Improving Training Quality in Developing Countries: Toward Greater Instructional Efficiency

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Factors associated with improved quality and efficiency of instruction in vocational education and training (VET) are reviewed, drawing on published research and evaluation literature. Despite the weakness of the literature specific to developing countries, a number of factors and associated strategies are identified.

Instructional quality can be improved by better use of classroom productivity factors associated with high student achievement; chief among these is the use of techniques to reinforce learning. Improved classroom and workshop management can lead to better use of instructional time, and gains in student achievement. Instruction should be organized to take into account differential student abilities. Instructors need a broader repertoire of instructional practices. Material resources -- for classroom and workshop instruction -- are essential: without acceptable levels, quality cannot be improved.

The principal means of improved instructional efficiency in VET is reduced training time, not the reduction of resources. The later strategy simply leads to unacceptably low quality. The scale of training should be reduced before resources are cut below minimum requirements. Reduced training time can be achieved by: 1) restricting formal instruction to minimum competencies, with more advanced skills reserved for on-the-job training; 2) improved classroom and workshop management; and 3) better scheduling of facilities. Realization of the cost-saving potential of reduced training time requires 1) close linkages with employment to determine acceptable minimum competencies for formal training; 2) replacement of rigid time-blocks of training with flexible scheduling.

Where resources are constrained, marginal improvements in quality and efficiency can be achieved through 1) stronger institutional management; 2) instructor training; 3) better supervision; 4) provision of acceptable levels of instructional materials; and 5) more effective monitoring to find out what works. Where resources are less constrained, additional strategy elements include: 1) flexible, modularized instructional systems; 2) stronger incentive packages for instructors and managers; 3) improved certification systems; 4) stronger professional capability for curriculum and professional development; and 5) development of a mixed public/private training system.
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Improving Training Quality in Developing Countries:

Toward Greater Instructional Efficiency

1. INTRODUCTION

Vocational training presents most developing countries with a perplexing challenge: how to do more with less. Low levels of program quality are a cause for concern. This concern is not limited to formal programs, but cuts across all training sectors. The evidence suggests that in many developing countries program quality has seriously eroded at a time when there are even greater demands on skill training systems. Limited financial resources, however, present serious constraints on program improvement. Educational policy makers are faced with the need to improve program quality with fewer resources.

Background

For over two decades developing countries have made relatively heavy investments in vocational educational and training. Responding to the needs of rapidly expanding economies and receptive to aspirations for greater social opportunity, government built facilities, trained teachers and equipped institutions. The expansion of educational opportunity was a priority, and investments often exceeded the capacity to establish and maintain efficient training systems. Although enrollments grew rapidly, in many cases the physical plant deteriorated, training was of uncertain quality, and manpower needs remained unfulfilled. Program quality and maintenance were subordinated to expansion.

Low quality training is also associated with private sector efforts, and this fact is often lost on critics of formal vocational training. The magnitude of the problem is much greater because considerably more training occurs through nonformal and informal means. Small firms in particular suffer from a lack of training know-how, capable training personnel and resources. Outmoded technology and inefficient production techniques serve as poor training examples, and in some countries there are few firms which can offer the quality and scope of training necessary to sustain development. A progressive deterioration in the stock of human resources is occurring.

The qualitative improvement of training probably has not received the international attention which it warrants. International discourse has centered more on the relative benefits and cost of different training models than on how to achieve effective program implementation. Most countries, however, have few available options, regardless of what cost-effectiveness studies show. There are already established training institutions, traditions, policies and practices, and the existing training systems are largely a result of the constraints imposed by history, resources, personnel, and social perceptions. Few countries can abandon costly investments in training for what appear to be theoretically superior alternatives and still successfully address ongoing demands for training. The best that can be expected is to improve the quality of the existing training systems while
formulating training policies and implementing programs which open the way for addressing national priorities more effectively.

The policy of donor agencies has often contributed to neglecting the qualitative aspects of program development. The emphasis has been on construction and equipment, with considerably less attention given to the systemic requirements essential to program quality.

The question of quality, however, has taken on some urgency. Policy makers are faced with fiscal austerity and eroding school quality. At the same time an increasingly demanding and complex marketplace requires revitalized training capacity. While formerly the priority was to expand training opportunity, the priority well into the decade of the 1990's will be to restore and enhance training quality within the context of limited financial resources. The alternative is for many countries to face the continued erosion of training capacity and low economic returns on training investment.

Focus of the study

This paper examines the chief conditions affecting program quality. Although the major focus is at the instructional level, attention is also given to organizational practices which affect quality as well as problems inherent in different training alternatives.

In many ways the classroom is the most important unit of a training system. It is the focal point of learning, where the student comes to grips with the content. The classroom is also the attack point for achieving quality. Chapter 2 reviews instructional factors, identified by research, which impact on student achievement, and thus on quality and efficiency. Different ways of organizing students for learning are also reviewed. Chapter 3 examines basic curriculum issues, including the questions of deciding what to teach and adjusting curricula to technological change. Improving instructional quality is partly a matter of improving efficiency; but it also involves the capacity of training to transfer appropriate skills.

Chapter 4 looks at instructional and classroom management practices which affect classroom achievement and which have an impact on cost. Better management practices have the potential to considerably reduce training cost and improve instructional efficiency. The availability and use of instructional resources will also be examined. Providing good, inexpensive training materials continues to be a major unresolved problem in many developing countries.

Chapter 5 discusses school-level practices which influence learning. The institution establishes the context in which training takes place, whether this be in an industrial setting, private school or formal training institution. A number of issues surrounding administrators, teachers and students will also be briefly discussed. Chapter Six presents a summary.
Application of Research to Vocational Training in Developing Countries

The majority of the research on school and classroom effectiveness has been conducted in North America or Europe. There are, however, a number of synthesized studies of correlational data which include extensive international samples. To what extent are research findings applicable to countries of the Third World? There is probably not a good answer at this point in time. Cultural values, attitudes, and thought patterns—as well as tradition, training, resources and politics—condition the use of instructional practices. While it is true that certain practices appear to be equally effective regardless of the cultural setting, the subtleties associated with incorporating these practices into the everyday instructional context are complex.

Effectiveness studies, nevertheless, have established the importance of improving quality. There are significant achievement gains associated with effective schools and classrooms, and there can be little doubt that instructional quality can be markedly improved, even though the efficacy of a particular instructional factor varies from setting to setting. It is unreasonable to think that effectiveness research cannot have an impact on the quality of vocational training in Third World countries, although it is less certain what the full effects of research finding will be.

The majority of research on school and classroom effectiveness focuses on academic instruction, particularly at the elementary level. And no single study has adequately investigated the interrelations and effects of all factors on learning. Although there is a growing body of research at the secondary level, little of this is focused directly on vocational instruction, with practically no research relating to training in industry. Industrial trainers have concentrated mainly on effective instructional design, rather than addressing training effectiveness. This is not to say, however, that more general findings do not apply to vocational training. They do, but the context may be considerably more varied. It is also necessary to fill gaps with case study material, reports and policy papers. While there is not always a close mesh with research concerns and findings, a more comprehensive picture, nevertheless, does emerge. It will probably be some time before a full and cohesive body of research appears relating specifically to the qualitative improvement of international vocational training.

Scope and Definitions

This paper, then, is largely exploratory: it attempts to synthesize a large number of research findings, to extract meaning, to clarify problems and to suggest policy alternatives for improving the quality of vocational instruction, tentative as they may be. The term "training quality" is linked to the concept of internal efficiency. The search is for more efficient training inputs and organizational practices that can be used to achieve maximum student achievement.
As used here, "formal vocational training" refers to publicly financed programs administered through Ministries of Education, although occasionally specialized programs are managed through other Ministries. Diplomas are usually granted, and there is often opportunity to continue to higher levels of education. Nonformal vocational training, in contrast, refers to "any organized educational activity outside the established formal system--whether operating separately or as an important feature for some broader activity--that is intended to serve identifiable learning clientele and learning objectives" (Coombs, Prosser and Ahmed, 1976, p.29). These programs may be offered through public or private agencies, training is usually highly specialized, and the purpose is direct job placement (Middleton and Demsky, 1988). A clear distinction is not made in this paper between vocational and technical education. The instructional and institutional problems are similar, the major difference being the skill level taught. Formal training programs receive greater attention because there is more research available. But there is also probably a greater concern about improving the quality of formal instruction because of the large public investment involved. Many of the research findings, nevertheless, apply equally to nonformal programs, particularly in the case of those which resemble formal counterparts. Then again, while attention is given primarily to school or center-based training, other alternatives are discussed, even if not as extensively.

In the end, individual policymakers must decide priorities and identify alternatives in light of their understanding of a specific political, economic, cultural and social environment. This paper does not attempt to prescribe policy. Instead it attempts to provide a conceptual and analytical framework within which more informed decisions can be made--decisions which can lead to a better use of resources.
2. IMPROVING THE QUALITY OF INSTRUCTION

How can the quality of vocational instruction be improved? The present chapter looks at some of the ways in which this can be done. In the first section a summary of research on teacher and classroom practices which influence student achievement is presented and examined in the context of vocational and technical instruction. Next, a number of instructional delivery modes will be briefly examined. There are different ways of organizing learning so that better use of existing resources can be made.

Teacher and Classroom Practices

There are at least two dimensions of teaching practice which impinge on student achievement. One can be defined as the qualitative aspects of instruction, those practices which are associated with higher student achievement because they help students to learn. They are the tools of the teaching craft: the ways that teachers get students to respond, to question, to see relationships, and to apply learning. Researchers have turned to the task of isolating these practices and assessing their relative effectiveness. For want of a better term, these are often referred to as "productivity factors" (Walberg, 1984; Fraser, et al, 1987). A second dimension is the "quantity" of instruction, which is simply the amount of time the student spends learning.

Three generalizations are in order: a) First, research has substantiated the powerful combined effect on student achievement of the qualitative and quantitative factors. Simply put, better instruction results when teachers are knowledgeable about those productivity factors which improve learning; b) Second, in many instances there is considerable latitude for improving the quality of vocational instruction. Vocational teachers are often unaware of effective instructional practices, and this lack of knowledge is a principal deterrent to student achievement; c) Third, the application of good teaching practice is relatively cost-free once the teacher has acquired initial understanding, and the cumulative effect on learning in the long term will outweigh the initial investment in training.

The Quality of Instruction: Key Factors

In general, teachers use a restricted repertoire. Anderson (1987), for example, in a study of nine countries observed that three primary kinds of activities occur in classrooms: teachers talk at or with students (35-82 percent of the time); students are assigned desk or laboratory work (15-47 percent of the time); and teachers conduct classroom management activities (1-16 percent of the time). There appears to be considerable room for exploring alternative ways of presenting instruction in order to accommodate the major productivity factors which improve student achievement. Following is a brief discussion to those factors which have broad research support:
Active teaching

Numerous studies support the view that students achieve more when the teacher plays an active instructional role. That is, the teacher establishes and maintains clear focus on the learning task; establishes expectations of high achievement; directly participates in the organization and structuring of learning; directly provides instruction; maintains control, monitors instruction, elaborates and provides feedback. The teacher delivers the content directly instead of relying on instructional materials. More time is devoted to content rather than procedural or management matters, and to answering questions and providing feedback rather than lecturing (Soar and Soar, 1972; Brophy, 1979; Centra and Potter, 1980; Burke, 1985; Brophy and Good, 1986; Cohen and Rossmiller, 1987).

When students spend more of their time being supervised and taught rather than working on their own, they learn more and in addition become exposed to other teacher-related factors which promote achievement—such as positive reinforcement, monitoring, and feedback. Similarly, when students are exposed to teacher-directed, large group instruction, in contrast to small group instruction, they tend to spend more time on task (Denham and Lieberman, 1980; Bourke, 1985; Anderson, 1986).

Students from low-SES seem to profit particularly from a structured learning environment. On the other hand, a greater degree of teacher control appears to be less functional for high SES students. Frequent interaction with the teacher appears especially important with low ability students. And although simple, proceduralized and factual content appear to be taught more effectively through direct instruction, higher cognitive problem solving skills tend to be learned more completely when there is more student interaction.

Reinforcement

Reinforcement has a powerful effect on learning. For example, in a synthesis of several thousand international investigations of productivity factors in learning, Fraser, et al (1987), found that of 26 different instructional variables, reinforcement had the single largest effect size: 1.17 standard deviations between group means. This suggests that the performance of a student at the 50th percentile can be raised to the 88th percentile, a remarkable gain (p. 158). Other work by Bloom (1976), Soar and Soar (1979), Walberg (1984), and Peterson and Walberg (1979) corroborate the findings of Fraser, et al, even though the results are not as dramatic.

Reinforcement can occur in many ways and it is generally defined as any event which following a response, makes the response more likely. Positive reinforcement appears to have more effect for low-SES students than for high-SES students (Good and Grouws, 1975, 1977; Brophy and Evertson, 1976; Soar and Soar, 1979).
Feedback, Cues, and Advanced Organizers

Achievement appears to be maximized when teachers not only actively present material, but also help students structure new information. Better results are also obtained when teachers relate the material taught to information already known by the students. Monitoring student performance and providing corrective feedback further reinforces achievement (Lasakowski and Walberg, 1982). Fraser, et al (1987), for example, found that the effect size of feedback on student achievement was 0.97 standard deviation.

Cues and advanced organizers help students to relate new content to previous learning and to identify main concepts and patterns; overviews and outlines help students to assimilate content and to integrate learning. Feedback helps students assess what they know. (Brophy and Good, 1986). Feedback is more effective when it is immediate, nonevaluative and task-related. The immediacy of feedback is particularly important in the case of teaching psychomotor skills, with achievement directly tied to how soon feedback is provided.

Pacing

Pacing is the speed with which students move through material to be learned. Pacing involves the amount of material to be learned, as well as how fast it is presented. Moderate pacing can be maintained, for example, by presenting a large amount of material at a slow rate, or a small amount at a fast rate. Pacing also involves altering instructional modes; with short teacher presentations, for example, interspersed with practice and review sessions.

In general, pacing should be at a rate sufficient to maintain instructional momentum and reduce wasted time; for younger students the instructional mode should be altered at relatively short intervals; and in the case of long presentations and complex material, the presentation rate should be reduced. Lower achieving students often fail to learn simply because pacing is too fast. They cannot sufficiently process the information presented. "Denying learners sufficient time and advancing them through the curriculum without understanding can have serious effects on what students learn (or fail to learn), as well as on their perceptions of their own learning competence and motivation for learning," Wang and Lindvall (1984, p. 208) observe. On the other hand, higher achieving students need a faster rate of pacing (Allen, 1975; Tobin and Capie, 1982; Brophy and Good, 1986).

Clarity of instruction

As might be expected, student achievement is also affected by the clarity of instruction. Students exposed to instruction high in clarity tend to have higher achievement than students experiencing low clarity instruction. Unclear instruction can result from deficient language and presentation skills and from poor mastery of the subject matter, or from a combination of both (Land, 1979; 1985).
Adaptive Instruction

Students learn in different ways and at different rates. More effective teachers recognize this and attempt to enhance each student's capability to learn through a variety of ways, including personalized instruction, tutorials, cooperative team learning, and combinations of small and large group instruction. The use of adaptive instruction strategies consistently shows moderate to large effect size, with 0.50, or one half standard deviation a typical research finding (Waxman, Wang, Anderson and Walberg, 1985; Walberg, 1984; Fraser, et al, 1987). The effect size extends across different categories of students and learning contexts.

Tailoring instruction to different learning characteristics contributes to the formation of a positive learning environment in which students realize that the objective of instruction is for all students to learn. Adaptive instructional strategies also enable the skilled teacher to better manipulate those factors which lead to improved achievement by altering time, group composition, pacing, and so forth; and by adjusting instruction to the conditions of the classroom.

The above list of productivity factors is representative, rather than exhaustive, indicating those factors which have broad research support and considerable effect size on learning.

Student achievement appears to be associated more with specific productivity factors than with particular teaching patterns or styles. This observation has particular relevance for the improvement of instruction in developing countries. Training and preference influence in part a teacher's "style." It is also culturally and socially determined. Teachers from the Middle East, for example, tend to use an instructional pattern that differs from that used by teachers in Africa or Latin America (Avalos, 1986; Avalos and Haddad, 1981). And as Guthrie (1986) cautions, "attempts to change teaching styles to fit new concepts of curriculum may ignore good cultural and educational reasons why teachers should use" certain methods (p. 83). It may be less important, however, to "convert" a teacher to a new instructional pattern than it is to maximize the use of those factors contributing to effective learning within the teacher's existing instructional repertoire. There may be no one idealized way in which to teach. But there are good instructional practices associated with good teaching.

Time on Task: The Quantity of Instruction

The use of classroom time is a major factor in student achievement. Effective classrooms are thought to be characterized by efficient use of time. Replicated research findings consistently link time devoted to learning with modest gains in achievement. Although more instructional time often appears to be a practical way to improve classroom achievement, this is not always the case. Time is a complex variable, and like any other resource, its benefits are derived from how well it is used.
Students learn to the extent that they are actively engaged in learning. There is a modest but consistent positive correlation between time-on-task and achievement (Denham and Lieberman, 1980; Frederick and Walberg, 1980; Rosenshine, 1979; Gettinger, 1984, 1985). The association is particularly strong with low achievers (Centra and Potter, 1980; Cohn and Ross, 1987). Engaged time depends primarily upon effective classroom management and teaching ability. It also depends upon student motivation.

