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1. INTRODUCTION

The ACM curriculum recommendations on Information System Analysis and Design (1,2) have been used as a curriculum model in over 100 universities in the seven years since their publication. The curriculum is being revised; the updating is expected to be completed before 1981.

The technical content is not the only target of the curriculum revision. Certainly, that portion of the curriculum requires updating. It is the behavioral content, however, which is being subjected to major overhaul.

The need for such change was substantiated by the national studies of motivation of computer personnel, by my colleague Robert Zawacki and myself (3,4,5). The studies revealed that the need for social interaction was much lower for computer personnel than for other professions. On the other hand, interaction (both with users and with peers) is a necessity for success in system design.

This paper examines the causes for low need for social interaction, its impact on system success and approaches to improving the curriculum to counteract the problem.

2. RESEARCH REVEALING LOW SOCIAL NEED

During the period of 1977-1980, three national surveys were conducted by Robert Zawacki and myself, on key factors for motivating computer personnel. All jobs in data processing were included: analysts, programmers, computer operators, data entry and data control personnel. Also included was management at three levels: first line, middle and executive.

The principal instrument for the survey was the Job Diagnostic Survey for Data Processing (JDS/DP). In order to compare perceptions of computer personnel to those in other professions, we utilized the JDS developed by Richard Hackman (Yale University) and Greg Oldham (University of Illinois). They have developed a database on more than 500 jobs, containing information on over 6,000 subjects. The reliability and validity of their instrument were carefully substantiated (6).

To preserve the integrity of the JDS, we made few changes in the basic instrument. It contains universal questions, independent of specific professions. To obtain additional information, we added questions peculiar to the computer field. Our goal was to establish national norms on motivation for the computer field. Only two aspects of the national norms will be discussed in this paper -- those relating to the characteristics of computer personnel for social interaction.[1]

2.1 LOW SOCIAL NEED STRENGTH (SNS)

Our national surveys produced a database on more than 3,000 persons in the computer field. One characteristic identified for analysts and programmers is their low social need strength (SNS). Survey questions related to this variable determine an individual's need to interact with others. SNS for analysts and programmers is lower than that of any of the other 500 jobs in the Hackman/Oldham database. On a scale of 7 it is only 4.19, compared to 5.48 for other professionals. While some professions attract people who have a high propensity for, and reinforcement from, interaction with others -- our profession does not exhibit this characteristic.

Contrary to our expectation, SNS was equally low for analysts and programmers. However, this result should not have been surprising. The normal promotion path in our field is from programming to systems analysis.

The difference in SNS between DP managers and their peers is also significant. The mean rating is 4.47, two-thirds that of other (non-MIS) managers. In this characteristic, DP managers are more like their subordinates than their peers.[2]

Since supervisors are promoted from the programmer and analyst ranks, continuance of low SNS should not be surprising.

Surprising or not, the results have important implications -- in two areas: 1) the effectiveness of communication with users and 2) the effectiveness of communication within the computer department. Those implications will be analyzed next.

2.2 IMPACT OF LOW SNS

There should be little argument on the importance of effective communication for success in system analysis and design. Unlike laboratory scientists, we do not design systems in a vacuum. Intensive and repetitive interaction is required to minutely and comprehensively identify user requirements.

Concomitantly, frequent interaction is necessary within the project team. For the long duration, complicated projects characteristic of our field, effective interaction is essential. Schedule and budget compliance cannot be assured otherwise.

Persons whose need for interaction is low may not be devoting sufficient attention to those important interfaces in system development.

Also, since they have had less practice at interaction due to their low SNS they may not be effective at communication. Communication skills appear to evolve more naturally for persons with high SNS. People in our field may need more formal education and training in the behavioral and communication area.

In presentations to computer professionals, it is not unusual for someone to question the statistics on low SNS. Comments are similar to the following: "But our people do socialize -- they play bridge and chess at lunch. They go bicycling and hiking together. They aren't antisocial."

Such an observation is quite valid. Persons with low SNS are not antisocial. They interact. They just do not need to interact as frequently as others. Their interaction is low relative to that of other professions.

But -- is low SNS inherent? Do we attract to our field persons with low SNS or do they acquire it due to the nature of the work? Our survey instrument does not identify causes. It diagnoses an organization and identifies effects. Nevertheless, we have some empirically derived hypotheses on the reason for low SNS in our field. Persons with whom these hypotheses have been shared tend to concur. These observations are discussed next.

