

AN ANALYSIS OF FRONT-END ANALYSIS – 1973

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The goals and procedures of "Front-end Analysis" are described. A number of examples are cited; This example is typical: "A proposed \$150,000 safety training program was cancelled when it was shown that the lack of skills and knowledge was not the most likely cause of the accidents. Instead, a much smaller amount was spent teaching supervisors to recognize error signals that could lead to accidents."

Buzz words like "reinforce," "behavioral analysis," and "feed- hack" have passed into our professional parlance without any commonality concerning what they mean. The phrase "Front-end analysis" is beginning to be uttered more and more frequently at NSPI Conventions and other places where jargon is an indicator of being with it. This paper is intended to show what the author intended by the term.²

GOALS, MISTAKES AND RESULTS

Front-end Analysis is about money, first and foremost. It's about how to spend money in ways that will be most beneficial to the organization and the performers in that organization. It is also about avoiding spending money on silly things like instruction when there is no instructional problem; or training everybody in everything when you can get by with training fewer people in a few things; or flying lots of trainees in for a course when a send-out checklist would do.

There is really nothing essentially new about F-E-A as there really isn't anything new about programmed instruction, contingency 'management, and behavior modification. Like these procedures, the thing that is new about F-E-A is that we are beginning to do it, consistently, systematically, and increasing the probability that works better than chance.

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² To our knowledge, the term was first used in the book, *An Ounce of Analysis (Is Worth A Pound of Objective)*, by the author of this paper; however, many of the procedures in that document were welded into a system whose parts have been around forever. Some of the conceptual framework was derived in association with such luminaries as Gilbert, Rummier, Horabin, Bullock, and the author's grandfather. The reader will note that there is no trademark, no copyright, or the like on the name. It, like the principles, is free to use and make money on – like a lot of people are beginning to do.

When a process we've dubbed Front-end Analysis is NOT done, things like this happen too many times:

- A government agency spent much money developing a training program that achieved 90/90 on a posttest-but the pretest scores showed 90% of the performers could perform 90% of the behaviors to criterion.
- A major industrial organization spent a lot of effort and money teaching its salesmen to spout the features and benefits of a new product, but few sales occurred. The commissions, it was later recognized, were attached to another product.
- An in-house training group, with a very big budget, spent \$200,000 for a diabolically clever simulation device-to teach the operation of a \$20,000 piece of equipment. (And apparent over-riding variables were present.)

When a process we've come to call Front-end IS done, these kinds of things have happened:

- A three-week centralized course, handling 200 students annually, was replaced by a two-hour slide-tape-workbook program and a few pages of checklists. The effectiveness of the send-out package was equal to the residential course at a fraction of the cost. (Students were being "taught" scores of irrelevant items.)
- A proposed \$150,000 safety training program was celled when it was shown that the lack of skills and knowledge was not the most likely cause of the accidents. Instead, a much smaller amount was spent teaching supervisors to recognize error signals that could lead to accidents.
- Instead of teaching field salesmen the traditional features and benefits of the product they were selling, analysis showed that a re-engineering of their territories would solve the low sales problem.
- Data from a multimillion-dollar fire information system accumulated in vast unused stacks until analysis revealed that the reason fire department managers didn't respond to it was because large amounts of the data were irrelevant, and they couldn't interpret the computer printouts. Instead of political pressure and other "motivational" schemes originally planned, a simple programmed text was prepared and the relevant data were channelled to the appropriate group in the department.

DEFINING F-E-A

All the above cases are about money because that is the way score is kept in our society. But the above are also about the achievement of human potential. Front-end Analysis is about both these things.

When pushed for a single concept definition of Front-end Analysis, we've replied variously ...

- "F-E-A is problem solving applied to human performance."
- "A series of analytical and decision-making steps that lead to plans for overcoming deficiencies in human performance."

- "It is all the smart questions that a manager, educator, trainer, and consultant should ask before deciding what specific solution to develop for a performance problem."

All of the definitions are correct, but none communicates the rationale or indicates the procedures. F-E-A is problem solving. It does involve decision making. It can be expressed in terms of a series of questions.