It is more cost-effective to limit initial training to minimum competency levels, with higher achievement levels obtained through work placement and on-the-job training. This is because time cannot be increased indefinitely. There is a point of diminishing returns once students approach the upper limits of their ability. More time yields progressively smaller gains in learning. Frederick and Walberg (1980), and Aldridge (1985) suggest, for example, that the relationship between time and achievement is nonlinear and logarithmic. It takes considerably more time to go from 80% to 90% mastery than from 70% to 80%.

Furthermore, slower learners might require inordinate amounts of time to reach mastery. Arlin (1984) observes, for example, that while a high ability student may take 1000 minutes of instruction to reach mastery level on a task, a low ability student might take as much as 10,000 minutes for the same task. It is to be expected that slower students may require between 5 to 10 times more time-on-task to reach achievement levels comparable to those obtained by faster students (Gettinger, 1985). The need to adjust instruction to accommodate different rates of learning continues to be an instructional management challenge.

Substantial improvement in instructional effectiveness can be realized simply by maximizing time-on-task without any increase in allotted instructional time. There is often a considerable difference between the time that the student is engaged in the task and the time that he is exposed to instruction (Willey and Harnischfeger, 1974; Bloom, 1976). It is relatively easy to allocate instructional time; it is considerably more difficult to make sure time is constructively used. Students may be unmotivated, disinterested, distracted, or confused. There may be a shortage of learning materials, or instruction may be poor. The classroom management skills of the teacher are extremely important: substantial amounts of time can be wasted by the poor manager in taking roll, assigning work, handling discipline problems, and going about what should be routine management tasks. And it is not uncommon for the unprepared or uncertain instructor to keep students occupied with "busywork" of doubtful learning value. The time that the learner spends engaged in the learning task, then, may range anywhere from 20 to 80 percent of the allotted instructional time (Karweith, 1983; Seifert and Bech, 1984). Students in low achieving classes are more likely to spend more time on tasks unrelated to learning (Frederick, 1977; Bookover, et al., 1979; Karweith, 1983).
In poorly managed schools there may be considerable time lost between classes, large amounts of instructional time used for school management tasks, and time wasted through discipline problems. When there is little administrative direction over what is taught there may be substantial differences in the use of time by individual teachers. Personal preference comes to dominate so that classes of like subject matter may vary greatly in allotted time for instructional units. One teacher, for example, may allot two hours and another teacher 12 hours for the same unit (Denham and Lieberman, 1980; Karweith, 1983). Absenteeism, student and teacher strikes, holidays, and school closings due to inclement weather contribute to lost time; individual students must be reintegrated into the classroom, affecting the instructional time of classmates, and classes may have to recycle through partially covered instruction (Smith, 1977; Cahen and Fisher, 1978; Karweith, 1983).

Grouping patterns and instructional practices directly affect time-on-task. The particular grouping pattern used by the instructor determines the amount of time available for instruction as well as how efficiently time is used. Typically, in whole group instruction a relatively small amount of time is used for classroom management compared with the amount of time devoted to instruction. Instructional time, however, is often used inefficiently because of the need to accommodate a broad range of student differences; pacing may have to be slow, concepts repeated, and misunderstandings clarified; it may be difficult to hold the attention of the whole group. On the other hand, when within-class ability grouping is used, more initial management time is required to establish a transition between groups, but instructional time is used more efficiently because groups are smaller and more homogeneous. Individualized instruction (self instruction), when of high quality, probably makes the most efficient use of instructional time because individual rates and levels of learning are accommodated. However, students may spend less time-on-task because there is less direct supervision by the teacher. As Karweit (1983) observes, the overall effect of any instructional practice is the result of the trade-off between quantitative losses resulting from procedural and management requirements, and instructional gains through the application of more effective teaching practices.

Finally, time is used most effectively when linked with other variables which have an impact on high achievement (Wang and Lindvall, 1984; Dempster, 1987; Slavin, 1987; Fraser, et al, 1987). Increases in instructional time alone yield ever-decreasing gains in student achievement. However, when coupled with substantial teacher interaction, reinforcement and feedback, organized and well-designed instructional materials, and a positive learning environment, increases in time can lead to substantial gains in achievement. Put another way, low quality instruction leads to poor results regardless of how much time is provided.

Time and the individual

The relationship between the use of time, the quality of instruction, and student characteristics has become the focus of recent
research (Centra and Potter, 1980; Karweit, 1983; Gettinger, 1984). The attempt is to clarify the instructional contexts and learner characteristics for which more time makes a significant difference. Although the body of research is small, there are useful findings.

Cooley and Leinhardt (1980) suggest that the quantity of time allocated to a given program of instruction is less important than the judicious use of available time; there are greater achievement gains resulting from high quality instruction than from increased time. With improved quality, course length can be reduced. Research examining the effects of instruction and the amount of time needed to learn indicates that positive feedback, the use of cues, advanced organizers, and well-organized instructional materials can reduce the amount of time needed to learn (Denham and Lieberman, 1980; Gettinger 1984). With low ability students, instructional pacing must be reduced, and instructional material is more effective if it is presented in small steps (Allen, 1975).

One recent finding is that not only do students differ in the rate in which they learn, but that learning rates vary in individuals across different content (Gettinger, 1984). The kind of instructional content covered determines how fast an individual learns. The level of difficulty of instructional materials is also important. When students spend time on excessively difficult material, they learn less and spend more time learning. Similarly, when students work with instructional materials which yield low "success" rates, achievement is low for the amount of time spent (Denham and Lieberman, 1980).

The Effective Teacher

In summary, then, more effective teachers are active, have better managed classes, spend less time making transitions between lessons and activities, and spend less time on discipline and classroom matters. The classroom climate is positive, emphasis is placed on achievement, and instruction is at a brisk and continuous but not too rapid pace. In the development stage of instruction, the lesson is presented clearly, advanced organizers and cues are used, questions are asked, and when students are confused the teacher is more likely to provide feedback in the form of an explanation. Throughout instruction the teacher initiates contact with students, students ask more questions and students call out more answers. Little time is spent on going back over instruction, and the pace of instruction is kept up. Learning is reinforced. Praise is modest and it is contingent on the quality of performance. When errors occur, the teacher is more likely to give immediate, nonevaluative feedback in the form of how to develop the correct answer, rather than supply the correct answer. The effective teacher, moreover, circulates and monitors activities, giving help where most needed. The effective teacher also may choose any one of a number of adaptive strategies in order to accommodate student differences.
Organizing Instruction

There are many ways to organize instruction. In developing countries, however, instruction is often highly teacher-directed, relies heavily on the lecture method, has few practical activities, students spend most of the time memorizing, and evaluation may be unsystematic and based almost solely on the recall of lecture information. This pattern of instruction may differ little in industry or public schools. However, there is a much broader array of delivery modes available, that is, of ways to organize students for learning which require fewer resources, can better take advantage of what we know about teaching and learning, and can be implemented without excessive training. In the following pages, selected instructional delivery modes of current interest will be briefly examined.

Modularized Instruction

One common instructional pattern is modularized instruction. Occupations are partitioned into tasks, and the tasks are grouped into related clusters that comprise a module, or related series of modules. The module specifies the learning objectives, with content organized around the required knowledge and manipulative skills of the specific task. Modules generally cover theory, with practical instruction handled by the instructor.

Modularized instruction requires good management skills on the part of the instructor, but a systematic and comprehensive coverage of content can be achieved. Modularized instruction also accommodates individual differences in learning rates, and perhaps most important, content is current, providing a way to keep abreast of technological change and compensate for the instructor's lack of knowledge. Moreover, the module's content can come from a systematic analysis of work at job sites, assuring valid instruction. Content is also standardized, assuring that similar programs produce like results, a particularly appealing fact to employers who need to gauge the competencies of prospective employees.

It is also possible to build into instructional modules key factors which promote higher achievement, such as reinforcement, cues, feedback, and pacing. Thus superior teaching as well as content can be provided, a distinct advantage when the quality of instructors is uneven, or, in the case of industry, when instructors with industrial but few pedagogical skills are used. It is also relatively easy to update materials, with only select parts needing revision at any one time.

Despite the inherent advantages, there are few examples of successful modularized instruction in formal training programs. Sufficient supporting materials simply cannot be adapted or produced. The development process is often too cumbersome or the cycle too long to maintain an adequate supply of instructional materials, in addition to the need to achieve high-use levels in order to realize economies of scale. So while modularized instruction has the potential to considerably improve the quality of vocational instruction, this potential is seldom realized. Problems associated with the production of instructional materials will be discussed more fully in Chapter 4.
Modularized instructional materials can be used as an adjunct to more conventional teaching methods, or they can comprise key components of some of the instructional modes discussed below. It is this flexibility and versatility which make modularization so useful as an instructional tool. At the very minimum, instructors should have the skill to produce simple modularized materials.

**Mastery Learning**

Variations of the mastery learning model are used in as many as 20 countries, with successful implementation in classes with student-teacher ratios as high as 70:1 (Block, 1979). The major idea behind mastery learning is for time-on-task to vary among students, accompanied by frequent evaluation and feedback in order to assess progress and provide additional work if necessary. All students can learn, proponents contend, but some take longer than others. (Bloom, 1974; Block, 1974; 1977; 1979; Block and Burns, 1976).

Mastery learning does not affect the presentation style of the instructor. Whole-class, group-paced instruction and lecturing can be used, although individualized work is also provided. Students, however, are expected to work mainly on their own to complete additional work so that the total class can progress together. Greater learning and higher motivation is thought to result because of the expectation for success and the removal of competitive evaluative conditions. Errors are viewed as experience along the way to achieving "success."

Typically, clear instructional objectives are established. Based on the objectives, instructional content is broken down into small, discrete units of learning. Content is organized hierarchically in increasing levels of complexity, with each small unit monitored closely to assess student understanding. The teacher generally introduces each unit to the total class, followed by the use of prepared instructional materials to give students practice in applying new concepts. Brief, ungraded, student-scored diagnostic tests are used to provide feedback, followed by the use of additional instructional materials depending upon the current level of mastery. Additional work may also include small group study sessions, peer tutoring, audio-visual materials, supplemental workbooks, and the like, continuing the cycle until an appropriate mastery level is reached. Fast students may be given additional enrichment material, thus probing deeper into some units of work.

Evaluations of mastery learning generally show modest gains in student achievement, but results are mixed. There tends to be a modest positive effect on interest and attitude toward the subject matter. However, if mastery learning is not used correctly and the teacher does not proceed to the next unit of instruction until substantial numbers of students reach mastery, then high-ability students spend considerable time waiting. This negative consequence can be largely avoided by open-ended instruction with sufficient curriculum materials so that fast learners are not held back. The need for prepared instructional materials and good test materials may be a drawback to mastery learning in cases where there is virtually no financial
support or sufficient teacher skills to produce such materials. Considerable flexibility and initiative are also required on the part of the teacher. Nevertheless, mastery learning provides one alternative to accommodating variation in student learning rates, and organized, systematic instruction results which can be replicated within different locations through the instructional materials prepared.

**Cooperative Team Learning**

Cooperative team learning is another instructional alternative. Four to six students work together on a task as a group. The task can be divided up, with the individual members working independently, or the total group can combine their efforts. Grading is based either on the product produced jointly by the group, or upon the combined average of each individual's performance. This format encourages cooperative learning and peer tutoring. Often higher achieving students will be paired in a team with lower achieving students. The use of cooperative teams helps to build peer norms which favor achievement, contributing to a climate which supports learning. Rather than compete against one another, members of cooperative teams learn to support each other's achievement. Competition is between groups and not individuals. (Sharan, 1980; Slavin, 1980; 1983). The idea is not dissimilar to work teams in industry.

Cooperative teams tend to maximize motivation and achievement since students who would normally achieve poorly can share in the total progress of the group, while at the same time benefitting from peer interaction and guidance. Some students, in effect, become adjunct teachers. Typically, the instructor first presents the new material, often through a lecture-discussion format. Students are then divided into teams which are roughly matched in achievement levels. Each team works together on the assignment, using worksheets, reference material or other appropriate resources. Assignments typically take up to a few days to complete. Students will quiz each other, check over work, and work together to correct mistakes. The results of each team’s work is judged against other teams.

A major benefit of cooperative team learning is that it fosters the concept of cooperating together to solve problems. Cooperation is resisted so strongly in some cultures that it interferes with constructive work. Then again, instruction and the accompanying activities are clearly focused on solving problems, or actually putting knowledge to work. The dichotomy between knowledge and practice, so prevalent in some cultures, cannot exist within the cooperative team structure.

**Learning Stations**

Learning stations provide an effective way to structure instructional activities with limited resources. At the same time, learning stations accommodate different rates of learning among students.

The concept behind learning stations is simple. Separate units of instruction are developed along with supporting instructional materials to enable students to work relatively independently, either singly or in small
groups. Both theoretical and practical work can be addressed through learning stations. In the case of practical work, the required tools and materials are located at the learning station. Students are guided through assignments either by written assignment sheets or prepared audiovisual presentations, such as slide-tape sequences. Information sheets and resource material provide the knowledge to complete activities, which may range from answering theoretical questions, to performing a laboratory experiment, tuning a carburetor or fabricating metal. Students can work through assignments at their own pace, and alternate assignments are often provided to supply greater depth of coverage for more capable students. Very little direct assistance from the instructor is required. Safety instructions, work procedures, project plans, and other useful information can be posted at the center for quick reference. Periodically, lectures and large group instruction is provided by the instructor in order to change pace and maintain group cohesion.

Individual learning stations are designed to accommodate from 4 to 6 students, so this means that only a half-dozen or so tools are needed for any one learning station, in contrast to large group instruction which may require tools for each student. There is less waste and breakage since it is easier to monitor individual stations. The only tools and equipment used are those directly related to specific assignments. However, the entire instructional facility and all the equipment are being used by students at any given time.

One reason why learning stations are not extensively used is the amount of initial work involved. It takes time to develop each of the individual learning stations, and as many as one or two dozen learning stations may be needed for a semester of work. Once a system is in place, however, it can be continually refined, resulting in a progressive improvement in instruction. The instructor plays an unconventional role which is basically that of a facilitator, monitoring work, keeping the flow of activities going, providing feedback, and answering questions.

Organizing instruction around the use of work stations can result in a better use of resources, a broader coverage of content, the accommodation of different learning rates, and the generation of high student motivation. Cooperative learning is encouraged since students are free to assist one another.

**The Keller Plan**

Searching for a more efficient way to provide instruction to large groups of students, Keller (1968) devised a system in which students progress at their own pace through prepared units of instruction. Students basically work independently, with the instructor or assistants monitoring work. After an initial trial, the student takes the unit mastery test, moving on to the next unit of instruction if the test is passed. Otherwise, the student restudies a corrective unit, continuing the cycle until mastery is attained.

Lectures and demonstrations are used, but these do not comprise a main part of instruction, with critical information obtained primarily through study materials. Simple audio and visual materials can be used as well as
computers, films, and slides, but these resources are not essential to the system. The assistants play an essential role, however: they score quizzes, provide immediate feedback to students, and they discuss course material with students. The number of students programmed in the course at any one time depends primarily on the number of assistants employed, with the instructor mainly responsible for the content and quality of instruction, overall supervision of the assistants, and the development, review, and upgrading of course materials.

The Keller Plan is similar in concept to mastery learning, with some important differences. First, there is no attempt to keep students together; each student goes at his own pace. Second, the instructor's role is significantly changed, the major responsibility being to plan, design and develop instruction, and to monitor and facilitate learning, rather than to directly deliver instruction. Finally, heavy reliance is made of assistants, capitalizing on what can be an effective and economical division of labor.

Evaluations of innovative teaching methods tend to consistently show the Keller Plan as superior to other methods with which it is compared. The use of frequent quizzes, immediate feedback, mastery requirements, and review units appear particularly effective (Kulik, et al, 1978). The Keller Plan has an additional feature that is familiar in developing countries, namely the use of a lead instructor with assistants, thus perhaps making the system readily acceptable. Because it achieves instructional effectiveness and economies of scale, the Keller Plan is a viable alternative for organizing instruction for large number of individuals.

Direct Instruction

Rosenshine (1979) along with Brophy (1983), Doyle (1986), and others have advanced the concept of "direct instruction" in which teachers play an active part in determining instructional objectives, presenting instruction and monitoring outcomes. Instruction is presented in a very ordered, sequenced and coherent way. Particular attention is given to clarifying the main instructional points, presenting instruction step by step, guiding student practice, checking for understanding, and providing feedback. During guided practice the teacher corrects errors, re-teaches if necessary, and provides additional practice. Considered particularly important is the use of small instructional steps, with active student practice, teacher feedback, and guidance between steps (Rosenshine and Stevens, 1986).