2.3 REASON FOR LOW SOCIAL NEED STRENGTH

Why is the DP professional's SNS so low? We believe we have identified the principal contributor. We will begin the discussion by an analysis of students who enter our degree program in Information System Analysis and Design. Few students decide to enter that program prior to taking the introductory data processing course. All students in the College of Business are required to take this course in their sophomore year. The course is almost equally divided into three subjects: 1) computing concepts, 2) computer programming, and 3) introduction to system analysis and design. The course is taught in that same sequence so students will have most of the semester to write and debug their programs.

Of the three subjects , one provides unusually good feedback on performance -- computer programming. Students do not have to be told by their instructor how well they are performing this task. The task itself provides excellent feedback because of the compiler diagnostics.

About 10 percent of the students are exceptionally good programmers and the system enables them to recognize this fact -- long before they have taken the midsemester exam. These students also find that they do not need assistance of others to develop their programs. Although we encourage students to work in teams, some prefer to work alone without the "hindrance" of the slower-learning team members. Not all of the better students work alone, but many do. They are bright, logical people who work well independently.

The system analysis and design portion of the course is more conceptual. Students must depend more on the final examination to provide feedback on how well they performed in this portion of the course. The best students in the course typically choose to major in Information System Analysis and Design. However, it was the programming aspect of the course which gave them the best feedback on the suitability to this career field. Their first course in the major is a COBOL course. It reinforces their decision on their career choice. Not until their senior year do they begin the system courses. Many are not nearly as comfortable in these courses as they were in the programming portions of the curriculum. Few change their major, however.

Company training programs are similar in structure. Those companies who train their staff from scratch begin with programming courses. Trainees who are successful in programming are permitted to remain in the program. They can be successful in both their training course and their first job without a great deal of interaction with others. Compared to

personnel in other parts of the company (for example, the sales department), programmers need far fewer skills in verbal communication. Nor is understanding of behavioral patterns a prerequisite to success in programming.

3. HIGH GROWTH NEED STRENGTH (GNS)

Another characteristic revealed by the JDS/DP as quite different for analysts and programmers is growth need strength. GNS is the need for personal accomplishment -- for learning and developing beyond where you are now, for being stimulated and challenged.

GNS for analysts and programmers is higher than that of any of the 500 jobs in the Hackman/Oldham database. System personnel perceive their need to grow at six on a scale of seven. Nor is the difference between analysts and programmers statistically significant.

GNS for DP managers is even higher -- significantly higher than the GNS of their peers in other parts of the company.

Although GNS may appear to be unrelated to SNS, there is an important interaction. People with high GNS need to be constantly involved in activities that show concrete results. Preparing system specifications, designing files and writing programs are activities where output is tangible and voluminous. Comparatively, meetings and discussions produce a minimal level of output. Computer personnel frequently complain about the amount of time spent in meetings. Now we know why.

Compared to individual activities like design and coding, the quantity of output per hour of effort is extremely low for the activities that involve meetings and discussions. For this reason, persons with high GNS have a low tolerance level for meetings and discussion. They frequently consider that these activities hinder rather than enhance performance.

Nor is this problem confined to group meetings. The same problem occurs in one-on-one sessions, with users and with project team members.

Since the requirements definition process is imperfect, it usually necessitates iterative sessions. Because users are rarely proficient in computing technology, they usually do not fully understand what it is we need to know to design their system. Requirements delineation typically necessitates informal discussions as well as formal documents. People who have little need for interaction may not spend as much time as is necessary in informal discussions.

Moreover, because of their low SNS, our people have less practice in communication. Therefore, meetings are less productive for them. Their growth need is not being met. They prefer to get out of the meeting and back to the activities that they perceive to meet their growth need.

So, these two characteristics of low SNS and high GNS can be counterproductive. Computer professionals have low need for meetings; also, they have not been effective in producing output from meetings, relative to their output from other activities. Therefore, high GNS personnel tend to place more importance on activities that produce overt results -- output that is concrete. Quantity and quality tend to be equated by such persons.

Of course, this perception is wrong. Effective interaction with users produces valid and complete requirements. Although viewed as necessary evils, meetings and discussions are necessary. And -- properly perceived, effective interaction complements rather than detracts from GNS. Performance is enhanced through effective communication. If we can provide persons in our profession with these skills, their perceptions about meeting will change.