The major "smart questions" are:

1. Do we have a problem?
2. Do we have a performance problem?
3. How will we know when the problem is solved?
4. What is the performance problem?
5. Should we allocate resources to solve it?
6. What are the possible causes of the problem?
7. What evidence bears on each possibility?
8. What is the probable cause?
9. What general solution type is indicated?
10. What are the alternate subclasses of solution?
11. What are the costs, effects, and development times of each solution?
12. What are the constraints?
13. What are the overall goals?

INSTRUCT, MOTIVATE, CHANGE

Implied in these questions is the assumption that one human can intervene in the performance of another in one or some combination of three ways: (1) by giving instruction on how and when to make responses (especially when), (2) by offering incentives or favorable consequences for desired responses on the appropriate occasions and/or (3) by changing the environment in which the responses occur. Determining which one or which combination of the interventions is required is one of the major purposes of Front-end Analysis.

By "specific solution," we mean a course of instruction (or any piece thereof), work simplification, informational feedback, "motivational" feedback, job aids, short-interval scheduling, contingency management, change of assignments, and so forth. (We exclude only those subsystems that employ surgical, pharmacological, or psychiatric treatment. But the dividing line is dimming, especially with the latter.)

By "performance problem," we mean how some real-world performance situation deviates from a model situation. This means that in order to engage in Front-end Analysis, we must generate in order to engage in Front-end Analysis, we must generate specification of problem-free behavior and collect data concerning behavior is occurring before treatment. The procedures implied these definitions occur several times in the F-E-A process at levels of specificity.

The goals of F-E-A are to:

1. Isolate performance problems that have potentially high "worth."
2. Isolate the precise performance deficiencies within the problem area that account for the greatest loss.
3. Increase the probability that the solution to a given problem is effective by matching the cause of the problem to the appropriate type of remedy. (That is, that training solutions are matched with the lack of skills and knowledges; that "motivational" remedies are paired with "won't do" causes, and so forth.)
4. Increase the probability that the subclass of solution selected is the most cost effective. (For example, a job aid in lieu of a training course; or inexpensive simulation rather than a close approximation of the real world; or a self-instructional, send-out package versus a massed, centralized course.)
5. Isolate the root cause of the performance symptoms or effects of the problem.
6. Increase the probability that there is a match between the precise performance deficiency and the individuals who have the deficiency.

The interim outputs of F-E-A are represented by the 13 previous questions. The tasks, steps, and subquestions under each are growing in number and specificity as we apply the procedure to real-world situations.

F-E-A has also caused us to look at some of the well-known steps of the validated instructional development process in a different way. For example, we find that Task Analysis is not a process that occurs at a single point in the instructional development sequence, but begins in a broad approximation with the very first question: "Do we have a problem?" similarly, we have found that there is no single time that we "write" behavioral objectives, but that they are evolved in successive approximations during and after the F-E-A process. For example, to answer the question, "Do we have a problem?," there must be some model situation existent, and there must exist behaviors that deviate from that mastery. Too, to answer the question "What is the performance problem?," a set of tasks of some job function must be described in enough detail that the precise deficiencies are specified.

This can be seen by the following simplified chart of part of the F-E-A process:

KEY QUESTIONS	RELEVANT ANALYSES
"Do we have a problem?"	- Monitor performance data baseline. - List of indicators, symptoms of problems. - Describe performance tasks that may be deficient.

KEY QUESTIONS	RELEVANT ANALYSES
"Is it a performance problem?"	- Hypothesis of nonperformance cause of the problem. - Test of hypothesis. - Observation of mastery performance.
"How will we know when problem is solved?"	- Description of mastery performance to task level of specificity. - Description of problem-level goals.
"What is the performance problem?"	- More detailed description of mastery performance. - More detailed description of actual performance. - Comparison of mastery to actual.

Given a precise problem statement (as output of the first four F-E-A questions), given that the performance problem has a potential high worth for solving (output of question #5: Should. we allocate resources to solve it?), F-E-A next addresses the question of what kind of intervention is warranted. That is, is it a problem that indicates instruction, feedback, job re-engineering, or some project to initiate and/or maintain motivation?