It is not surprising that there is research support for the direct instruction approach. This view of teaching gives primary emphasis to a number of factors which have a strong positive association with student achievement. Positive reinforcement and feedback, for example, are major elements in the direct teaching approach. Similarly, the use of instructional cues, clearly defined objectives, pacing, and practice contribute to effective achievement. The direct teaching approach also appears to maximize time on task and minimize management time, by reducing interruptions and maintaining teacher presence. A positive learning environment is created in which achievement is clearly the goal: the classroom is well-managed, teachers are business-like, all students are involved, and students are busy.
The concept of direct instruction may be particularly relevant to vocational and technical education in developing countries. In the first place, it may be readily accepted as a means of improving instructional efficiency because of its familiar elements. Teacher direction, for example, is still maintained, but it is accompanied by strategies which accommodate student differences. Combinations of lectures, questions, oral practice and laboratory work are practically universally used by teachers, and while they form the substance of direct instruction they are used in more effective ways. Put another way, the direct approach may contribute to changed practice while maintaining much of what may appear to be familiar.

The aim of the direct instructional approach and vocational and technical instruction is the same: efficiency. The direct approach focuses on the achievement of clearly defined objectives in the least amount of time by maximizing the effectiveness of classroom instruction. Moreover, the use of small steps, feedback, and reinforcement, for example, are familiar instructional concepts incorporated into the competency-based paradigm widely used to teach technical skills. And while the direct approach is most effective for well-structured content, perhaps limiting its effectiveness for higher-order learning, this limitation does not apply to the step-by-step procedures, ordered facts, and process skills characterizing much of technical instruction. Finally, the direct approach is a logical, easily understood, and easily applied approach to improving instructional effectiveness which demonstrates results. It would probably find a receptive audience among trainers in industry and public institutions.

Competency-based Instruction

Competency-based instruction is a method of organizing and delivering instruction. It has considerable appeal among vocational and technical educators because of its apparent logic, close instructional link with job activity, and its emphasis on performance measures (Chalupsky, et al, 1981).

Although individual instructional systems vary in design and sophistication, a common element is the identification of instructional content through task analysis. This is considered extremely important as a way to ensure a close link between instruction and work requirements. To this end, various methods of sampling work activity are employed: trade or craft committees, experts interviews, and work observation. Job tasks are translated into performance objectives, instruction is organized into modules and works on the open-entry/open-exit principle; prepared student guides, instructional booklets and media are used to enable trainees to progress at their own pace; an instructional management system is required to organize and keep track of progress, and minimum levels of competency must be attained before the trainee progresses to other instructional objectives (Blank, 1982; Perry, 1982).
<table>
<thead>
<tr>
<th>Instructional Delivery Mode</th>
<th>System Requirements</th>
<th>System Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modularized Instruction</td>
<td>Considerable development time; high use of prepared instructional materials; good management skills; ability to produce simple material.</td>
<td>Accommodates individual differences; incorporates productivity factors; standardized content and method; flexibility; low marginal cost.</td>
</tr>
<tr>
<td>Mastery Learning</td>
<td>High use of prepared instructional materials and tests; development time and cost; initiative and flexibility; management skills.</td>
<td>Efficient use of time; greater learning and higher motivation; feedback; flexible methodology; systematic instruction; low marginal cost.</td>
</tr>
<tr>
<td>Cooperative Team Learning</td>
<td>Modest resource requirements; familiarization with concept of group work.</td>
<td>Builds peer norms supporting achievement; motivation and achievement maximized; stresses problem solving and practical use of knowledge.</td>
</tr>
<tr>
<td>Learning Stations</td>
<td>Good management skills; ability to produce simple instructional materials; time to initially develop system.</td>
<td>Cost savings in tools and equipment; accommodates individual differences; effective use of time; high motivation.</td>
</tr>
<tr>
<td>Keller Plan</td>
<td>Good lead instructor key; capable assistants required; good management skills.</td>
<td>Capitalizes on economies of scale; high achievement gains; accommodates individual progress; modest resource requirements.</td>
</tr>
<tr>
<td>Direct Instruction</td>
<td>Good knowledge of productivity factors; substantial preservice and inservice training required.</td>
<td>Low resource requirements; use of productivity factors; high time on task; low management time; efficiency</td>
</tr>
<tr>
<td>Competency-Based Instruction</td>
<td>High development costs and time; high system maintenance costs, good management skills; high instructional material requirements.</td>
<td>Efficiency; standardization of content; link with work; self-paced, open entry/open exit; large number of program completions.</td>
</tr>
</tbody>
</table>
Competency-based instruction is widely used in industrial training because of its efficiency. Moreover, training content can be standardized over time and location (Tracy, 1984). Instructional programs in public institutions tend to be more broadly based, focusing on a range of skills in an occupational field.

There are a number of advantages of competency-based instruction over more "conventional" vocational and technical instruction which may be particularly important in the case of developing countries. In the first place, greater instructional relevancy is assured. Competency-based programs make use of industrial and business input to identify and validate instructional content, thus maintaining a functional relationship between training and job placement. Competency-based instruction may result in instructional improvement simply because relevant content is clearly identified along with required performance standards.

Competency-based instruction can also reduce instructional time and cost. One reason is that instructional content is limited to only what is essential to teach. Superficial subject-matter is eliminated through rigorous task analysis procedures, leaving only content which has direct application to work requirements and which needs to be taught in the formal instructional setting. While perhaps the greatest gains in reducing superficial content can be realized in public programs, industrial and business training can be no less streamlined. Also, because instruction is individualized and based on the principle of open-entry/open-exit, individual trainees can advance rapidly, unhindered by lock-step instruction. In the case of some trainees, instructional time may be reduced as much as 50 percent (Van Steenwyk, 1987; Orlansky, 1985). Time saved is particularly important in the case of industrial training because wages are typically paid during training. In addition, program failure can be reduced, eliminating waste. Available instructional materials, individual assistance, clearly established objectives and expected standards of performance, these and other elements of competency-based programs tend to contribute to higher trainee completion rates (Fraser, 1987; Wang and Lindvall, 1984). A larger number of program completions in less time lead to real cost savings.

On the other hand, because of the amount of support materials which need to be developed, the need to keep instructional materials current, and the management requirements of the system, competency-based instruction is generally a costly alternative. In cases where there is access to inexpensive instructional materials, however, cost can be kept reasonable. Teachers also have to be trained in its use.

Summary and Implications

The general conclusion of this review is that the quality of vocational education and training can be substantially improved at relatively little cost by making better use of inputs into the learning process. To be sure, additional costs may be involved, but these can be offset in part by gains in efficiency, and in any case the additional expense may be only a fraction of current expenditures on a system which is now producing limited
results. The difference between "good" and "poor" schools is substantial, with teacher and school practices having a significant impact on student achievement gains.

At one level are productivity factors which contribute to student achievement. Teachers need to make use of reinforcement, feedback, cues, advanced organizers, pacing, and other such factors which increase achievement and reduce the time needed to learn. The combined effect size is significant and, when used in conjunction with better ways of organizing and managing instruction and a positive school climate, contributes substantially to learning. The application of these factors is relatively independent of the resources of the school, attitudes brought in by students, sophistication of educational technology, and other influences inside and outside of the classroom. Application results from a positive attitude toward students and an understanding of what constitutes "good" teaching and how these factors can be applied. In other words, application is relatively "cost-free" once the teacher is trained. "Good" teaching costs little more than "poor" teaching.

In the long run, many countries will find it difficult to improve training output without first addressing the training and upgrading of teaching staff and implementing school-level procedures which result in better teaching.

Good teaching practices reduce the amount of time needed to learn; and good instructional and laboratory management techniques keep students engaged on-task, eliminating wasted time. The poor use of instructional time in vocational laboratories is often so extensive as to warrant special attention. The potential for efficiency in general, and cost savings in particular, is enormous.

The relationship between time and learning is nonlinear and logarithmic, with progressively greater amounts of time required to reach mastery levels and diminishing returns once students approach the upper limits of their ability. It is thus more cost-effective for initial training to be targeted at minimum competency levels, with higher achievement gained through work experience. Since the amount of time to learn varies greatly among students, with slower students taking up to 10 times more time-on-task to reach mastery levels comparable to fast students, there is considerable instructional inefficiency when these differences are not accommodated. Open entry/open exit programs should be used as one way to accommodate student differences in learning time.

Instructional practices affect the use of time. Large group, teacher-directed instruction, for example, makes better use of instructional time because students remain on-task, but individual learning rates are not accommodated well; conversely, small group and individualized instructional practices accommodate student differences, but more instructional management time is often required and students may spend less time-on-task. Teachers need to know the relative trade-offs of different instructional practices and, equally important, how to maximize the use of instructional time within the context of different practices.
As long as instruction is organized in set time blocks, however, productivity gains cannot be realized by either more effective teaching or a better use of instructional time. Students remain in the course until the term is completed regardless of what they learn.

At another level are the ways to organize instruction designed to realize more effective teaching, make better use of resources, or reduce cost. Some of the alternate ways to deliver instruction need to be explored simply to break the hold of more "conventional" means of instruction--which have proved ineffective, but nevertheless persist. In introducing different delivery modes, teachers are also exposed to new concepts of teaching and organizing learning.

Direct instruction is the least costly and probably easiest alternative to implement. Few additional resources are needed in addition to the teacher; many of the instructional elements are already familiar to teachers; at the same time good use is made of instructional time and of the productivity factors which promote student learning; and it is effective for teaching the well-structured content which characterizes much of vocational instruction.

The efficiency and effectiveness of direct instruction can be further enhanced by using task analysis methods to identify instructional content and learning stations for laboratory instruction. Task analysis ensures instructional relevancy and eliminates superfluous content. The use of learning stations provides a low cost way to offer laboratory instruction. The combination of direct instruction, task analysis methods to identify content, and the use of learning stations may prove to be one of the most potent and cost-effective ways to provide vocational instruction with limited financial resources.

Modularizing instruction is a useful concept. The productivity factors which are associated with student achievement can be accommodated along with the efficient use of instructional time. The concept, in other words, provides a way to synthesize and apply much of what is known about good teaching. In addition, it is a versatile concept, with modules forming a key component of other delivery modes. At the very least, vocational teachers should be introduced to the concept of modularized instruction and be able to develop and use simple modularized instructional materials.

A fully modularized instructional system, however, needs initial resources beyond what can be reasonably expected in some countries. Furthermore, for a sophisticated system, considerable development time and support services are required, placing real limits on its application, and requiring a long-term commitment of resources. Mastery learning, and competency-based instruction have similar constraints. And while competency-based instruction is one of the most effective modes for delivering instruction, it is also costly and requires development skills which may not be available. The development of competency-based systems should only be undertaken in cases where adequate resources can be ensured, along with capable staff support.
When a teacher develops a course outline, makes up a daily lesson plan, assigns an instructional activity, or designs resource material, he is making a decision about what students should learn—the content of instruction. Strictly speaking, questions about instructional content relate to the effectiveness of instruction, that is, the strength of the relationship between the skills taught and job performance. When there is a strong relationship between what is taught and what the job requires, then the instructional program is effective and has content validity.

Establishing content validity is as important as achieving instructional efficiency. It does little good to have a very efficient instructional program if what students learn is not useful. Improving quality is partly a matter of improving instructional and organizational efficiency. But it also involves the capacity of training to transfer appropriate skills, be they related academic subject matter, manipulative operations or new technology. Obviously, when designing instruction, the aim is to maximize both instructional efficiency and effectiveness. Furthermore, there is a direct link between the two. By eliminating superfluous content, instructional time can be reduced, and greater emphasis can be given to the most important content to be learned.

Issues surrounding content identification and selection will be discussed. Next, the crucial question of how much to teach prior to employment will be examined, followed by a brief discussion of problems associated with technology transference.

**Focusing on What to Teach**

Instructional effectiveness depends upon three conditions: a) establishing direct links with employers, b) using task analysis procedures to identify content, and c) making the right selection of content.

**Linking with employers**

The source of content for vocational instruction is the workplace. Contact with employers should be established at the initial stage of course design and should be continued periodically, with course revision based upon changing work requirements. The consequence of not maintaining a link with potential employers is instruction characterized by low content validity—that is, the teaching of inappropriate or unnecessary content.

As suggested previously, formal programs tend to overestimate—often in response to the need to fill a set time block—the number of skills which an individual can profitably use and for which training is required. Many tasks, in reality, can be learned more effectively on the job.

The flow of information can be maintained through several ways: the formation of advisory committees or employer associations, the use of
placement or development officers, and systematic feedback from job placement. Cost, however, is involved in whichever way is used, and few individual institutions systematically address employment-related information needs.

Analyzing jobs for content

Well-designed task analysis procedures have been developed to effectively identify training content after the initial decision has been made to train in a specific job or occupational category (Melching and Borcher, 1973; Norton, 1985). These procedures are straightforward and make use of some type of validation process. Task analysis procedures, however, can be used to identify a broad array of instructional content, a fact often lost sight of by program developers. When task analysis procedures are not used, training usually lacks content validity. But when inappropriate tasks are sampled, training also lacks content validity.

Standardized task lists, which appear to provide a short-cut to instructional development, are often available. These listings, however, are generally inapplicable to local conditions, especially when material from developed countries is used in developing countries. Such material, although providing an initial, basic task listing, can serve only as a beginning point. Additional steps are necessary to identify relevant content.

Task analysis procedures are most commonly applied to identifying job-specific content. By the use of clustering techniques, occupational-specific and basic academic skills can also be identified, but this is often not done--even when the intent is to provide more generic training. Programs can be designed to emphasize different "skill mixes," depending on the intent of the program and the characteristics of the population being trained.

Different Kinds of Skills

Formal vocational programs are often equated with specific skill training. Work, however, involves the application not only of strictly academic skills, but also special uses of academic skills common to a particular occupation, in addition to specific job skills--the particular techniques and processes applied to work. There are also attitudes and habits, i.e. the affective behaviors associated with work. Different training alternatives are more or less successful in their capacity to transfer these skills. In general, formal vocational training is conceived too narrowly when the instructional focus is limited to specific job skills.

Basic skills

Proficiency in basic academic skills is important to training and work, since it establishes the foundation for successful skill development. Many job skills are merely adaptations and extensions of academic skills. As the technology incorporated into work becomes more complex, academic skill requirements tend to increase. Probably the greatest contribution to human resource development that can be made by formal training institutions is the
assurance of a sound grounding in academic skills and special vocational uses of academic skills.

Many students in developing countries do not now possess high enough basic skill levels to enable them to profit from vocational training or to realize their full work potential. It is the deficit in basic skills that inhibits vocational development, within school and at work.

Jobs that require significant uses of cognitive skills are probably best learned in formal programs; similarly, the academic skill component of many jobs is best learned in structured, classroom programs, in either public or private settings. Few employers, however, have the capability or inclination to instruct in formal knowledge. The inclusion of basic academic education is one reason why formal vocational education is often less job-specific than some critics would like it to be.

Psychomotor skill development:

Some jobs consist mainly of the application of psychomotor skills, such as the manipulation of tools, machinery and equipment. In general, psychomotor skills can best be learned at high proficiency levels within the actual work setting. Relatively long periods of practice are often required and the actual machinery and equipment of the firm can be used. Combinations of classroom instruction and work experience may work best, with classroom instruction focused on the cognitive job skills and familiarization with manipulative skills; supervised work placement is used to bring the trainee to required proficiency levels.

Formal classroom programs tend to concentrate too heavily on psychomotor skill development; firm-based programs tend to spend too little time on related cognitive skill development.

Job-and-occupation-specific skills

Training for job-specific, or "firm-specific" skills, is best provided at the work site, using the equipment of production. These are skills linked with the performance of specific job tasks. Occupation-specific skills, in contrast, are a representative sample of skills common to an occupational field or related fields. Formal vocational training is often equated with specific skill training, particularly when the support of the employment community is needed--the program is "sold" on the claim that it can, indeed, address the immediate skill needs of specific employers. "Conventional" formal programs, however, are limited in their capacity to provide skill-specific training largely because of an inability to rapidly upgrade machinery and equipment, to adjust curricula, and to focus on the varying skill needs of specific employers. Also, the trainee's occupational choice is usually not well-defined.

Formal programs best provide "generic training" in occupation-specific skills. The individual has the skills necessary to gain entry-level employment, but additional short-term, specific training is needed either just prior to, or at the time of, employment. The mobility of the
trainee is enhanced since he is prepared to enter any number of related jobs with a number of different firms. Instruction itself is less costly because it teaches large groups a core of common skills, making better use of equipment and requiring a limited range of instructional resources.

The criticism that trainees are not prepared to go immediately and directly into employment proves largely misleading when it is realized that the intent is to provide broad training, and skills are not always taught to high performance levels. Broad coverage is traded for depth of instruction. Occupation-specific training develops the general ability to assimilate additional training, a capability that is not necessarily an outcome of firm-specific training (Herschbach, 1984b).

How Much to Teach

As suggested previously, probably the most common error made when designing training programs is the inclusion of too many instructional tasks (Butler, 1972; Swain, 1973; Legere, 1978). This error is particularly common when the actual job has not been adequately analyzed.