Compounding the problem is the high SNS of users. Attending meetings is a good way to fill their social need. A prolonged meeting does not bother them. Also, they would be less frustrated by the insertions of topics unrelated to the purpose of the meeting. Some examples are helpful in understanding the interrelationship of SNS and GNS.

3.1 REACTION OF DP PROFESSIONALS DUE TO SNS/GNS CHARACTERISTICS

Illustration 1:

Along with materials for the meeting, one analyst takes his technical journal. "When users began to talk about last Sunday's football game, I just open my technical journal and catch-up on some important reading. I don't tell them they are wasting my time when they don't stick to the meeting topic -- but, until I began bringing my journal to read at these times I was really upset by these parts of the meeting that were so unproductive."

Illustration 2:

A director of DP takes his in-box along to the weekly staff meeting of the

executive vice-president. "Some of the subjects of that meeting don't relate to my department. At those times, I keep one ear open while I go through my in-box. If I didn't do this I would never meet my own management schedule."

These are just two of dozens of examples of ways DP professionals keep from "wasting their time" in the meetings common to any company or governmental agency.

The need to "keep busy" and to maintain progress toward personal objectives is a symptom of high GNS. What our people frequently overlook is the importance of meetings in accomplishing system objectives. Without the rapport established with users or peers, ideas are more difficult to sell. Better to "waste a few minutes" listening to a football story if it helps in improving a relationship. Users enjoy meetings for "meeting-sake" -- to meet their need for social interaction. We don't. Nevertheless, our project objectives may be met more quickly if we participated completely at meetings -- paving the way to acceptance of our ideas.

A frequently discussed subject at national conferences of DP managers is "Why aren't we being promoted to executive level positions." DP managers are often viewed as technicians -- interested more in technical than general management. In the second illustration above, the DP director conveyed that feeling when he "fully participated" only in discussion relating to his department.

The cause of some of these behaviors is the unique combination of high GNS and low SNS of DP personnel. Another cause is the feeling that meetings are not an effective approach to getting the job done.

Educators need to re-evaluate both curriculum contents and pedagogy to counteract this behavior.

4. REMEDIES: CURRICULUM AND PEDAGOGY

The problems resulting from the disparity between GNS and SNS can be remedied. However, both curriculum and teaching methods must be restructured to correct the problem.

4.1 REMEDY 1: CURRICULUM REVISION

The ACM curriculum did not ignore the behavioral subjects. A course in psychology was established as a prerequisite. The discription called for "elementary psychology, including fundamentals of personality formation, attitudes and motivation."

Also, a full course on human and organization behavior was included in the curriculum. The contents of that course, illustrated below, are just as appropriate today:

Title: Human and Organizational Behavior

Prerequisite: elementary psychology.

Approach: This course examines the principles of human behavior in individuals, groups, and organizations in the contexts relevant to information systems.

Behaviorally-oriented reference material relating specifically to information systems is sparse, and particularly so for the final section on implementation. The cited references frequently have a management or engineering orientation, leaving the behavioral implications to be supplied by the instructor or by the class.

An appropriate computer game or interactive laboratory experiment could be used as an effective tool to demonstrate aspects of individual, interpersonal, and group behavior, with the student population itself as subject.

Content:

1. Individual behavior (20%)

   Human sensing and processing functions. Visual, auditory, motor, and linguistic mechanisms. Perception, cognition, and learning. Human factors engineering in information systems.

2. Interpersonal and group behavior (20%)

   Personality and role. Motivation, participation, and communication. Influence and effectiveness. Authority and leadership. Mechanism or group action. The impact of information systems on interpersonal and group behavior.

3. Organizational structure and behavior (25%)

   Organization theory. Impact of information systems on organizational structures and behavior. Implications for management.

4. The process of organizational change (25%)

   Resistance to and acceptance of change.

The management of change. Problems of adjustment to the information systems environment.

5. The implementation and introduction of information systems (10%)

Interaction between information analysis and system design groups and the remainder of the organization. Information system project teams and their management. Preparation for installation and operation.

This course was a prerequisite to the system courses, as it should be. Our mistake was in the assumption that these topics would be given proper emphasis in the systems course. That was a faulty assumption.

We left it up to the instructor to determine how the behavioral topics related to the system development topics and how they should be integrated. That was poor curriculum building. We should have explicitly stated where these topics belong. That omission has been corrected in the revised curriculum.