It is at this point that we've found F-E-A most difficult to carry out in the real world. In order to answer the key question, "What is the probable cause of the problem?," the manager, trainer, educator, or consultant must address the question, "What are the possible causes of the problem?" In other words, a trainer, who has been hired to develop and deliver training, must admit to the possibility that his/her services may not be needed. Too, by the time projects get to the training department, for example, the assumption usually been made that some sort of instruction is necessary. (We have found that an alarming number of times this is an assumption.) Thus, the trainer may be in the untenable position having to go to his/her client (in-house or not) with news that the client doesn't want to hear.

ALTERNATE PROCESSES

As outside consultants, we are in a somewhat similar position as in-house personnel. By the time we are called in, many assumptions and precluding decisions have been made. This has led us to painfully examine our own philosophical and ethical position. We have promised to the extent that we've developed the stance that isn't A Front-end Analysis, but alternate processes that use the previous 13 questions (and scores of subquestions) as a model.

These alternate processes are:

1. NEEDS ASSESSMENT

This alternate form of full-blown F-E-A entails using the process to determine what instruction or guidance³ problems exist in the organization--including specification of what "other" kinds of problems exist, but without recommendation concerning what-to-do-about-them. As a rule, the same 13 questions output from the analysis, but the emphasis is on looking for lack of skill/knowledge problems. Thus question #6, "What are the possible causes of the problem?," becomes "Is it a problem that requires instruction?" Seemingly this is a small difference, but the former question has considerable organizational and political implications.

2. DECISION TESTING

A compromise to the full-blown F-E-A model that is applied when the organization comes to us with: "We think this problem can be solved by a training course, but we want to make sure before we allocate further development budget for it." This is not to be confused with: "We know we have a problem that can be solved by training, but we want you to prove we are right."

3. ALTERNATIVE SELECTION

Over the last few years, influenced by consultants such as Gilbert, Rummier, Mager, Bullock, Horabin, Shoemaker, Harless et al, managers and trainers have begun to address some of the questions represented by F-E-A.⁴ (Although the concept and procedures are in a definite minority of the industrial-government community as a whole.) Having done some approximation of F-E-A in-house, we are often asked to begin with question #10: "What are the alternative subclasses within the solution type?" and "What are the probable costs and effects of each?" In training-type solutions, this often takes the form of deciding centralized vs decentralized course; deciding emphasis of skill and knowledge deficiencies vs correcting motivational deficiencies, and so forth.

4. CREATION OF MASTERY

We've defined a problem as the difference between model and actual performance. A considerable number of times, model performance (or model performers) do not exist. That is, the performance problem is one that is likely to occur in the future because of new policy, new tasks, new equipment, and the like. In such situations, classic F-E-A is not possible except in the sense that problems must be anticipated by first describing

³ 3 We use the term "guidance" to be roughly equivalent to "job aids."

⁴ It is encouraging to note that a handful of professionals, like Fred Wells of AT&T, inside industrial organizations have begun to bring about considerable changes using Front-end Analysis-like processes.

what the mastery behavior will be and predicting what skills and knowledges the performers will bring to the performance situation. 'The basic questions are still applied, but much more emphasis goes toward task analysis-like work. And, the "data" on problems must be speculative.

EXAMPLE OF FULL BLOWN FRONT END ANALYSIS

1. Do we have a problem? (That is, what are the indicators and symptoms?)
 - Fire departments do not encounter city management and planners with budget requests and plans backed by hard data.
 - Printouts from a fire information reporting system used once a year for writing annual report.
 - Requests for additional data during the year nonexistent.
 - Evaluation of decisions made shows available data not considered.

Final outcome: Yes.

2. Do we have a performance problem? (Do the indicators above show that human performance or nonperformance is at least involved in some manner?)
 - Checks show that data arrive at the department on time, are complete and accurate.
 - Although some problems getting computer time, not a significant factor overall.
 - A few problems with the computer programs, but not enough to explain the indicators.

Final outcome: Apparently.