Selecting content

The matrix in figure 3 provides one way to conceptualize content selection, and illustrates the importance of selecting and prioritizing tasks.

Jobs are made up of many tasks, some of which all employees need to know how to perform. These tasks comprise primary job tasks. The ability to perform primary tasks means that the individual will be successful on the job. There are also tasks which are not basic to the job. These are secondary tasks. In general, secondary tasks are more specialized and are outside of the normal range of daily work activity. They are assigned on the basis of prior experience, seniority, or demonstrated ability to perform. The individual can still obtain and hold a job without being able to perform secondary tasks.

<table>
<thead>
<tr>
<th>Primary task</th>
<th>Secondary task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formal instruction required</td>
<td>A</td>
</tr>
<tr>
<td>Taught on the job</td>
<td>C</td>
</tr>
</tbody>
</table>

Figure 2. Task classification matrix
There is also a distinction between tasks which require formal instruction and those that can be learned on the job (Melching and Borcher, 1973). Some tasks are better mastered on the job and need little or no formal instruction prior to job placement. A specialized piece of equipment may be involved, or the employer may prefer to teach the task only after the novice has demonstrated the ability to perform primary tasks. Of course, the opposite is also true. Some job tasks must be taught prior to job placement; for example, any primary task which the employer cannot take the time to teach. Some tasks cannot feasibly be taught on the job because they require extensive periods of close supervision or they may be needed immediately upon job placement.

In any case, employers simply do not expect new employees to be able to perform all of the tasks associated with a job. Legere (1978), for example, suggests that the typical range of work activity is limited to between six and nine different skill clusters.

The simple matrix classification scheme provides a way to establish instructional priorities. Tasks in category A must be given primary instructional emphasis. They are fundamental to job performance and cannot be learned on the job. These tasks should form the basic core of the instructional program. The tasks included in category B are less important to teach since they can be learned on the job. However, trainees should become familiar with these tasks in order to know what to expect on the job; they are, after all, primary tasks. More important, trainees need to master the prerequisite skills required to learn the tasks on the job. If a task requires computation, for example, then it is essential that the trainee know how to compute.

Category C tasks are optional. They should not be taught, if at all, until the trainee has learned the tasks included in category A and the prerequisite skills associated with category B. Perhaps all that is needed is to inform the trainee that category C and D tasks are a part of the job functions of some employees.

Some skills are important to formally teach and some are not. By making a judicious selection of instructional content instructional time can be considerably reduced, and equally important, resources and time can be concentrated on what is most essential for students to learn.

**Establishing instructional priorities**

It is useful, then, to view the instructional design process as addressing two essential conditions. One is the selection, from the total universe of potential skills only those which require formal instruction, thus reducing the scope of instruction. All instructional programs must select content. What is important is that this be done objectively and systematically, resulting in high content validity. The second condition is the identification of instructional priorities. All skills do not have to be taught to the same level of mastery. As illustrated by the simple matrix, for some tasks familiarization is sufficient while for others a high proficiency level is desirable.
In general, tasks which are critical to job performance, performed immediately at the time of placement, and which cannot be easily taught on the job should be taught to high performance levels. But tasks which can be taught on the job, and are less critical to performance and are not performed immediately require considerably less instructional emphasis (Melching and Borcher, 1973; Herschbach, 1977).

In any case, instructional priorities should be established, thereby reducing instructional time. In many programs there is considerable latitude for reducing the competency levels established for instruction.

**Transferring Inflows of Technology**

It hardly needs to be said that technology is changing the nature of work and that these changes are profoundly affecting both developed and developing worlds. In order to maintain competitiveness, companies have to adopt new technology and provide appropriate training. Yet there are no easy answers to the question of how to incorporate technology into training. Task analysis is a static approach to the identification of instructional content. It focuses on the current skills of production, and does not generally incorporate within its methodology ways of anticipating changing skill requirements. For this reason, changing technology must be addressed separately.

**The obsolescence of content**

The obsolescence of instructional content is a major problem which directly infringes upon the quality of instruction in formal programs. In general, training institutions lag from 6 to 10 years behind companies in reflecting new technological development in their training programs (International Labor Office, 1987). Besides the fact that many formal training programs do not have the required managerial and programming flexibility to adapt relatively quickly to changing training needs, they simply do not have access to state-of-the-art knowledge and technique.

Small and medium-size firms tend to be outside the mainstream of technological innovation and change, and consequently do not have ready access to new knowledge "in" practice. While small firms probably do a satisfactory job inducting the raw employee into existing production practices, they also experience considerably more difficulty in retraining and upgrading their work force to improve quality and productivity.

The problem of obsolete content is not so critical among large firms. Many large firms have links to multinational corporations, are members of trade associations or have licensing agreements with international firms. They acquire information through imported machinery, turnkey plants, copied products, joint ventures, nationals who travel abroad and many other informal and formal means. Training content is embedded in the new technology used, and is transferred along with the technology. This advantage is not enjoyed by the small employer or the formal training program, and their ability to transfer new work skills is therefore seriously impaired.
Emerging strategies

One strategy being followed in some developed countries in their efforts to make schools more responsive to technology transfer is to speed up the flow and amount of information about job content and work organization so that the training system can adjust accordingly. Decisions regarding instructional content are also decentralized and local schools can make changes in response to the local labor market (Noah and Middleton, 1987; International Labour Office, 1987). Also, again, cooperation with innovative firms is encouraged so that appropriate curriculum changes can be made. Schools use experienced individuals from local firms as instructors and share training technology. Support is solicited from industry to supply current training equipment, and the enterprise-school collaboration is encouraged by "contracting" with specific industries for services.

Accelerated training

Accelerated training programs are another way to accommodate technological change and compensate for the slow response of formal programs.

Accelerated programs are not permanent, but are phased in or out as market needs change. They range from a few days of intensive instruction to a few months of training. Training is generally focused on high technology requiring the application of academic and academic-related skills, with little emphasis on manipulative skill development. The facilities, machinery and equipment of participating firms is used, and teaching staff are hired on a part-time basis, drawing from technical experts in industry or education. It may be necessary to recruit successful workers as teachers and provide limited training, with the workers returning to their regular duties when the training cycle is completed. Enrollment is usually limited to employees or potential employees of participating firms. Representatives of the firms participate in course development.

The training agency, which is often a formal training institution, requires a small permanent skeleton staff for long-term administrative coordination, makes facilities and instructional staff available, provides short-term training for potential instructors from industry, and directly channels graduates of academic and vocational preparatory programs into industry-based programs. Firms identify training requirements, provide in-house training facilities and equipment, provide technical instruction, and identify participants (Herschbach, 1984b).

Industry-sponsored training centers

In Brazil SENAI has successfully pioneered the concept of industry-sponsored training centers which serve to technologically upgrade workers (Castro, 1979; Ducci, 1980; 1983). Similar centers are found in Columbia, Singapore, and Japan (Corvalan, 1979; Salome and Charmes, 1988); often administered by trade associations, unions, professional groups or government agencies. These centers may be one of the most effective ways to serve the training needs of both large and small employers.
The center keeps abreast of technological innovation and current market needs. It functions as a clearing house of new technology. It can centralize and disseminate information in a way that cannot be matched by individual employers. The center also provides training services, both within the center and within firms. The center may supply trained instructors to firms and assist in setting up training departments. Training is usually focused on skills in short supply, or new technological developments. While the cost may be substantial, it is shared among participating members.

**Summary and Implications**

There is a direct relationship between content selection and the quality and cost of instruction. An instructional program may be efficiently organized and taught but include an excessive amount of unimportant content. Quality can be improved and cost reduced by judiciously selecting content based on a systematic analysis of job requirements. Then again, there is a considerable difference between what has to be formally taught and the universe of job skills in an occupational field. Some skills can be taught better and at less cost on the job.

Instructional design should be conceived as a systematic, ongoing process which makes use of task analysis procedures and establishes functional links with employers. But the potential "skill mix" of instruction should also be broadly conceived and include basic skills, special application of academic skills and specific job skills when appropriate to the aims of instruction. In general, formal programs should concentrate on occupation-specific training in contrast to job specific training, which can best be carried out in firms. Formal training programs should also emphasize the development of basic and cognitive skills. High levels of psychomotor skill development can best be attained on the job.

Many skills do not have to be taught formally to high levels of competency. Considerable instructional time and cost can be saved by establishing minimum competency levels. Greater instructional effectiveness results because instructional time is focused on what is most essential to learn.

The introduction of new technology warrants particular consideration. Formal training programs tend to lag behind new technology. Similarly, small and medium-size firms tend to be outside the mainstream of new technological development. It is necessary to counter the obsolescent of training by adopting strategies responsive to technological change, including speeding up the flow of job information and decentralizing curricular planning so local schools can respond to local markets. Accelerated training and industry-sponsored training centers are also effective ways to address changing training needs.
4. MANAGEMENT DIMENSIONS OF INSTRUCTION

Instruction takes place in a physical setting, and in the case of vocational instruction this usually involves a laboratory (or "workshop") full of tools, equipment and machinery. The vocational instructor is thus faced with all of the demanding management tasks associated with practical work, in addition to coordinating and presenting instruction. The first section of this chapter discusses the management of the instructional laboratory. Poor management skills can not only affect student achievement but can also result in the loss of instructional resources, scarce as these may be. The next section discusses instructional resources, problems surrounding their use, ways in which they can be used more economically, as well as alternatives which permit the use of fewer resources.

Managing the Instructional Laboratory

Instructional laboratories are complex environments. In addition to instructional responsibilities, the vocational teacher must also perform a range of management tasks from setting up a tool-and-supply dispersion system and developing short and long-term maintenance schedules for machinery and equipment to ordering, stocking and inventorying a wide variety of tools, supplies and repair parts. These tasks must often be carried out under conditions of inadequate finances, uncertain supply sources, deteriorating physical plant and an instructional environment where dust, dirt, moisture, and heat are ongoing concerns. Moreover, the typical vocational instructor probably has had little training and experience in laboratory management practices.

Factors Contributing to Poor Management

Lack of Resources

Poorly designed and managed instructional laboratories are probably the norm in most developing countries, with well-managed laboratories being exceptional. One reason is the lack of adequate resources. There must be a sufficient level of recurrent expenditure to support the maintenance of school laboratories. Under austere financial conditions, maintenance funds are usually the first to be eliminated, and in any case, they are probably restricted to start with. Without lubricating oil, spare parts or special tools, instructors cannot maintain and repair shop equipment—even if they are inclined to do so. Similarly, it may be difficult to obtain spare parts or maintenance supplies because of currency controls, uncertain transportation, or reliance on foreign sources with no local supply outlets (Herschbach, 1985).
**Little opportunity for training**

There may not be an opportunity to obtain training in laboratory management practices. Instructors from teacher training institutions may have had little exposure to laboratory organization and management practices. Instructors recruited from industry may have had no exposure to instructional and laboratory management techniques. Then again, few principals have the background to conduct in-service training for staff members, and when management training is given, it probably is not at the instructor level. Participant training is often provided through donor agencies, including study tours, conferences, internships and institutional training. Although such experiences are beneficial, there is still a need for those undergoing training to learn how to deal with management problems within the instructional context in which they will be working (Herschbach, 1985).

**Attitudes**

Poorly managed instructional laboratories are also the consequence of social and cultural attitudes. Practical work may be considered inferior to theory, with the supervision of laboratory work relegated to assistants and helpers with little training or status. This attitude of superiority may only mask the fact that the instructor has little or no practical experience and understanding--whatever the case, the result is detrimental to instruction.

**Need For Effective Management**

The consequences of poorly managed instructional laboratories are multiple: Firstly, the scope of instruction is reduced. Students may not be able to learn some essential tasks because of malfunctioning, broken or lost tools and equipment. Secondly, considerable time is lost. When the tools and equipment to support instruction are insufficient, students waste time standing around, with markedly little time-on-task. When instructional laboratories are poorly organized and managed only a small part of allotted time is used for instruction, with inordinate amounts of time spent by the instructor maintaining some semblance of order. Finally, there is often a gradual, but increasingly costly, erosion of quality that cannot be easily reversed. Disorder begets more disorder.

**Institutional management**

Poor classroom management often reflects inadequate institutional management (Squires, Huit and Segars, 1985). The institution's administrator establishes the policy, conditions, and climate which support the individual teacher's efforts. The department chairman is responsible for overall planning, coordination, and monitoring of daily activities. Failure at any one level diminishes management effectiveness at the other levels and lowers the overall quality of the instructional program.

The instructional management task of industrial trainers is no less important to program quality than that of the instructor in formal programs. However, in industry, organized training units are probably more
self-contained; while at the same time embedded within the larger corporate structure. They may have more resources, while program development, and hence management capacity, is addressed on a long-term, continuing basis. Their training may also be more well-defined and structured, and they may use production equipment rather than instructional laboratories.

Maintaining classroom order

Probably the most important instructional task encountered by the teacher is to maintain classroom order. Research generally shows a positive relationship between indicators of teacher control and student achievement (Soar and Soar, 1973; 1978; Brophy and Good, 1986). When classrooms lack order and discipline, all else falls by the wayside. Students spend considerably less time engaged in learning, considerable instructional backtracking occurs, instructional concerns give way, and an atmosphere prevails in which learning is only incidental.

Managing instruction

There is a difference between control of the physical environment and control of learning tasks. Both are necessary, but one may be present independently of the other. Classroom order and control are most commonly associated with the physical environment, but an increasing amount of research indicates the critical importance of controlling the learning task (Rosenshine and Stevens, 1986; Doyle, 1985; 1986). In the case of laboratory classes, the task of maintaining order in the midst of operating equipment, using tools and fabricating materials may be so overwhelming to the untrained teacher that less attention is given to the degree to which students are actually engaged with the subject matter.

Classroom order and control are not necessarily linked with a confining emotional climate, nor should they be. Negative classroom climate indicators show negative correlations with student achievement. The converse, however, is not necessarily true, indicating that while a negative classroom climate should be avoided, a neutral climate is as supportive of achievement as is a positive one (Soar and Soar, 1979; Doyle, 1986).

Class Size

The complexity of instructional management is related to class size, commonly expressed as teacher/student ratio. Researchers have studied the relationship between class size and achievement for some time. The evidence is somewhat ambiguous. Some studies show that there is little relationship between teacher/student ratio and achievement; other studies show that there is a significant relationship. This ambiguity is partly due to the interrelationships between teaching style, instructional pattern, subject matter, and student characteristics on the one hand, and class size on the other. Also, many studies are poorly designed, and few examine the upper or lower class boundaries. More recent analysis, however, sheds greater light on the interaction effect of class size.
Small is better

In an integrated analysis of over 100 studies with good experimental controls, Glass and Smith (1981) found that there was a "threshold effect" when class size was reduced to 15 students and under. Gains in achievement were dramatic. Conversely, "conventional wisdom" indicates an adverse effect on learning when class size extends beyond a ratio of 1:30 or so students (Hedges and Stock, 1983). Although researchers have found that there is little difference in student achievement between classes of 40 and 60 students, current thinking is that smaller classes promote higher achievement, better attitudes, and a greater degree of teacher satisfaction (Glass, Cahen, Smith and Filby, 1982). In smaller classes it is more likely that teachers will use practices which enhance learning. For example, smaller classes tend to be taught as a whole, resulting in greater time-on-task; there are fewer interruptions and less time is spent on procedural arrangements; there is more teacher directed instruction and greater attention is also given to questioning, with more feedback (Bourke, 1986; Glass, Cahen, Smith and Filby, 1982; Preece, 1987). It is these mediating factors, brought into fuller play in small classes, that have a positive effect on learning, and not just the small size of the class.

Facing reality

The fact remains that few schools can maintain small classes, particularly of 15 students or less. The best that can be expected in most cases is to keep class size in the 30's. It is possible, however, to incorporate into larger classes the same instructional practices which contribute to greater student achievement in smaller classes, even though they may not be applied with the same degree of effectiveness. This is probably the best policy option.

Class sizes of 20-25 students are a commonly accepted practice in vocational and technical laboratories. The justification is improved safety and better class management. In instructional laboratories full of machinery and equipment it is difficult to supervise large numbers of students. It is one thing to have 35 students sitting in desks with the teacher directing instruction from the front of the classroom; it is quite another to have 35 students working at the same time on different equipment scattered throughout the instructional laboratory; students spend less time engaged on-task, and considerable time is wasted in movement between activities. In some cases the instructional laboratory is simply too small to accommodate larger numbers of students, with considerable space occupied by machinery and equipment.

However, in some cases, increasing class size to 30 or more students will probably not have a detrimental effect on learning--if accompanying training is given to instructors. For example, in fields of study like electronics, drafting, and business practice, classroom conditions are similar to academic instruction. Then again, there are alternatives to "traditional" group instruction, such as the use of learning stations, mastery learning and the Keller Plan, which can effectively accommodate larger teacher/student ratios because they have built-in management procedures establishing a flow of activities and holding students on-task.
The Allocation of Instructional Time

Yet another management concern is the allotment of instructional time, which should reflect content requirements and student learning needs. The initial allocation of instructional time, however, is usually a management, rather than curriculum, decision. National laws, for example, may establish the number of school days per year, or institution policy may stipulate the length of classes, school day, and semesters. Each course or program must fit into the time established regardless of its scope or complexity. Of course exceptions can also be scheduled, but this seldom happens. As previously suggested, however, by tying instruction to set, predetermined blocks of time, potential cost savings through a judicious selection of content are lost and productivity gains through more efficient instruction cannot be realized. Students remain in class or program for a stipulated period of time regardless of what, and how fast, they learn.