The following section has been added to the system courses:

Individual behavior and group dynamics in the development process. Review of principles of individual behavior, interpersonal and group behavior. Application of these principles to the development process. External interactions: interviews with users, negotiating final specifications, design reviews and walkthroughs, implementation. Internal interactions: selecting and organizing the development team; interfacing with data entry, data control, computer operations personnel; reporting progress to d.p. management.

Suggested deliverables by students. Project interaction plan for each of the activities identified above.

4.2 OUTPUT CHARACTERISTICS OF GRADUATES

The original curriculum guidelines also identified output characteristics of graduates -- the knowledge and abilities necessary to work effectively in the field. The list included these behavioral objectives for graduates:

- Knowledge of typical roles and role behavior in each functional area;

- Knowledge of techniques for gathering information;

- Ability to gather information systematically within an organization, given specified information needs and/or specified information flows;

- Ability to develop positive and negative impacts of a specified information system on specified parts of an organization.

Two additional output characteristics have been added in the curriculum revision:

- Understanding of behavior and needs of individuals, including computer department personnel as well as users;

- Ability to present in writing and orally a summary of a project for management action (suitable to serve as a basis for decision).

4.3 REMEDY 2: PEDAGOGY

As indicated earlier, persons with low social need probably do not communicate as naturally as those with high SNS. They require practice to become proficient in their essential skill area. Our courses should provide opportunity for practice. Ironically, the system courses are ideally suited for such practice. Why we have neglected it is enigmatic.

The principal teaching method for the system courses is the system life cycle approach. Students learn system analysis and design techniques in the sequence of the system life cycle. In the revised ACM curricula, we identify student "deliverables" at each step in the system life cycle. Practice reinforces theory.

Because of the requirement for deliverables for the behavior activities, students cannot ignore this important area of the system development process.

However, what are the best approaches for teaching this material? Two approaches have proven successful for the University of Colorado at Colorado Springs.

Pedagogical Approach #1: Integrating Courses

In this approach, we invite graduate students majoring in human and organizational behavior to use the system course as their laboratory for the course Org. Mgt. 632 - Behavior of Task Groups. The course description is as follows: a study of interpersonal competence in organization; group formation and development, leadership, power conflict, conformity, cohesiveness and task effectiveness.

One third of the way into the system analysis course, we organize students into project teams. They are to produce team deliverables as they go through system life cycle activities for a real or real-like project.

One OB graduate student is assigned to each team to observe how the team is formed. OB students write a report to their instructor and to me, then give an oral presentation to the team. The report identifies good use of behavioral concepts as well as those that could have been improved. Requiring the written report permits the two instructors to insure consistency among all OB observers and to make sure the criticisms are reported in a positive manner.

The OB student observes two subsequent team meetings, one near the start of the project and another at the end. They report to the instructors and teams, as before. In these two sessions, they are concentrating on team communication skills and effectiveness.

This approach worked well for both OB and systems classes, and has been used twice, with different OB instructors

Pedagogical Approach #2: Using the OB Laboratory

We implemented an OB Lab in the School of Business over 10 years ago. It is used by all departments. It is a classroom bordered by small group rooms. An observation corridor permits the instructor to observe and to videotape team meetings through two-way glass.

After instruction on applying good behavioral principles in the project assignment, teams organize and produce the deliverables described previously, I provide feedback both to individual teams and to the entire class. I use the videotapes to illustrate key points on behavioral and communication skill application. Students are encouraged to check out the videotapes for individual improvement.

5. SUMMARY

A recent article in the Wall Street Journal quoted a manager who opposed office automation because its principle objective was to reduce the need for meetings. Electronic mail can pass along documents and ideas instantly and a lot more cheaply, according to the system designer. "But I like meetings," the executive responded. Undoubtedly, this executive has high SNS, as do most managers.

Computer personnel have low need for meetings. Yet, meetings are necessary -- both in requirements determination and system implementation. Our curriculum and pedagogy should help persons with low proclivity for interaction: 1) to recognize the importance of meetings and discussions, and 2) to understand the behavioral implications in interaction with others and to be able to communicate effectively. More effective communication will improve the productivity from meetings and facilitate computer personnel to realize their need for achievement.

FOOTNOTES

1. The complete statistics on the survey are reported in Management and Motivation of Computer Personnel, J. Daniel Couger and R. A. Zawacki, John Wiley and Sons, Inc., 1981.

2. Throughout this paper differences are significant at the $p < .01$ level.

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