3. How will we know when the problem is solved? (What is mastery performance?)
 - Each role in the department responds differentially to the computer printouts applicable to his division.
 - Decisions such as equipment allocation, manpower allocation, maintenance scheduling, fire house location, etc. are made based on data accumulated and analyzed.
 - Division heads routinely review data.
 - Interim requests for special data are made.Etc.

4. What is the performance problem?

General Statement: Fire data reporting system not meeting intended goals.

Root Problem: Roles in the fire department are not using data to make decisions and plans.

5. Should we allocate resources to solve the problem? (What is the value or priority of solving this problem versus some other?)
 - Approximately one million dollars spent to date in development and pilot testing.
 - Potential loss in efficiency, unnecessary equipment purchases, poorly used manpower, and so forth, is many millions nationwide.
 - Pending federal legislation could make such a program mandatory.

Final outcome: Solution to problem very high priority and potentially worth millions in cost savings. Increase in potential fire protection capability difficult to calculate. (Life and property loss.)

6. What are the possible causes of the problem?

- Printouts not in a form that can be interpreted.
- Data arrives too late for decisions and plans.
- Data is not differentially reported to the appropriate role.
- Roles in the department do not perceive a need for the data.
- There is no need for the data.
- Roles are being reinforced for behavior incompatible behavior.
- Roles are being punished for desired behavior.
- Roles cannot interpret the data.

And many more.

7. What evidence bears on each hypothesis?

- In test situation, trained fire department managers can and do use data to great advantage.
- Estimates are that it would take up to full time for one person to respond to all the data.
- Review of date of receipt of printouts shows that it is short enough intervals.
- Data is reported in format unfamiliar to manager.
- Untrained managers in test situation cannot respond to data that is appropriate for their role.
- Survey shows that many managers feel that data is good only for writing yearly reports.

Etc.

8. What is the probable cause?

Outcome:

1. Motivation for use of data has not been initiated.
2. Environmental factors, such as all the data going to each role, make use difficult if not impossible.
3. Most managers don't know how to use data in solving their problems, making decisions, and in planning.

9. What general solution type is indicated?

- Initiation of motivation and behavior maintenance schemes for A.
- Task re-engineering for B.
- Some sort of instruction or guidance for C.

10. What are the alternate subclasses of solution?

For example, for C: Training...

1. Train in-house trainer to train roles in management by data.
2. Develop and conducted a series of workshops for fire department managers for each fire department.
3. Develop a massive handbook for interpreting and using data.
4. Establish a centralized workshop for training fire department roles.
5. Develop a completely self-instructional package along with job aids.

11. What are the cost/effects/development time of each?

Outcome: Number (2) above as a vehicle for later development of (5) and maintained by (1).

12. What are the constraints?

- Department managers do not at present have "motivation to encounter," any instruction. Must be initiated.
- Funds available at present to do only first step.
- Some resistance on part of developers of data reporting system to comply with results of analysis.
- Entire fire data reporting project may become nationwide before steps above can be implemented.

Etc.

13. What are the goals of the project?

Outcome:

- A. Solve the reengineering problem first. (Recasting of way data are reported and distributed.)
- B. Describe mastery performance of managing by data.
- C. Develop instructional objectives.
- D. Analyze learning problems involved in the objectives.
- E. Develop parallel scheme for initiating and maintaining motivation.
- F. Validate first approximation workshop.
- G. Seek funds for further development and implementation based on outcomes for this project.

SOME GENERALIZATIONS ABOUT F-E-A

1. 1. For F-E-A to be most successful, everyone in the organization should be cognizant of at least the fundamentals of the process – especially at the decision-making level.
2. It is helpful if there exists in the organization a system for measuring and monitoring performance on an ongoing basis. That is, if there is a baseline of data, problem indicators become more apparent.
3. Problems that have the greatest potential payoff for solution should be sought after.
4. There appears to be more payoff in looking for ways to avoid instruction rather than looking for training opportunities.

