure 3, on all three dependent variables, the low readers assigned to the modified version attained means very close to the high readers assigned to the original version.

The time students spent reading the book and doing the test was measured in minutes. There was a significant difference ($p < .001$), for time on book but no significant difference for time on test. Students completing revised version took an average of 19 minutes longer than students reading the original chapter.

Discussion

The main purpose of this study was to determine what effect standard instructional design revisions of traditional print instructional material had on teachers' attitudes toward adopting the material. Another important purpose was to verify that the instructional design revisions resulted in a product that was more effective in teaching students the objectives of the instruction. Based on the results of this experiment, the following conclusions are made.

An analysis of teachers' responses to the open-ended question concerning

what features influenced their adoption decisions shows that content was the most important factor. Teachers tended to pay attention to the same characteristics in both books and for the most part they did not consider the presence or absence of the standard instructional design revisions or their intended effects as especially important to their decisions.

In this study teachers were not made aware of the differences in the two versions of the materials. It would be interesting to determine whether instructional design revisions influence teachers' choices of materials when teachers are asked to make a comparative evaluation. Another worthwhile line of inquiry would be to investigate whether providing teachers with feedback on student performance, attitudes, and time it took students to achieve mastery would produce significantly different degrees of acceptance of the two versions of materials. If teachers' decisions are influenced favorably by raising their awareness of the instructional design revisions and their effects, or by providing feedback on student performance and attitudes, then designers could increase the use of their products by promoting instructional design features.

The focus of this study was limited to the effectiveness and acceptability of a group of instructional design revisions

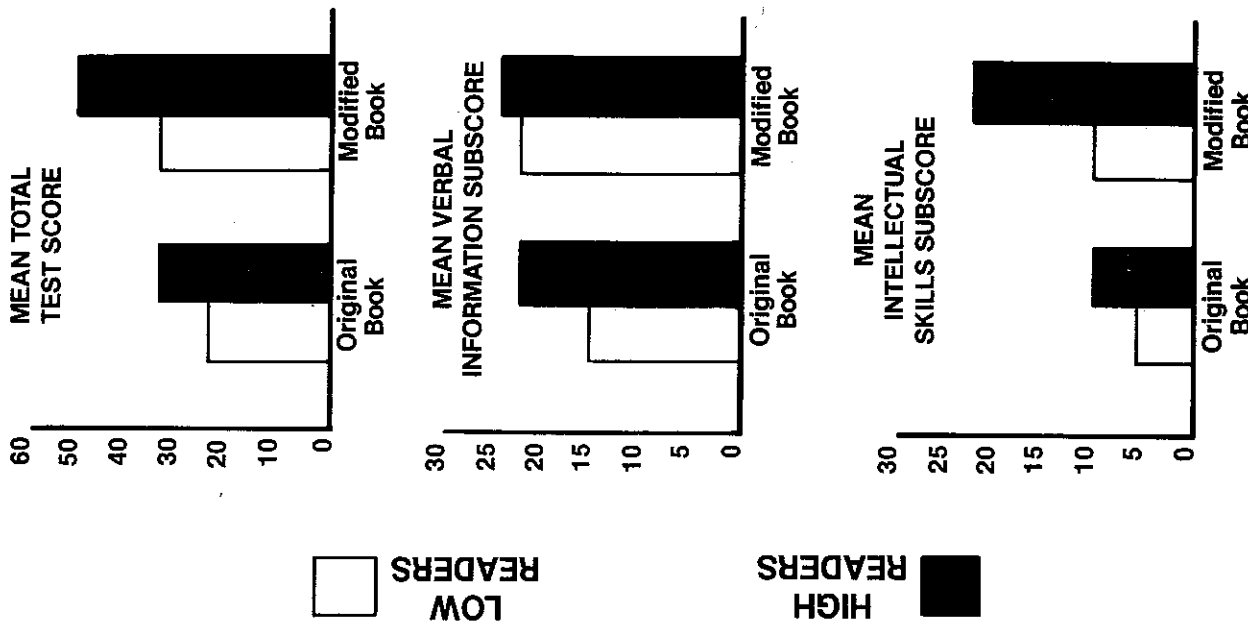


Figure 3. Mean test scores for the total test, verbal information subpart and intellectual skills subpart.

Table 2

Analysis of Variance for Total Test, Verbal Information, and Intellectual Skills Scores

Source	df	SS	MS	F
Total Test Scores				
Main Effects				
B_i	1	3846.79	3846.79	19.38*
R_j	1	3802.86	3802.86	19.16*
Interactions				
$B_i \times R_j$	1	234.12	234.12	1.18
Error	70	13895.41	198.51	
Total	73	21583.04		
Verbal Information Subscore				
Main Effects				
B_i	1	788.75	788.75	19.80*
R_j	1	826.32	826.32	20.74*
Interactions				
$B_i \times R_j$	1	.62	.62	.02
Error	70	2788.59	39.84	
Total	73	4362.88		
Intellectual Skills Scores				
Main Effects				
B_i	1	1151.78	1151.78	14.48*
R_j	1	1083.83	1083.83	13.63*
Interactions				
$B_i \times R_j$	1	258.85	258.85	3.25
Error	70	5568.47	79.55	
Total	73	8005.62		

* $p < .001$

on a particular set of print materials. Having established that the revisions did result in higher student performance scores, the next step in examining the effects of the revisions should be to determine how much each of the changes contributed to differences in student performance. It is important for the instructional designer to know this because: (a) some of the revisions may not have had much of an effect and (b) some revisions cost more, in time and/or dollars, to implement than others. Knowing which revisions were more cost effective would help designers choose techniques that are not only effective but also fit the constraints of tight time lines and limited budgets. In addition, if student performance or teacher acceptance is equally affected by several different revisions, the designer should take into account how much a revision costs in time and dollars in comparison to other equally acceptable and effective alternatives before implementing it.

The instructional designers in this study did not use empirical data on student performance as the basis for their revision decisions. Instead, they relied on their own informed judgments and experience. Carrying the question of the cost-effectiveness of design decisions one step further, it would be informative to know whether the differences in performance attributed to the designers' expert judgments would be equal to, or significantly less than, differences when revisions were based on formative evaluation of student performance data. Do the outcomes of one or more cycles of formative testing and revision justify the additional costs? The answer depends on how much better the results would be using student feedback in addition to expert judgment as the revision criteria.

Instructional designers are in the business of producing effective learning materials. Yet, if designers are to achieve widespread success by affecting large numbers of students, they have to produce materials that will be used by teachers. In addition, more often than not, designers have to produce quality instructional materials within the constraints of limited budgets and time lines.

This study demonstrated that the extra cost and work involved in preparing the revised version of a chapter from a traditional textbook had no effect on teachers' adoption attitudes, but the revised chapter did significantly im-

prove student performance. Although designers may be able to improve the instructional effectiveness of materials, it still remains to be seen whether they can promote teacher adoption of those materials.

References

- Gagne, R.M. (1977). *The conditions of learning*, (3rd ed.). New York: Holt, Rinehart and Winston.
- Pickle, H.B., & Abrahamson, R.L. (1981). *Small business management*, (2nd ed.). New York: John Wiley and Sons.

Instructional designers have to produce quality instructional materials within the constraints of limited budgets and time lines.