Some learning requires less time

One major way to achieve greater instructional efficiency and cost-savings is to limit instructional content to only those job tasks requiring formal instruction, as discussed in Chapter 3. All jobs do not require the same amount of instructional time to learn: they differ significantly in scope, difficulty, and complexity of tasks performed. What is taught, however, may be more a function of established time blocks than of occupational requirements. And the common tendency is to include too much content, rather than not enough (Butler, 1972; Swain, 1973; Legere, 1978). Units of instruction are selected because they appear logical to teach and to fill time, and not necessarily because they require formal instruction. To avoid inefficiency, time allocation has to be based on what actually needs to be learned. There are a number of task analysis procedures that enable one to do this (Melching and Borcher, 1973; Perry, 1982; Norton, 1985). Failure to actually assess job requirements leads to inappropriate instructional content as well as poor use of allocated time and considerable inefficiency.

Inefficient time allocation is less of a problem with industrial-based training programs where there is usually more flexibility in allocating time. The scope of content is more narrowly defined and relates to a specific set of skills to be learned. In addition, lower performance levels in training are often acceptable in lieu of more instructional time because mastery levels can be quickly attained on the job.

In order to allocate time more efficiently, it is also necessary to make judgments about the time needed to learn. This requires an understanding of the background and ability of the student as well as an understanding of the complexity of the content being learned. Any initial allocation of time is at best a rough estimation. Obviously, instructional time must be adjusted according to the experience gained from running a course through several trials. In general, for most school-based training programs the duration of courses is too long in relation to either student or content requirements.
**Different rates of learning**

A more complicated concern, however, is the fact that students learn at different rates. No one time-frame is appropriate for all students. As previously discussed, the slowest students may take as much as 5 to 10 times as long to learn a given unit of instruction than the fastest students (Gettinger and White, 1979; Arlin, 1984). When instruction is organized into fixed time blocks, considerable inefficiency occurs. Some students will have too much time, others not enough. For this reason, the proponents of mastery learning underline the need for variable instructional time (Bloom, 1976; Arlin, 1984). Scheduling a fixed time block becomes less important.

**The Use of Facilities**

Low levels of facility use tend to be associated with low quality programs. Students are not attracted to programs which are perceived as providing poor or inappropriate instruction. Training may be perceived as inappropriate to the job market, the fields for which training is provided may be associated with low wage or status occupations, the occupations may be declining in employment opportunity, or there may simply be excessive training capacity in relation to job openings. In some cases, then, facilities are markedly under-utilized, with training capacity generally exceeding enrollment.

The scheduling of facility use may also be inefficient. In some programs, for example, lectures and practical work are conducted in separate rooms so that costly instructional laboratories remain idle for a considerable time. The scheduling of different classes can be dovetailed in order to achieve fuller use of facilities. The use of double shifts and staggered holidays can increase facility use. Then too, facility sharing arrangements can considerably reduce training costs, as, for example, in cases where the apprenticeship programs make late-afternoon use of training centers operated by the Ministry of Education. Work release and cooperative programs have considerable potential for cost reduction because the facilities of the work environment are used for training purposes. In any case, there is probably considerable latitude in most developing countries to achieve a higher rate of facility use through better scheduling, extension of the instructional day, or cooperative sharing arrangement.

It is not unreasonable to think that in some cases enrollment can be doubled without expanding facilities—simply by attracting more students, by making better use of the existing training capacity, and by using available resources in industry.

**Potential Gains**

In sum, then, there is an extensive and common body of knowledge relating to efficient instructional laboratory management practices (Brown, 1979; Finch and McGough, 1982; Ferrari and Lancaster, 1987). This information
is generally accessible through commercial publishers, although its availability and use appear restricted in most developing countries. Improved laboratory management practices do have the potential to reduce the long-term cost of equipping and running laboratories as well as to considerably enhance the quality of instruction. The potential gains in cost reduction, efficiency, and quality may at least equal the gains achieved through improved instructional practices alone.

**Material Resources**

Adequate instructional resources are necessary, but are not themselves sufficient to insure student achievement. The level of spending per pupil and the quality of classrooms have not been shown to be related to achievement. However, most studies have been conducted in developed countries. In many developing countries the material conditions are sub-standard, and this makes a difference. Below a certain point material conditions do have an adverse effect on achievement. (Hanushek, 1981; Cohen and Rossmiller, 1987).

**Tools, Machinery and Equipment**

One of the most costly instructional investments in vocational and technical training is in tools, machinery, and equipment. The unfavorable cost comparison with academic instruction is primarily due to the combination of smaller vocational classes and the greater capital and recurrent expenditures required to equip and maintain instructional laboratories. Most theoretical technical instruction needs to be complemented by practical experience. One major reason why technical instruction is often ineffective is that students do not learn to apply what they know. This may be because of a cultural bias which values "book learning" over practical application, or it may be because of the lack of sufficient resources to adequately support instruction. Compounding the problem of limited resources is the fact that many programs are not well-managed, resulting in poor maintenance, a deterioration in equipment and facilities, and breakage and loss. Needless to say, well-managed classrooms serve to at least conserve the existing resources.

School-based programs also have the problem of obsolescence. It is necessary to amortize costly machinery and equipment over a relatively long period of time in order to approach cost-effectiveness. This period may stretch over ten to fifteen years or even more. In actual fact, equipment is used until it completely falls apart or until replacement parts cannot be purchased or made. In some technical fields which undergo rapid and constant change, obsolescence can set in within as little as five years. Nor can technological and market changes be easily anticipated, resulting in poor investment decisions which become instructional liabilities (Herschbach, 1985).
Resource Alternatives

One alternative to restricted resources is the use of instructional patterns which require fewer resources. Conventional laboratory group practices require a considerable amount of supporting tools, machinery, and equipment. In some cases, students are supplied with individual tool boxes, small equipment, and work stations. Alternatives instructional patterns, such as learning stations in which students rotate through work assignments, may require up to 25 to 30 percent fewer resources than conventional practices—a considerable saving. Greater instructional planning and preparation, however, is required, and problems of maximizing time-on-task, managing the flow of activities, and developing supporting instructional materials have to be addressed.

The purchase of instructional resources should follow from instructional objectives, and not from an idealized perception of the work place. Often the decision to purchase a particular mix of tools, machinery, and equipment is based on duplicating as closely as possible the work tools used in business and industry. The reasoning is that trainees should be exposed to the same working conditions as those which they will likely encounter on the job. This reasoning is not necessarily correct and can result in an over-investment in tools, machinery, and equipment.

Another alternative is to use combinations of in-school instruction and work placement, with basic instruction given in the school laboratory and more advanced practice obtained on the machinery and equipment at the work site. Successful examples, such as the Vocational Training Corporation in Jordan (Herschbach, et al, 1985), indicate considerable potential for cost savings. However, to make such a system work, there must be a sufficient potential number of quality placements available. In some locations this is obviously not the case.

Textbooks and Print Materials

Textbooks, including related print materials, remain the most widely used and cost-effective instructional resource (Neumann, 1980; Woodbury, 1980). In developing countries, however, many schools are fortunate just to have one or two books per class, and textbook expenditures are only a small fraction of those in developed countries. Classrooms are generally characterized by a lack of all types of instructional resources including textbooks and other print media.

Relationship to achievement

Research findings consistently show that the presence of textbooks is positively related to achievement in developing countries (Heyneman, Farrell, and Sepulveda-Stuardo, 1981; Altbach, 1983). Lockheed, Vail and Fuller (1986) estimate that the presence of textbooks accounts for the equivalent of 1.61 additional months of schooling per year. Their findings are consistent with other research. However, Psacharopoulos and Woodhall (1985, p. 223.) caution that as the availability of textbooks approaches a
ratio of 1:2 per pupil the positive effect is less. This observation may explain in part why textbook use has considerably less impact on achievement in developed countries. To be sure, the lack of instructional resources has a markedly negative effect, but beyond a certain point there are diminishing returns to the addition of more resources.

**Uses of print material**

Print material, such as textbooks, manuals, student and teacher guides, and work sheets, are highly flexible and adaptable to a wide range of uses. In cases where teacher preparation programs are poor, or where there is a lack of qualified teachers, high quality instructional materials can provide instruction that is superior in content and design to that provided by the local instructor. Gaps in the teacher's knowledge can be filled and existing skills complemented, compensating for limited training. Lockheed, Vail and Fuller (1986) after analyzing a national sample of eighth grade mathematics classrooms in Thailand, concluded that textbooks were 3-4 times as cost effective as post-secondary teacher training. Through the use of textbooks untrained teachers had a ready-made, organized, and coherent curriculum.

It should not be assumed, however, that textbooks can automatically substitute for teacher training, particularly in the case of vocational instruction. The Lockheed, Vail and Fuller (1986) study relates to formalized, well-structured content. Manipulative skills, however, are very difficult to teach through written material alone. And technical content often changes rapidly, while instruction is often specific to a particular piece of equipment. Furthermore, the use of print materials requires a literate trainee population, which is often not the case in many programs. Nevertheless, there appears to be a trade-off between teacher training and resource materials. Better trained teachers can compensate, up to a point, for a lack of textbooks, and vice versa. Research suggests that lower levels of teacher preparation can be offset with greater use of instructional resources, and indeed, this may be the most cost-effective combination in some developing countries. Research also clearly shows that limited teacher preparation coupled with a lack of classroom instructional resources results in low levels of student achievement.

**Cost and production**

Simple print materials can be produced inexpensively. Textbook production, on the other hand, is relatively expensive, particularly since the potential clientele for technical materials is limited, and frequent revision is often needed. A relatively long development time is also required for textbooks: three to five years compared to a one to three year cycle for other print materials. A highly capable staff is needed to design, write, edit, and produce good print materials.

Few developing countries have a viable commercial market which can be relied on to produce educational materials. Consequently, this task often falls to government ministries, or, lacking any organized effort, the local instructor. In contrast, the major source of print materials in developed countries consists of commercial publishers and vendors who can supply a
diversity of current material at reasonable cost. They keep abreast of technical changes and inform trainers and educators. Lacking an associated commercial capability, few governmental organizations in developing countries can satisfactorily address the specific and highly diverse instructional requirements of technical curricula. The unavailability of technical print materials, in fact, may be a greater barrier to school use than cost. One long-term policy option may be to encourage the development of commercial capacity (Herschbach, 1984a).

Because the demand for educational materials cannot be met, heavy use is often made of textbooks printed in developed countries. The relative cost is usually prohibitive. An additional constraint is the fact that most instructional materials produced in developed countries do not fully reflect training needs in developing countries. The mix of machinery and equipment, for example, may be different, and building codes, manufacturing procedures, material standards, and engineering concepts may differ significantly. Most technology brought from abroad goes through local adaptation (Westphal, Rhee, and Pursell, 1981). Then again, the training populations may differ in significant ways.

To be most effective, instructional resources from abroad should be adapted to in-country specifications. Adaptation is also probably more cost-effective than producing new materials from scratch. Print materials can be modified or supplemented by adjusting language and vocabulary, and addressing the technical complexity of material and local conditions. Nevertheless, competent staff is needed with skills approaching those required to produce original work (Herschbach, 1984b).

Large enterprises usually have fewer problems with locating and acquiring appropriate instructional materials than do public institutions. They have better links to sources that produce the materials since many are members of international associations, subsidiaries of multinational corporations, or establishments that have licensing franchises with firms in more developed countries. There is a flow of technology and of instructional materials required for company training. The major task of the firm is to translate materials and adapt them to in-firm training activities. Small employers, in contrast, have little knowledge of, or access to, instructional resources and must rely on indirect sources for training materials, if they do, indeed, conduct any formal training (Herschbach, 1985; Herschbach, et al, 1985; Kelly, et al, 1985; Cuervo, 1986).

Educational Technology

Educational technology has attracted considerable recent attention as a way to improve the effectiveness of technical instruction. An impressive array of hardware and courseware is available, differing in complexity, use, cost, and quality. Particularly attractive is "high" technology because of the revolutionary changes accompanying its use in industry, and because of its promise to bring similar results to education. Some advocates contend that it may be possible to overcome problems like poor teacher preparation, inefficient or outdated instruction, and restricted opportunity through the
use of advanced communication and video technology. A more cautious
assessment, however, is probably in order.

Uses of educational technology

Vocational instructors mainly use simple technology: slides and
cassettes, transparencies, film loops, simple models, and assorted visual
aids. Such technology is inexpensive, flexible, portable and easy to use.
The teacher needs little prior training, back-up requirements are few, and
storage, handling, and maintenance requirements are uncomplicated. Teachers
mainly use simple technology as an adjunct to instruction.

Students, moreover, learn from all forms of educational technology,
and no one technology is superior to another. There is no research to suggest
that more sophisticated technology, such as computer-assisted instruction,
leads to higher student achievement, or that any one type of technology is
superior to teacher-directed instruction. Content, the lesson conveyed, and
the instructional sequence, are the important factors, not the mode of
delivery; be it teacher, instructional booklet, or computer (Kulik, Kulik, and
Cohen, 1980; Pitts and Schneider: 1981; White, 1982; Office of Technology
Assessment, 1982). The use of all forms of educational technology generally
adds cost to instruction. This is because technology complements rather than
supplants the instructor, so an added-on cost is created. The instructor
serves the same number of students regardless of how much instructional
technology is available. While it is true that the quality of the learning
experience can be improved, additional extra cost must also be expected. In
the case of technical instruction, use levels are often not high enough to
take advantage of economies of scale, and the unit cost is increased as a
result. Vocational instruction is very specific and serves a limited
population, making it impossible to approach use levels realized by more
general instructional materials. This is a real barrier to "high" technology
materials which tend to be more expensive and need high use levels over a long
period of time to approach cost-effectiveness. Then again, instructional
materials rapidly become outdated, leading to replacement costs. Commercially
produced materials may have to be replaced in as little as five years
(Herschbach, 1984a).

The use of some technologies strains the capability of the
educational system to use them. High levels of recurrent expenditures are
required to keep the technology maintained. Specialized staff is required as
well as specialized facilities, and there needs to be a supporting
infrastructure along with local suppliers.

Value in developing countries

In regard to developing countries, the use of educational technology
can have benefits which partly offset the relatively high cost. As in the
case of print materials, technology can compensate for the lack of qualified
teachers through well-designed instructional materials incorporating appropriate content as well as superior instructional sequences. New technical content, for example, can be introduced to teachers who otherwise do not have the opportunity for upgrading. Through educational technology, new concepts and skills can be introduced more rapidly than through established teacher training programs. However, print materials and simple technology can also be used, as well as more elaborate and costly technology.

In addition, educational technology has the potential to extend opportunity to groups and individuals not served through more conventional instruction. Self-contained, multiple media packages, for example, can be designed for use with small groups of individuals. Instruction can be delivered to just about any place and time. Training is short-term, it is provided in different geographic locations, uses existing facilities, and has modest staff requirements. This may include, for example, small rural programs, specialized skills upgrading in small firms, or evening programs run by community organizations. Educational technology can distribute instruction in alternate ways not possible through conventional instruction (Herschbach, 1984a).

The use of educational technology by industry is instructive: Short-term training is provided through self-contained, multimedia packages used with small groups to introduce new products, train salespeople and instruct production and maintenance personnel. Once the material is developed, staff requirements are modest, training can be easily delivered to different locations, and existing facilities are used. The material is expensive to develop, and a highly qualified team is needed to produce them, but cost is offset by the capability achieved, instruction is portable, it accurately reflects standardized content, and delivery is flexible, serving equally well groups of different size and composition (Brown, 1981; Office of Technology Assessment, 1982.).

The U.S. military makes extensive use of high technology, particularly computers. Large sums are spent on instructional design research and product development. One hour of computerized instruction may cost between 50 and 300 thousand dollars to develop, with the cost of a complete course exceeding a million dollars or more. Instructional technology reduces training time: recruits can be brought up to satisfactory performance levels in less time than it takes with 'conventional' instruction, although performance levels may be lower (Orlansky, 1985). However, high proficiency levels can be obtained on the job, making it possible to increase operational assignment time. This is a major concern because military personnel have limited enlistments and are paid during training. Programs are also standardized over location and can be administered to a large training population. Finally, trainees also become familiar with computer use as they are learning, an obvious advantage as weapons systems become more computerized. (Zucker, 1982; Wagner, 1982; Office of Technology Assessment, 1982).
Cost and scale

In general, educational technology has a high ratio of fixed to variable cost. Start-up costs are high, with unit cost high depending upon utilization rates. Once an instructional system is in place, however, cost approaches conventional instruction if high use rates can be achieved. The marginal cost of serving additional students is usually low, and this capacity to extend instruction at a low cost beyond the number of students normally served by a single teacher is the unrealized promise of educational technology. Finally, once a system is in place, courseware costs become the dominating factor. Teachers typically do not have the capability to develop courseware--except for the most simple educational technology. Instead they must depend on commercial or public sources. There may be so little courseware available as to render hardware devices next to useless (Herschbach, 1984a).