5. F-E-A seeks to avoid instruction whenever possible. Instruction can be avoided if:
 - a. There is no performance the problem in the first place.
 - b. The problem is of low potential value to be solved.
 - c. The cause of the problem is other than the lack of skills and knowledge.
 - d. Personnel who are deficient can be reassigned to tasks in which they have competence.
 - e. the job or deficient task can be simplified or otherwise reengineered.
 - f. Existing instruction can be used.
 - g. Job aids can be developed.
6. There appears to be more payoff in spending time describing master performance than in “writing objectives.”
7. The more precisely the deficiencies can be defined, the better. (Why instruct the entire set of tasks when only one task is faulty?)
8. if instruction is the indicated solution, instruct the fewest number of performers with the greatest deficiencies.

AN ANALYSIS OF F-E-A BY ITS OWN TECHNIQUES

One of the basic rules of F-E-A is that solutions to problems should match the cause of the problem, and that the cause of the problem should stem out of a study of the problem situation itself. The front-end analysis, itself, is a solution to a problem. Are we, then, violating our own principles? Perhaps so, but the process, itself, appears to be a useful model for a need many people have recognized. If so, then it appears useful to use the process to examine itself. And that is what follows...

Do We Have a Problem?

- Lack of significant difference between pre- and posttests.
- trainees complain of irrelevant instruction.
- evaluation studies show misdiagnosis of causes of performance problems.
- Studies show rising training budgets do not necessarily result in an increase in effectiveness.

The above are generalized examples of what we call “problem indicators.” When a significant number of these occur and they are of sufficient importance, we can answer the question. In our experience, the above – as well as war stories presented earlier in this paper – are sufficient to answer the question “yes.”

Is it a Performance Problem?

We define a performance problem in one of three ways:

1. someone is not doing something he or she is expected to do.
2. Someone is doing something he or she should not be doing.
3. A prediction of should or should not in the future.

Technological inadequacy, limited state-of-the-art, poor general economic conditions, acts of God, etcetera are examples of non-performance problems. Most problems, however, involve people and their performance (or lack of it). We believe the indicators under the first question and our experience in applying countermeasures indicate a people problem.

How Will We Know When The Problem Is Solved?

When:

1. Trainers, educators, managers, and consultants stop prescribing instruction for non-instructional problems.
2. Problems are selected for treatment on the basis of high worth rather than on the basis of non-critical attributes.
3. Objectives for instructional programs are based on critical skills and knowledges, rather than on a "Body of Knowledge."
4. Objectives for instruction show evidence that they have been generated out of a study of performance and show that performance is the ultimate goal rather than learning.
5. Root causes of performance problems are isolated and treated rather than the effects and symptoms of problems.
6. Instructional developers began to prescribe more job aids and less instruction.
7. Instructional developers begin concentrating on analysis of performance and learning problems rather than on the characteristics of media.
8. Budgets and development schedules reflect the belief that a larger proportion of the effort should go for analysis rather than the development.
9. Indicators like the ones under the first question become the exception.

What Is The Performance Problem?

We believe the performance problem to be: Managers, Trainers, Educators, and Consultants are Not Engaging in Front-End Analysis.

Should We Allocate Resources To Solve The Problem?

This is another way of asking: What is the value or priority of solving the problem? In order to answer this very complex question, we need to calculate a dollar amount of how much is spent on:

1. Developing instruction for non-instructional problems.
2. Irrelevant instruction.
3. Unnecessary instructional methods and media.
4. Teaching skills and knowledge that will be forgotten before they are needed.
5. Teaching people who need "motivating"; "motivating" people who need instructing; and doing either when re-engineering of the performance environment is required.

We have no hard data on the matter, but the considerable number of cases we've been involved in lead us to believe that the cost of not doing a Front-end Analysis is staggering. (Perhaps in the billions each year.)

What Are The Possible Causes Of The Problem?

As with any performance problem, we must admit to ourselves that one or some combination of three general classes of causes are at the base of the problem: (1) People lack the skills and knowledge to engage in F-E-A; or (2) their performance environment prevents or hampers engaging in the process, or (3) the effort is not worth the rewards (or some similar motivational-incentive-attitude type of cause).

Thus, the following are some of the possible causes why Front-end Analysis is not being used to a significant degree.