The tendency of some countries is to undertake large instructional development projects with the goal of establishing national curricula. The intent is to produce print materials as well as training technology. Expectations usually cannot be fulfilled. The cost is higher than expected and the results less impressive than anticipated. Aside from the capabilities needed to produce materials, the potential population of users is simply too small. In general, for technical materials, countries must have an overall population somewhere in the range of 10 to 15 million before there is a large enough potential specialized population of users to result in economies of scale. Even large international projects, such as the International Labor Organization's Modules of Employability Skills, have difficulty recovering development and production costs.

Regional sources of training technology, such as the instructional materials produced and distributed through SENAI and SENAC in Brazil, offer promising potential. As yet, similar capability is not available in other regions. Making available current instructional material of high quality and low cost is a challenge yet to be successfully addressed in most developing countries. Yet making instructional materials available is probably mandatory in any effort to improve training quality.

Summary and Implications

Two related problems are encountered regarding the management dimensions of instruction. One is the lack of resources. Below certain levels of material support, instructional quality suffers. The other dimension is the use of resources: good management is essential to efficient use.

The lack of sufficient tools, machinery and equipment puts constraints on programs, and scarcity is often accompanied by partially operating and obsolete equipment. Ideally equipment maintenance and replacement schedules should, on a regular basis, phase in new purchases. The alternative is a progressive deterioration in instructional quality and a
future choice of either completely abandoning a program or making massive investments in it.

There are at least three policy alternatives for dealing with restricted resources. First, use instructional delivery modes which require fewer resources, such as learning stations and modularized instruction. The savings compared to more "conventional" laboratory instruction can be considerable. Second, restrict instructional content to only that which must be formally taught, with the purchase and use of instructional resources following from the instructional objectives. Instructional programs only have to provide a representative exposure to industrial processes, machinery and equipment. Third, make use of combinations of in-school instruction and work placement, using the machinery and equipment of the work site for advanced practice.

It is imperative to address shortages in instructional materials. A lack of instructional materials combined with shortages of qualified teachers, limited and obsolete equipment and weak links to the job market results in instruction that is only marginally useful, if at all. In the short term, investment must be made in simple print materials, charts and diagrams: overhead transparencies, and other "small media." These materials provide the best investment return, are easy to use, require little supporting staff or infrastructure, and result in achievement gain. In the longer term, local teachers need the capability to develop and produce simple instructional materials. This requires material support and training.

Supporting the development of commercial capacity is another policy option well worth exploring. In the long term, the answers to shortages in instructional materials will inevitably involve private sector firms which can provide the innovation, versatility and incentive to limit cost now lacking in government agencies. A case in point is computer technology, where the stimulation for software and courseware production comes almost solely from the private sector, mainly small innovative firms. Although the private sector will not replace government supported initiatives in the near future, a viable alternative needs to be nurtured. Ultimately any answer will involve both public and private capacity.

The dependency on foreign produced instructional materials must be reduced. In addition to high cost, this dependency serves to hinder the development of local production capacity.

For small countries, the development of regional capacity to produce instructional materials is essential. At the national level, economies of scale are not possible. The most likely scenario involves a two-step process, in which some tasks will be carried out on the regional basis, with others completed by individual countries. Such an effort will require secure long-term financial support and the recovery of cost through user fees is not to be expected. Political and economic barriers will have to be overcome, and a regional coordinating mechanism will be needed.
In the immediate short-term, it cannot be expected that the use of "high tech" educational technology, such as computers, video disks and communications technology will result in cost savings or improved instructional effectiveness. Unit costs are simply too high, the training population too small, and implementation problems too extensive. Nevertheless, selective experimentation should continue, in order to determine under what conditions cost-effectiveness can be achieved, since the unrealized potential to revitalize training is considerable.

Considerable potential also exists to expand training opportunity without adding to physical capacity. In many countries, training facilities tend to be underused because of low enrollment. Put another way, more training can be done with existing, or less capacity. In addition, more efficient facility use results from staggering classes and double shifts, and considerable potential exists for shared facility use with nonformal training programs. These cost savings should be pursued because they free money for investment in improving instructional quality, which in itself may be one key to achieving higher use levels. In the past there has probably been a tendency to overinvest in physical plant and underinvest in the human and instructional resources essential for program success.

Improving the management capability of training staff is in fact a priority. Apart from the problems of attracting and retaining good training staff, there is a pressing need in many countries for management development at all levels. There must be a broad policy approach to addressing the management needs of administrators parallel to those of department chairmen and classroom teachers. The consequence of a lack of good management is poor returns on an educational investment already made, the costly loss of physical resources and a reduction in educational quality. More resources do little good if they are poorly used.
5. **SCHOOL-LEVEL PRACTICES**

Teacher and classroom practice have considerable impact on student achievement. School-level practices, however, form the context in which the classroom functions, and are no less important in optimizing student achievement. Studies conducted by different researchers consistently show a common finding: the characteristics of schools may account for 30 or more percent of between-school variance in student achievement. School processes have an important effect on student achievement, and may affect student achievement at least as much, if not more, than school inputs, such as the SES of students, home background, teacher certification, and funding level. Moreover, schools are not interchangeable. Some schools have considerably more impact than do others with similar resources and serving similar populations (Edmonds, 1979, 1981; Brookover, et al, 1979; Rowan, Bosset and Dwyer, 1983; Rutter, 1983; Rosenholtz, 1985; Corcoran and Wilson, 1986).

This chapter briefly examines how specific school-level factors contribute to differences between schools, making some schools more or less effective.

**Elements of Effective Schools**

**Goal orientation**

Goal orientation appears to be extremely important to effective schools. (Leithwood and Montgomery, 1982; Bossert, et al, 1982; Greenfield, 1982; Cohen, 1983; Corcoran and Wilson, 1986). Successful principals project a vision of the mission of the school, delineate barriers to be overcome, and constantly project before the staff a clear image of the tasks at hand. The more successful schools tend to have high achievement standards, a strong belief in the educability of all students, and a sense of shared purpose and commitment among faculty, students and parents (Brookover, et al, 1979; Leithwood and Montgomery, 1982; Edmonds, 1981; Rosenholtz, 1985; Mann and Inman, 1984).

**Policy and rules**

Examining the effects of school policy on student behavior, Stallings and Mohlman (1981) found that schools with clearly identified and consistently enforced policy and rules showed higher teacher morale, lower absentee rates, fewer classroom intrusions, and more student time-on-task. In addition, teachers were more likely to alter their teaching practices following recommendations by the principal.

**Managing control and order**

A common element of effective schools is better control and discipline. (Harnisch, 1987). Professional disagreement, however, surrounds the question of order and control, and how these can best be achieved and
maintained. One view holds that managers should maintain tight control. An alternate view maintains that organizational effectiveness can ideally be fostered through decentralized management (Clark, Lotto and Astuto, 1984; Firestone and Wilson, 1985). A more recent alternative emerging from research in business (Peters and Waterman, 1982) holds that successful management behavior creatively combines control and discretion, resulting in tightly controlled and monitored decisions and outcomes, with the means of carrying out decisions delegated. A management pattern of simultaneous tightness and looseness has been found to characterize successful schools (Corcoran and Wilson, 1986). The school's operations are continually monitored in order to assess performance and identify need for change; particular attention is given to curriculum articulation and management, with the principal participating in monitoring and evaluation; and teaching staff is thoughtfully and carefully evaluated in order to improve instructional quality. At the same time, instructors have considerable autonomy in implementing instruction and selecting appropriate teaching strategies. Rather than work independently, however, teachers participate collectively, sharing responsibility and accomplishment; this reduces isolation and fosters a sense of control over their work. These schools, Corcoran and Wilson (1986) contend, "are searching for a balance between control and discretion that will enhance their efficiency without harming the vitality and sense of community that have made them successful" (p. 45).

Need for autonomy

Effective schools, then, work together in solving problems and improving the school (Corcoran and Wilson, 1986). However, there is a need for autonomy in determining the means by which problems can be addressed, with little interference from higher authorities (Purkey and Smith, 1983). This observation may be particularly relevant to developing countries which have rigid, centralized control of local training institutions. The ability of the institution to adapt and change is seriously hampered by a lack of local autonomy (World Bank, 1986). The movement in some countries to "decentralize" educational control may be at least partly motivated by this perception. This is not to say, however, that high level support is not needed. School-level management needs support, but this is best characterized as help and guidance.

Sense of community

A sense of community is yet another element of successful schools. A school's climate--referred to as "culture" or "ethos"--has been identified as a major determinant of learning (Brookover, et al, 1979; Brookover and Lezotte, 1979; Purkey and Smith, 1983; Cohen, 1983; Squires, Huitt and Segars, 1985). In high achieving schools, an atmosphere is created which fosters and supports good teaching and successful learning. Administration, teachers, and students work together to achieve the shared goals of instruction; with respect for authority, concern about individuals, mutual trust and understanding, and honest and consistent enforcement of norms defining behavior. The effective principal conveys to teachers the certainty that they can improve student achievement and to students the confidence that they can succeed. Achievement is expected and recognized; collaborative planning and
collegial relationships are fostered; and a sense of common purpose is generated (Purkey and Smith, 1983; Rosenholtz, 1985).

Brookover, et al (1979), suggest that the social system of the school has a strong influence on the role definition, norms, values and beliefs of faculty and students alike, and that through a positive learning climate students internalize behaviors which affect achievement. While it is true that teacher and student characteristics as well as the quality of instruction and school processes influence learning, the school social structure, as perceived by participants, has at least an equal affect on achievement and, indeed, contributes substantially to achievement variation among schools. The climate of the school, according to Brookover, et al (1979), is shaped by parental involvement, instructional patterns, classroom management, time allotment to academic, social and administrative functions, and staff satisfaction.

Nested layers

Purkey and Smith (1983) suggest that it is useful to view school systems as "nested layers." The school, or outer layer, "sets the context for the adjacent (classroom) layer" (p. 443). The outer layer embodies organizational and structural variables that are established by administrative policy and action, such as site management and staff development; and which facilitate the development of a second group of process variables which largely define the school's climate, such as collaborative planning and commonly shared expectations. It is the school's climate which "seems to be the determining factor in its success or failure as a place of learning" (p. 444). Although this climate may vary, it will still promote learning and the sustaining factor is a shared commitment to instructional effectiveness (Barr and Dereeben, 1981; Purkey and Smith, 1983).

School Leadership: The Principal

Strong leadership is consistently identified as an essential element of effective schools (Edmonds, 1981; Leithwood and Montgomery, 1982; Purkey and Smith, 1983; Squires, Huitt and Segars, 1985; Corcoran and Wilson, 1986). In most schools, leadership is diverse and can be exercised by a number of individuals, including teachers and administrative staff--although the most effective leadership probably comes from the school principal. The principal is in a controlling position of authority; he can establish clear goals, contribute to a positive learning climate, and encourage, monitor and evaluate learning. Good principals make a difference.

Leadership styles

There is growing evidence to suggest that principals are effective to the extent that teachers are receptive to a principal's management behavior (Dwyer, et al, 1982; Rosenholtz, 1985). A number of early research studies examined the relationship between "leadership styles" and the kind of leadership provided by principals. More "humanistic," "people-oriented" principals may be very successful with interpersonal relations, while
"task-oriented" principals, in contrast, are considered to be more efficient. Some doubt exists, however, whether or not neatly categorized, dichotomous leadership styles exist, and if they do, whether or not they relate in a meaningful way to effectiveness. Human personalities are complex, and administrators behave in many different ways to achieve results. There is probably no one dominant leadership style; rather there are many different ways of working that are more or less successful within a given school context. Probably what is more important than a particular leadership style is the "fit" between the principal's behavior and the prevailing school climate, which the principal, in part, conditions. (Good and Brophy, 1986; Corcoran, 1985).

Fostering a climate for learning

There is generally broad agreement among researchers that instructional leadership is one of the more important functions of successful principals. Effective principals foster a climate conducive to learning. They also set standards, monitor the instructional process, participate in evaluating instructional results, implement the improvement process, and promote staff development when needed. In addition, the effective principal fosters good student teacher relationships and recognizes and rewards good teaching (Edmonds, 1979; Brookover, et al., 1979; Brookover and Lazotti, 1979; Leithwood and Montgomery, 1982; Mann and Inman, 1984; Corcoran and Wilson, 1986). Positive involvement by the principal can affect student achievement as well as teacher morale (Anderson, 1982). Younger and less mature faculties may require more direct intervention by the principal while experienced faculties may require altogether different strategies (Dwyer, et al., 1982).

Effective principals believe in the capacity of teachers to affect learning, and they convey to teachers the certainty that they can make a difference in student performance. They also set high standards of achievement and establish ways of achieving these standards. And they press teachers for greater commitment, and hold them accountable for the performance of students, and they communicate high expectations to students and teachers (Rosenholtz, 1985; Sizemore, et al., 1983; Corcoran and Wilson, 1986).

Staff recruitment

Effective principals become directly involved in the recruitment of staff, screening applicants carefully, checking credentials and interviewing. Effective principals attempt to recruit staff who share the goals, standards and values of the school and faculty. "Applying school goals to the selection of teachers serves as an important control mechanism to ensure the school's quality," Rosenholtz (1985, p. 362) observes. Equally important is the need to reduce faculty turnover in order to avoid becoming trapped in a cycle of high turnover and low achievement.

In highly centralized training systems personnel decisions are often made with little or no school-level collaboration. This policy is usually counter-productive. It is difficult to build staff cohesion: allegiance is to the main office, and not the local institution; and personnel changes cannot
be anticipated, leading to instability and inability to make long-term staffing plans.

Managing and instruction

There is a growing opinion among researchers that the principal should guard against concentrating too heavily on management tasks and spending too little time on instructional leadership. The principal can promote effective instruction by establishing the conditions necessary for its occurrence, but first, however, he has to know what is going on in the classroom (Mann and Inman, 1984; Ebmeier and Ziomek, 1983; Cohen, 1983). The relationship the principal develops with teachers should center more on the task of improving the school, rather than on promoting good "human relations" (Leithwood and Montgomery, 1982).

In reality, however, principals may have little time to engage in classroom observation. Most principals complete hundreds of short tasks each day, with frequent interruptions. Their interactions tend to be personal, brief, and problem-solving, and they often have conflicting expectations from staff and students. And in developing countries, some of the management problems are so complex that the principal has little time to concentrate on instructional leadership.

Training institutions tend to be more complicated to manage than academic institutions. This reflects the complexity of the instructional task itself, which fully integrates and coordinates practical work with theoretical work, using different tools, machinery and equipment. All procedures must be overseen by the principal, who is also responsible for maintenance, equipment purchase, and long-term planning. While it is true that the individual instructors have day-to-day laboratory responsibility, the principal is ultimately accountable for the overall operation of the institution. Then again, more so than in academic institutions, the principal of a training institution must establish and maintain positive community relations, particularly with employers, thus assuring a functional link between instruction and work, and opening up potential placement opportunities for students (Corcoran and Wilson, 1986).

Training administrators

One of the better ways to train vocational administrators is to attach aspiring applicants to successful administrators through internships. This is the most cost-effective way to acquire training and valuable experience. Prospective administrators can even alternate through a select number of exemplary institutions, thus gaining broad experience. While such a training system is easy and inexpensive to design, it requires long-term commitment and planning. The greatest barrier may be a personnel policy which does not accommodate training functions.
One of the most direct and cost-effective ways to improve student achievement is to employ higher-ability teachers. Higher-ability teachers simply produce better results. Teacher verbal ability in particular is consistently correlated with student achievement. More experienced teachers also produce better results, with student achievement gains associated with years of teaching (Glassman, 1984).

Quality differences in teachers are crucial. Students of the "best" teacher will gain up to a whole grade level in achievement over students of the "worst" teacher. Superior teaching, moreover, tends to be constant across different school years, indicating that achievement gains are not just the function of a particular class (Hanushek, 1981). Although ability and experience contribute to higher student achievement, there is no good way of telling what portion of student achievement is a result of teacher characteristics and what portion is a product of the particular teaching pattern and strategies employed.

Most often, vocational teachers have very modest and basic levels of education, and little or no professional training and work experience. The preparation of vocational instructors requires both professional and practical work. Teacher training programs can supply professional training, but they cannot really offer sufficient exposure to job skills. Vocational teachers who are a product of teacher training programs seldom have sufficient practical skills. On the other hand, vocational teachers recruited from industry have practical skills but they usually lack basic educational and professional skills. Their practical experience, moreover, may be in a narrowly defined job specialty; in which case they do not have the background to give comprehensive training.