1. Lack of Skill/Knowledge Hypothesis:
 - Managers, trainers, educators, and consultants do not have sufficient skill and knowledge concerning Front-end Analysis.
 - The leading advocates of front-end analysis-like processes lack skill and knowledge in communicating the concepts.
 - Personnel lack feedback on results or lack of results of training.
2. Poor Environment Hypothesis:
 - Personnel responsible for instructional development are not allowed access to data required for F-E-A.
 - Organizational structure prevents in-house personnel from engaging in F-E-A.
 - Solutions to problems are given to the in-house personnel by management without detailed analysis.
 - Instructional and management personnel lack the time and/or resources to perform F-E-A.
 - And many others.
3. Improper Motivation-Incentive-"Attitude" Hypotheses:
 - Management does not inspect for or reinforce F-E-A.
 - In-house personnel have been punished for F-E-A.
 - In-house personnel are reinforced for behaviors incompatible with F-E-A behaviors. And many others.

What Evidence Bears On Each Hypothesis?

The scientific method demands that hypotheses be tested; however, the real world seldom allows the full-scale, controlled experimentation to satisfy experimental design requirements. We do have much evidence from our experience promoting and training personnel in F-E-A the last five years. For example, we routinely ask training organizations we begin to deal with what behaviors they would engage in if no constraints were present. Rarely do these responses contain tasks similar to F-E-A. Too, we have amassed hundreds of responses, questions, and

objections in our consulting and formal workshops. These data bear on the cause of the problem.

What Is The Probable Cause?

We find evidence to support contributing causes in all three major categories. We believe that managers, trainers, educators, and consultants do not engage in Front-end Analysis because of a combination of:

1. They don't know how.
2. They are prevented and/or hampered.
3. They aren't reinforced for it.

What General Solution Type Is Indicated?

If we assume that a major rule of F-E-A is "the solution type must match the cause," then three types of solutions are indicated:

1. Training, information and feedback.
2. Re-engineering of the performance environment.
3. A motivation-initiating subsystem and a behavior maintenance subsystem.

What Are The Alternate Solution Subclasses?

Some of the ones we thought of are:

- A. Training Alternatives:
 - Courses in F-E-A as part of graduate curriculum in educational technology programs.
 - Off-the-shelf learning systems in F-E-A.
 - In-house workshops and consultation in F-E-A.
 - Unvalidated publications such as papers, texts, etc.
- B. Environmental Re-engineering Alternatives:
 - Upper levels of management in organizations "legislate" in-house capabilities for F-E-A.
 - All F-E-A contracted to outside consultants.
- C. "Motivational"-Incentive Alternatives:
 - Papers and articles about F-E-A success stories.
 - Tougher evaluation requirements in-house.

What Are The Costs And Effects Of Each?

The calculation of the costs and probabilities of effectiveness of each and combinations of the above is obviously an enormous undertaking-certainly exceeding the scope of this introductory paper. However, it has been our experience that these actions should be taken in the government and industrial setting:

1. Top management be briefed on F-E-A.
2. A system for in-house F-E-A capability be planned for the unique features and needs of the organizations.
3. A detailed series of training experiences be provided for each decision-making and development role.
4. Demonstration projects by outside consultants are helpful for long-term commitment to the process.
5. Management should demand the kind of evaluation that shows whether F-E-A has been done properly.

What are the Constraints?

- Most managers, given superficial explanation of F-E-A, express the belief: "We are doing that already."
- There is a prevalent belief that analysis is a luxury, not a necessity.
- The introduction of F-E-A concepts and procedures in existing organizations has vast reorganization implications.
- F-E-A is a way of thinking and behaving that is difficult to embrace without a critical incident to precipitate wholesale management acceptance.
- In order to engage in F-E-A, "front-end funds" must be allocated without a product, in the usual definition of a product.
- The whole structure of how trainers, for example, are reinforced is working against F-E-A. (For example, trainers are paid to train, not avoid training.)

What are the Goals?

The goals we've adopted are:

1. Build in a F-E-A phase in each proposal we write, whether requested to or not.
2. Build in instruction and discussion in every management training course we conduct.
3. Raise the possibility of in-house F-E-A capability development with every consultation we become involved in.
4. Discuss the F-E-A that was done for every developmental project reported in journals and magazines.
And, write articles like this one.

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