Employer-based programs

Generally, employer-based training programs experience fewer problems in recruiting training staff. They can pay reasonable wages and there is an available manpower pool. The common practice is to select a superior worker and assign him training responsibilities. Unfortunately, instructors recruited from within firms often lack sufficient teaching skills, and individual firms usually do not provide training to instructors. Very large firms, particularly those with links to international associations, or subsidiaries of multinational corporations, are often exceptions. They may have established training departments, and the quality of training is high with a well-trained and experienced staff. The opposite is usually true, however, in the case of small firms. They do not have the resources to establish in-firm training programs and must rely on outside sources for trained workers. Common problems

Competent and effective vocational instructors are certainly available. But in many developing countries there are a number of common problems associated with recruiting and retaining good vocational teachers. In the first place, a "natural" pool of potential teacher training candidates is often unavailable. There is such a sharp distinction between the academic
and the practical that talented youth find themselves isolated from any opportunity to acquire a practical orientation, even if they are inclined to do so. Conversely, there may be little opportunity for the individual with work experience to obtain the additional general education and professional training to become a vocational teacher. There may be no natural feeder system which allows crossing over what may be rather rigidly defined social conventions.

Another problem is that effective certification requirements often do not exist. Teaching is considered a public sector job which may be dispensed to individuals thought worthy because of their political affiliation, friendship, loyalty, ethnic or tribal origin. Little attention is given to prior work experience or professional preparation.

Teachers may have low morale or poor attitudes. Pay is often low, and vocational teachers may be expected to work in conditions which are marginal, with few supplies, little equipment, no instructional materials and crowded classrooms. Because of low pay and unacceptable conditions, some instructors may consider their jobs as a stepping stone to higher-paying positions in private industry. Then again, low paid civil servants may seek supplementary outside work and put forth only minimal effort. On the other hand, political appointees may feel secure in their jobs regardless of their level of performance.

Many institutions follow a policy of using former trainees as instructors. This results in low staff costs because the novice commands a low salary, and within a few years the individual moves to a better paying job to be replaced by yet another low-paid novice. Such inbreeding usually has a detrimental impact on program quality. In addition to preventing the development of a stable staff, there is usually a progressive deterioration in instructional quality because deficiencies in content and practice are compounded and passed on.

Unfortunately, the best vocational teachers are often lost to industry where pay and working conditions are considerably better. It is not uncommon for a competent teacher to double his salary in industry.

The supply of teachers often follows a cycle inversely related to need. With economic expansion there is a drain of teachers and potential teachers into industry, attracted by expanding employment opportunity. Because of the consequent shortage, candidates are hired who would not normally be considered; and they become established in the system, even though their teaching performance may be marginal. In periods of economic retrenchment, there is a relatively large pool of potential candidates, many of them excellent. However, there is less need for their services, so the opportunity to reinvigorate the teaching ranks with high quality teachers becomes decreased.

**Teacher improvement a priority**

The improvement of the quality of vocational teachers should be a policy priority, along with more selective admissions and certification.
There is little doubt that program quality is directly related to teacher quality. Resourceful and competent instructors can often provide good training programs despite shortages of instructional material and limitations of machinery and equipment. But material resources cannot easily compensate for poorly-trained or unmotivated teachers.

Just how teacher training and upgrading should be accomplished is open to question. In general, pre-service professional preparation programs need not be extensive—if key components are included, such as laboratory organization and management practices, instructional methods, student evaluation, and so forth. Short pre-service training, perhaps as little as 10 to 12 weeks, coupled with periodic in-service training and on-site supervision may be a more cost-effective combination than extensive pre-service training. And it may be a better option to select teacher training candidates from those who already have technical skills than to attempt to provide costly and ineffective skill training. For teachers with marginal technical skills, internships, work placement and short formal courses during off times may be a better alternative than extensive residential programs.

**Admission and Placement Policy**

Some kind of student selection is made by all training institutions. The relevancy of the criteria, however, may be highly suspect in many cases (Bray, 1985). Often students are "redirected" into vocational training on the basis of their poor academic progress; the student's aspiration to obtain more education can only be realized through enrollment in a vocational program. In any case, there may be little relationship between the requirements for admission and the capabilities needed to complete a program.

When vocational schools are conceived as institutions for the academically unqualified, the range of training options is seriously restricted to low-level jobs requiring little formal preparation. The school, in effect, becomes little more than a "holding tank," a place where students can wait while they age and eventually find a place in the labor market. Substantial parts of the training can often be taught in a matter of weeks, and in fact may be learned more effectively and informally in the local labor market.

Admission policy, then, largely defines the character of the training institution. Schools which primarily enroll low-ability students are often characterized by poor programs, low-level training, and low student achievement (Bray, 1985). And, in fact, they may not be able to attract students, so facilities remain under-utilized. Schools with a more balanced student population have the opportunity to offer a broader range of programs, can expect more of students, and can probably make a larger contribution to meeting skill demand.

Guidance programs are often advocated as one means of attracting enrollment, facilitating program choice among students, and fostering more positive attitudes toward training and work. Many programs aim at addressing what are considered unrealistic student aspirations. Most guidance programs,
however, fall short of these broader goals, with activities mainly centered on program scheduling. The perception of student, parents and peers about work is a stronger determinant of occupational preference than is school guidance (Chapman and Windham, 1985; Baksh, 1985). Then again, "guidance" may be an alien concept in many countries, with training and occupational choice largely determined by taking advantage of any opportunity which can be seized upon at the time. In many countries, most young people do not have the luxury of making "choices."

Guidance activities, however, can contribute best to efficient program operation when they are conceived of as complementing training by assisting with program planning, identifying students with leaning difficulties, assisting with remediation, and providing placement and follow-up activities. Guidance activities can bridge training and work, and linking employment and school may be one of the most beneficial functions of guidance. It is not surprising that employment placement rates among students are higher in those schools which facilitate contact between staff and employers (Lewis, et al, 1982).

**Summary and Implications**

School practices are yet another level of challenge. A positive learning environment is important, but difficult to achieve. Good leadership is required. Schools need support and autonomy to solve problems, stability and security is essential and it may take years of commitment and dogged determination to effect change. Yet, without a positive learning climate attempts to strengthen teacher and classroom practices will have limited success.

While research has identified variables associated with constructive school-level practices, there is considerably less certainty about how a positive school climate can be developed--given the social, cultural and political complexities of many developing countries. Addressing this problem should be a research priority. There are examples of superior training institutions in developing countries; more needs to be known about what makes them superior.

Strengthening school-level practices is not a matter of providing more material resources. Rather it requires dealing with perceptions about leadership and learning, with attitudes about how schools should be organized and run--in short, human resources. It requires formulating policies and practices which encourage and enable individual schools to pursue a commitment to excellence.

In general, schools need a degree of autonomy to solve their own problems, suggesting that highly centralized administrative systems may be dysfunctional. Similarly, it is important for school principals and staff to play a direct role in the recruitment, training and evaluation of fellow teachers.
There are at least two dimensions to successful school leadership. One is efficient management. As discussed elsewhere, poor management practices are linked to the loss of equipment and tools, deterioration in the physical facilities, wasted time and disorderly institutions. The other dimension—often not fully recognized—is instructional leadership. The school's chief administrator conditions to a considerable extent the climate in which learning—or its lack—occurs. Both are essential to effective leadership.

It is crucial to have good school administrators. Along with the training of teachers, the training of administrators should be a priority in many countries. It cannot be assumed, moreover, that the training for academic school administrators is sufficient for administrators of vocational schools. Vocational schools are by and large considerably more complex institutions.

The use of administrative internships is a policy option which warrants more use. It is a low cost and effective means of training.

Good teachers are essential to any strategy of revitalizing training programs. Teachers are the individuals most directly charged with implementing training, and whether or not the conditions affecting program quality are employed in instructional programs depends upon the training, ability and attitudes of teachers.

There is a combination of factors contributing to poor teacher quality which cannot be accommodated through training—including low wages, marginal working conditions, poor status, the lack of a "natural" pool of candidates, no feeder system and barriers to gaining practical work experience. Teacher training will only be marginally successful unless these factors are also satisfactorily addressed.

Improving the quality of teaching must be based on strategies for upgrading the existing teacher corps, increasing the supply of qualified individuals, and strengthening teacher training programs. In-service training can be effective if it relates directly to the instructional needs of specific institutions and is followed up by the guidance and supervision of administrators. Staff training is most effective if it results from the collaborative planning efforts of local staff. The supply of qualified individuals needs to be increased through incentives, the removal of social and cultural barriers, and the elimination of practices which result in the hiring and retention of unqualified persons. In general, selective admission practices can result in the recruitment of higher ability teacher training candidates, and certification and credential requirements can function as a means of controlling hiring practices, resulting, in the long term, in higher ability and a more qualified teacher supply.

Teacher training programs must give primary attention to those conditions which affect program quality, including the productivity factors discussed in Chapter 2; laboratory organization and management skills; the production and use of simple instructional materials; as well as alternate ways of organizing instruction to achieve greater instructional efficiency.

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more perplexing problem is the acquisition of technical skills. Adequate technical training cannot normally be given in formal training programs; yet admission is generally closed to the ranks of technicians and skilled workers. Internship and work placement arrangements must be explored, and links forged with industry so that technically skilled individuals can be recruited into teacher training programs.

The most cost effective teacher training model is a short pre-service teacher training program coupled with a planned and systematic program of regular in-service training and in-school supervision. Teacher candidates are selected from those who are already technically skilled, or skills are learned through internships and work placement coupled with additional skill upgrading through technical workshops and short-term work placement.

Policies must support staff stability within institutions. The qualitative improvement of instructional staff can occur over a period of time only if a stable school climate is created which supports good teaching and successful learning.

Admission policies directly influence the level, scope and quality of training. Low level and poor quality programs cannot be justified on economic or social grounds. Admission policies should favor attracting students who can benefit from higher level technical training that cannot be obtained readily through other means. Vocational institutions must be conceived as institutions which provide a variety of options for job placement and further education and training.

Although "guidance" activities are generally ineffective in influencing student career choices and changing attitudes, they are helpful when used to bridge training and work, resulting in high student placement rates.
6. **SUMMING UP**

There is considerable potential for improving the quality and efficiency of vocational training in the Third World, but this potential is largely unrealized. Some changes involve preparing better teachers, strengthening school leadership, or altering instructional content; others involve forging closer links with employers or experimenting with more effective training modes. The context, quality, policy and practices of training institutions vary enormously, but there needs to be a common commitment to improvement. Institutions need to define and implement policies which will enable them to address the qualitative improvement of training. The alternative is the acceptance of an eroding training capacity.

Strong centralized leadership is required with a commitment to change and a will to provide constructive leadership. At the same time, a degree of local autonomy is necessary. Many of the changes required have to be worked out within local institutions, for quality is as much a product of interrelated characteristics unique to each institution as it is a result of centralized policies and bureaucratic procedures. In one sense, change cannot be dictated fully from above, but rather has to evolve from the institution itself through local leadership. In another sense, however, centralized leadership establishes the priorities and environment which support local initiatives. This balance is probably very much at the heart of the process of revitalizing training quality.

Training, moreover, must be conceived as part of a system comprising a number of integrated components. This is true whether speaking of in-firm training, apprenticeship programs, or formal institutions, although the most complicated systems are probably those embedded within public bureaucracies. But all too often it is the system itself that does not adequately function. This may be because essential components are missing or malfunction, or because the components themselves are not functionally integrated. Failure to address training revitalization within the context of the total system usually means that change will not be effective. It does little good to invest in new facilities and equipment, for example, if teachers are not trained in how to manage and maintain the new investment To introduce expensive educational hardware into a system that cannot afford investing in simple print material is dysfunctional, since it consumes large amounts of scarce resources. And to train teachers but not administrators only creates a weak link. It is the need to address all of the interrelated complexities of a training system that makes revitalization so difficult.

Then again, change must be viewed in the long-term, with considerable experimentation and maturation required for an effective training system to evolve (Dougherty, 1988). There needs to be relatively small investments, with the training system incrementally expanded as the capacity to plan, implement and manage the system is developed (Middleton and Demsky, 1988).
Finally, a program designed for one country training context can seldom be successfully and fully duplicated in another. A number of productivity factors and operating conditions which impact on training quality and efficiency have been identified in this paper. But the extent to which they can be effective in revitalizing training quality depends upon the training context in which they are implemented. Change is conditional; there is no general set of answers that is universally applicable. There are ways, nevertheless—tentative as they may be—of thinking about training improvement, of seeking solutions and of addressing problems. Major points are the following:

**What We Know About Training Quality**

Instructional quality can be substantially improved in schools by making better use of the productivity factors which are associated with high student achievement. Of these factors, reinforcement has the single most powerful effect on learning. Active teaching; the use of feedback, cues and advanced organizers; appropriate pacing; clear instruction; and adaptive instruction also have considerable effect. "Good" teachers know how to combine these factors to reduce learning time and improve achievement. Productivity factors are more important than the particular teaching pattern or style used. In fact, it may initially be more constructive to maximize the use of the productivity factors than attempt to change the teaching pattern.

Better use of instructional time is crucial. The actual amount of time students spend in learning may be very low. Considerable loss of instructional time is encountered in schools and classrooms which are not well managed. When essential resources are lacking students spend less time engaged in learning, and poor teaching requires more instructional time. Substantial gains in student achievement can be realized with no additional cost simply through a better use of instructional time.

Instruction must also be organized in order to accommodate individual differences. The student's academic background and ability level are among the factors influencing the amount of learning time needed. Failure to accommodate individual differences results in instructional inefficiency, with too much instructional time allotted for some students and not enough for others.

Teachers tend to use a restricted instructional repertoire. This repertoire needs to be broadened. There are a number of ways to organize learning, such as the use of modules and learning centers, which make better use of resources, save cost and realize more effective teaching. Good use is made of productivity factors, instructional time is efficiently used, and individual differences are accommodated. These alternate ways to deliver instruction should be tried simply because of the potential to substantially improve instruction while at the same time containing cost.
Learning is enhanced through a positive school climate. This requires good school leadership, a commitment to change, local autonomy and staff stability. A positive school climate often takes years to develop, but without it lasting change in instructional quality will be difficult to effect.

A minimal level of resources is needed, below which instructional effectiveness tends to be reduced. This includes tools, machinery and equipment as well as instructional materials. In too many countries the level of material support is below the threshold required for program operation; consequently, little meaningful learning takes place.

Instructional quality is directly related to good management. Poor management is accompanied by a poor use of instructional time, the inefficient use and loss of resources, and a deterioration in instructional quality. The improvement of instructional quality through better management can be substantial.

Most developing countries have yet to successfully address instructional materials production. Cost, the need for highly qualified production staff, the specialized character of technical material--these and other factors have tended to inhibit materials development. Yet it will be difficult in many cases to achieve a qualitative improvement in vocational instruction without a source of inexpensive instructional material.

Print material in all forms is the most cost-effective instructional material. Print material can compensate for lower levels of teacher preparation and contribute to student achievement. The use of charts, diagrams, transparencies and other simple materials can contribute substantially to instructional quality at relatively little additional cost. The use of educational technology provides no learning or cost advantage. Students can learn equally well from all forms of instruction, including teacher-directed. However, in some cases the quality of instruction provided, as well as the standardization and portability achieved, may partly offset the high cost of educational technology.

In public programs, admission policies often result in the selection of low ability students. When admission is limited to low ability students, the scope and quality of instruction is itself often limited. Instructional quality is linked with student ability and attitude.

For many students, the provision of remedial training, particularly in reading skills, is mandatory for improved achievement in vocational instruction.

The lack of qualified teachers is a persistent barrier to the qualitative improvement of instruction. One of the most cost-effective ways to improve the quality of learning is to employ higher-ability teachers. Students learn more from a better teacher. A rigorous teacher selection process, coupled with certification standards, can result in better instruction. Policies must also support staff training within institutions and staff stability. Staff development occurs over a period of time.
Good administrators are a key to program quality. The school administrator establishes and maintains the conditions necessary for improvement. It is unlikely that substantial change can occur without at least the support, if not the active participation, of the institution's head administrator.

Uniform certification systems can contribute to reducing uncertainty about training quality and lead to long-term instructional improvement.

The selection of instructional content is directly related to program quality. Content selection should be based on a rigorous analysis of job requirements in order to realize content validity and effective instruction. Instruction should be limited in scope and characterized by high priority tasks and minimum competency levels. The "skill mix" of instruction, moreover, should be broadly conceived.

**What We Know About Containing Cost**

One obvious way to contain cost is simply to not provide resources, and this is precisely what is being done in all too many cases. Instructional materials, maintenance, upkeep and repairs are not provided. Little is invested in staff development. Such policies promote waste, since the instructional benefits accruing from the initial training investment are few, even if the investment is modest. A minimal amount of learning takes place, and, in addition, a cycle of deterioration sets in: insufficient upkeep and maintenance and decreasing amounts of operable equipment means less training, a situation that continues because of the inability to make repairs or provide adequate maintenance. The original investment yields little in return.

Underfunded programs tend to yield low instructional returns on investment. There must be sufficient annual recurrent expenditures over the long-term to insure a reasonable return. In other words, high levels of instruction and use of machinery and equipment over a sufficient period of time are needed to amortize costs.

A prudent policy would be to avoid the establishment of training programs unless there is a sufficient level of recurrent support over the long-term. The challenge faced by program planners, then, is to contain cost while at the same time providing adequate levels of program support. This challenge can be faced by improving instructional management, making better use of instructional time and facilities, limiting content, and using less costly instructional alternatives.

One of the most direct and immediate ways of realizing cost savings is to improve the laboratory management capability of the staff. The capital investment in instructional laboratories is relatively large, and the same is true of repair and replacement costs. Considerable loss occurs through breakage, wear, waste and theft, which in turn are the result of inappropriate management procedures, neglect, and lack of management knowledge.
While the instructor is immediately responsible for laboratory management, all administrative levels are involved in the development and maintenance of a management system. Short-term training in laboratory management is probably sufficient for instructors if accompanied by supervision. But training must also be given to department heads and principals who will share the responsibility for planning and supervising activities. Failure at any one level diminishes management effectiveness at the other levels. In any case, the strengthening of management capability is a priority requiring a combination of policies to develop effective classroom and institutional management practices.

In many cases, instructional facilities are underused. Low quality programs tend to be underenrolled, resulting in high unit cost per trainee. Greater emphasis clearly needs to be placed on improving program quality and formulating policies which attract more students. It may be necessary to close out underenrolled programs, change the status of institutions, and remove perceived barriers to enrollment. Training expansion should be deferred until existing capacity is fully used.

By moving away from scheduled, set time blocks greater efficiency in the use of allocated time can be realized. Open entry/open exit programs have the potential for using instructional time better. More students can complete an instructional cycle in less time, thus expanding use levels and reducing overall training time and cost. Fewer physical resources are needed for increased training output. Increases in training efficiency can be translated into productivity gains.

It is possible to increase class sizes moderately without any appreciable effect on student achievement, if the increase is accompanied with training in instructional and management techniques. Instructional effectiveness depends as much on effective instructional and classroom management as it does on class size.

More intensive use of the physical facility has potential for containing cost. Training activities can be scheduled more efficiently, making fuller use of instructional laboratories and classrooms. The use of double shifts and staggered classes along with sharing arrangements with industry capitalizes on low marginal cost.

There is considerable potential for reducing the scope and hence the cost of instruction in formal programs. Contrary to popular belief, training programs do not have to provide comprehensive content coverage, with students mastering all job to high levels of proficiency. Some content has low priority, and should little instructional emphasis. Some content can be learned sufficiently on the job and does not have to be covered in formal instruction: it is not needed at the time of job entry, it is infrequently used, and it is not critical to job performance. In general, manipulative skills can be better mastered on the job. Students may spend too much time learning unimportant content, and too little time learning what may be essential. The judicious selection of instructional content can not only reduce cost, but also can result in better instruction.
The potential cost savings of different instructional alternatives needs to be explored. There are ways of organizing instruction which require less instructional resources than "conventional" instruction, and which accommodate larger numbers of students or require less instructional time. Cost savings, however, must be weighed against the cost of staff training and system development. These alternatives usually require staff capability to design and develop supporting instructional materials and the establishment of an efficient instructional management system. The wide use of standardized materials over different programs may offset the relatively high development costs. Moreover, program maintenance costs are lower than initial development costs.

Direct instruction coupled with the use of learning stations for laboratory work is the least costly and probably the most effective way to organize learning.

Other alternatives include combinations of school and industrial-based training programs (such as accelerated training) and cost-sharing arrangements. The equipment of industry is used, instructors exchanged, or facilities shared. Less investment is required by both parties. The school-based component often focuses on clusters of generic skills, with specific skill training acquired through cooperative training on the job. Such cooperative arrangements make good sense costwise: training time can be reduced and less equipment and machinery are required. The problem of training obsolescence is partly overcome, and the trainee has considerable job flexibility. The potential for exploring this alternative, however, is limited in many locations because there are not sufficient numbers of local firms with quality placements.

Two Scenarios

Many countries now face eroding program quality and limited financial resources. Whether or not training quality can be restored and enhanced depends in part on events external to training, such as economic growth. It also depends upon the ability of decision-makers to formulate appropriate policy and to implement change. One can formulate a conservative scenario for training revitalization based on the premise that external events are not going to appreciably improve, and that, in fact, financial resources may become more restricted. Or one can assume a more optimistic scenario. It is useful to examine possible policy directions with reference to these two scenarios.

The conservative scenario

There are three institutional capabilities that need to be provided for regardless of other components of the training system. First, staff needs to be trained. The tendency has often been to direct investments into buildings and equipment: these investments are highly visible, relatively easy to manage, and involve large aggregates of funds. Investments, however, need to be shifted to developing human resources. People make the system work; therefore, they should become an immediate investment priority. Change cannot
be implemented without addressing the qualitative aspects of instruction and management.

**Developing staff**

Staff development policy must embrace three elements: a) selection, b) training, and c) supervision and monitoring. Without all three of these elements, staff development efforts will not be highly successful.

Selection is needed to insure that the most qualified individuals undergo training. It is poor investment policy to train individuals who will be only marginally successful. For a variety of reasons, selection often is not carried out. The predictable consequence is uneven staff quality. In any case, selection must be viewed as an integral first step of any staff training program.

In general, preservice training does not have to be extensive if complemented with periodic in-service training and school-level supervision. Periodic upgrading through in-service training is not common in developing countries, but it is a relatively inexpensive alternative that should be used more extensively, given high staff turnover and the lack of qualified teachers.

It is essential that teacher training include at least four components: a) Emphasis in particular should be placed on strengthening the management capability of institutions. Good management is so closely intertwined with effective teaching and cost containment that its importance cannot be overstressed. b) Teachers should be trained in the use of the productivity factors associated with higher student achievement. The use of these factors in the classroom is relatively "cost free" and constitutes one of the most effective ways of improving instructional quality. The use of instructional time should be especially stressed. c) Teachers need the opportunity to become familiar with the different modes of organizing instruction, to test their use, and to become aware of the relative tradeoffs in terms of preparation, time and cost. d) Teachers need to know how to produce and use simple, low cost instructional materials, including modularized instruction.

In general, teacher training programs have not solved the problem of providing sufficient technical skill development. It is less costly to recruit teacher candidates with an industrial background and train them in instructional skills than to impart technical skills to individuals undergoing teacher training. Failing this, the next best option is to couple short preservice technical courses with internships and work placement. Periodic inservice workshops for technical upgrading would also be given. The least desirable option is to attempt to provide comprehensive skill training. This should be avoided since a satisfactory program would simply be too costly.

Vocational administrators often come from the ranks of academic administrators or work their way up through the ranks in a training institution. They already have experience. One low cost, but nevertheless effective way to prepare administrators is to make greater use of internships.
This needs to be coupled with a selection process which favors individuals with a strong commitment to vocational training and qualifications which suggest that they will be successful. Those selected can be attached to exemplary training institutions following a short preservice course.

Certification programs for administrators and teachers ensure standardization and a minimum level of professional competency. It is necessary to ensure that objective standards are established and the program is equitably administered.

More successful schools are characterized by supervision and monitoring. A third element, staff training, occurs in individual schools. Staff development must be conceived as a long-term effort, with the major part of the training occurring within the school after the new teacher is employed. This requires a stable staff, capable administrators, and a commitment to qualitative improvement. Moreover, it involves modest resources on a long-term basis. The training itself must focus on problems which are identified in the course of monitoring instruction.

The staff training unit, whatever form it takes, is charged with the responsibility for inservice training within individual schools. Linking preservice and inservice preparation is not common practice, but it is probably an essential combination under conditions of restricted resources. If the staff training unit is not able to directly serve individual schools on a continuing basis, it would work with a cadre of local teachers responsible for the long-term planning and conduct of staff development.

Investments in human resource development are not highly visible; results are long-term and less obvious; they are difficult to manage, and relatively small aggregates of funds are involved. Yet priorities must be reordered in order to concentrate on building the human capabilities essential to implementing quality training programs. Anything less probably means that constructive change will not occur. More capable training and administrative staff will improve the quality of training even if only modest supporting resources are available.

**Making instructional materials available**

Under conditions of scarce resources, a second priority is to increase the availability of training materials. The use of simple instructional materials has a considerable impact on achievement. In the case of technical instruction, technological obsolescence can also be countered. Investment should be made in an instructional materials development unit, the purpose being to locate, develop, and adapt training material for use by public and private training programs. The emphasis would be on low-cost instructional materials made available to all users. The unit would also be charged with making available information on new technological developments, as well as identifying critical training areas. The unit may or may not be linked to the staff training unit, its size and organizing structure being dependent upon the number of institutions and establishments served. Again, financial requirements must be moderate, with stable long-term development.
Most developing countries have not successfully addressed the challenge of creating widely available instructional materials; yet it will be difficult to achieve improvement in instructional quality without such resources.

Two related problems must be addressed in a successful instructional materials strategy: cost containment and development capability. Economies of scale are difficult to realize and development costs are high. The use of simple print materials is a less costly option than more sophisticated educational technology. Adapting materials is less expensive than developing new materials, and locally produced materials are generally less costly than instructional materials from abroad. If the use of instructional materials can be extended to include formal and nonformal education, the market size can be increased. In the long-term, the best answer may lie with the development of materials on a regional basis, particularly in the case of small countries.

Greater attention must also be given to developing the capacity of local schools to produce instructional materials. In most cases, the development of instructional materials has not been given the systematic attention which it warrants. It is a capability that teachers must master at the local level in order to contain cost and improve quality. In addition, the use of the different instructional delivery modes, such as mastery teaching, learning stations and competency-based instruction, requires the capability to produce simple instructional materials. Without materials the opportunity to use these modes is limited.

Finding out what works

A third priority is to develop an exemplary training institution. In many developing countries, training resources are spread too thinly. Consequently, many institutions are underfunded, and do not work well. There is a crucial need for an example of a cost-effective institution which delivers quality training services. Such an institution, though modest in size, would provide flexible training services; considerable experimentation would take place. There is a pressing need to find out what works within a particular country context.

This institution would address both public and private sector training, with considerable emphasis on experimenting with school/employer-based combinations, including short-term training. Training to address the needs of small and medium size employers would be emphasized, in addition to training problems surrounding the assimilation of technological developments. Different instructional delivery modes would be experimented with, including modularized instruction, cooperative team learning, direct instruction and learning stations; the use of key productivity factors would be stressed; and emphasis would be placed on efficient instructional and institutional management. A major objective would be to develop an integrated and effective learning system which can be replicated. The institution would exchange staff with other public and private institutions, and serve as a placement site for training teachers and administrators.
Given resource constraints, it will probably be necessary to consolidate existing training institutions and to phase out programs yielding marginal benefits. "Savings" will have to be generated to fund improvement.

The level of investment for all three of these policy priorities should be modest because it is essential to have long-term stability, thus ensuring the development of an institutional basis for teacher training and instructional improvement. Initial, high-level investments which cannot be sustained are probably a mistake because they distort the institution, resulting in disruptive contractions later on.

The optimistic scenario

If there is the potential for more resources, an opportunity is presented to broadly address training revitalization. The above three policy directions are applicable and constitute the essential elements of any basic strategy to restore training quality. In addition, training quality must be improved at the individual institution level, strengthening a diversified training capacity.

It is imperative that emphasis shift from program expansion to improvement. In most developing countries the training system is overextended given the level of financial support available. There are immense social and political pressures for expanding training opportunity, yet underfunded programs are a poor educational investment. The training is often so poor that the output does not justify the investment, even at modest levels, draining away resources which can be better used elsewhere. Policymakers have to face the hard decision of reordering priorities to focus on program quality rather than expansion. Change, in essence, is a process of reallocating critical resources. Improvement in the quality of instruction will require the reordering of priorities in order to give change the best chance of occurring. This means shifting resources to those areas which will have the greatest impact on improving the quality of training and containing cost.

Expanding operational support

There is a general need to expand operational support, including equipment and facility maintenance, and instructional resources. As previously argued, institutions need at least a threshold level of support in order to return reasonable educational benefits. The cycle of deterioration evident in some countries needs to be reversed.

A modest level of support for instructional resources will help to maximize the results achieved through the use of productivity factors and better ways of organizing instruction. And teachers with improved instructional management skills can make full use of better maintained equipment and facilities.

With a modest increase in resources the possibility is presented to develop alternatives to teacher-directed instruction which can result in higher quality instruction in the long-term. Competency-based instruction, for example, is one of the most effective delivery modes, but its
implementation requires considerable development support, and while mastery learning is effective in accommodating variation in student learning rates, large amounts of instructional and test material are required. A modest increased in resources provides the opportunity to invest in the development of these instructional alternatives.

**Strengthening the institution**

The in-service capability of institutions needs to be strengthened so that they can implement policies which foster improvement. As emphasized earlier, in-service training must be conceived as an ongoing, regular operational feature of all training institutions.

Placement services are needed to bridge the gap between school and work. These services are rarely provided but yet they are a way to interface with employment, reducing the often self-imposed isolation of many training institutions.

The management capability of local institutions needs to be systematically strengthened. This requires addressing organizational and structural variables within schools. But is also requires the formulation of policies which promote local development.

Individual training institutions need a degree of autonomy to solve their own problems. This is essential for the development of a positive school climate—a perception of shared purpose, collaborative relationships and a commitment to quality. To the extent that resources and political constraints permit, administrative responsibility needs to be decentralized. Local school principles need the authority to make school policy, effect organizational change, select staff and implement development programs.

To restore quality to some institutions will require building a new image. Training institutions need to be considered on par with other public schools and conceived of as providing an avenue for opportunity. An appropriate student selection policy must be established, and the training level and quality must he high. There also must be positive support from higher administrative levels, and training itself must provide placement opportunity and the chance for individuals to pursue goals to the extent of their ability. These are obviously long term goals which involve changing social perception; nevertheless they must be addressed through policy decisions. The "climate" of an institution conditions in large part the quality of instruction and the extent to which high standards can be established and maintained.

Administrators and teachers need incentives. In some cases there are simply not the personal or group incentives to expect that change can be successfully implemented. More institutional autonomy may be sufficient, but in most cases more pay and better working conditions are also essential. Unless the conditions fostering incentives are addressed, it is unrealistic to expect that substantial improvement can be realized in the long-term. This is a concern that again requires positive policy decisions.
The usefulness of certification

Certification is yet another area in which investment can be directed. Two levels are involved: teacher certification and training certification. Both improve training in the long-term, one by ensuring the progressive development of a competent staff, and the other by establishing base-line standards to work towards. Training certification has a direct influence on the instructional content of individual institutions. Instruction is aligned to correspond to certification requirements. When certification tests are based on a systematic process of task analysis: content validity and instructional effectiveness are also translated into local instructional programs.

Certification tests, however, must reflect the training needs of local employers. This implies that there must be local input and control associated with the design, development and implementation of the certification system. Better flows of information from local employers result in better instruction insofar as training relates directly to work requirements.

Strengthening related institutional support

One barrier to the improvement of training is the lack of related institutional support, especially support from private organizations. There are a number of possible reasons for this situation. Organizations may be disaffected with government or they may not have been effectively drawn into the training network. Or there may simply be a lack of organizations. The training challenge is simply too extensive and complex to be "solved" without the support of nongovernmental organizations.

For example, there is often a lack of an institutionalized knowledge-base regarding teaching effectiveness, one that is available to practitioners in the field. While there are knowledgeable individuals, they generally do not have the opportunity to work through available institutional outlets, nor is their knowledge embedded in any institutional form which insures its spread, application, and further refinement. The journals, professional associations, and informal communication networks necessary to professional development are largely lacking, and this may place an unrealistic burden on government bureaucracies. Similarly, a long-term investment in the private capacity to produce instructional resources may yield results considerably beyond what can be expected from investment in government agencies. Private initiative may be characterized by more incentives, flexibility and innovation.

In the long term, investments must be made in strengthening institutional forms. These include trade groups, trade associations and commercial firms; these parallel the training system and are essential to the formation of a profession. These groups tend to be ignored by government and donors, but their existence can aid considerably in developing a viable training presence. Without them, it will be difficult to sustain development efforts in the long-term.
Broadening training options

The training system must be conceived as including a combination of in-school and enterprise-based training, with close coordination between the two. Each offers capabilities not fully realized by the other. Training quality can be substantially improved and cost reduced through the elimination of duplicated effort and building on the strengths of both sectors. This implies an administrative structure responsive to both sectors, coordinated and integrated curriculum development, joint materials production and an articulated certification system. In the optimistic scenario, investments would be used to develop a mixed training capability, including public and private centers, short-term programs, and various industrial training schemes. No one institutional configuration is sufficient to address the varying and diverse skill requirements within economies. While it is true that some training forms are more expensive that others, it is also true that some forms are more responsive to particular skill needs within a given context. It is useful, then, to think of institutional layers, each varying somewhat in form, complexity, quality and kind of training.

Large public-supported training schools have probably been over-emphasized. They are attractive, despite all of the difficulties encountered: resources can be centralized, training is contained, they can be managed after a fashion: economies of scale can be realized, and they have physical presence. But training itself is much too complicated an enterprise to be addressed through any one of a number of institutional forms. Developing countries face the challenge of restoring and enhancing training quality within the context of limited financial resources. But they also face the challenge of evolving better institutional forms, and this, in fact, may be the greatest challenge.
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