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ABSTRACT

This study provides information on science teachers' perception of themselves and their working conditions. A stratified random sample of junior and senior high school science teachers from three regions (12 states) of the United States was selected to respond to a questionnaire and an attitude measure. The questionnaire contained 20 items dealing with teacher satisfaction on teaching skills and 25 items dealing with teacher satisfaction on school conditions. Results showed that both junior and senior high school teachers rated their knowledge and abilities as satisfactory to good on all the 20 ability items. However, five of these items showed a significant difference between the ratings of the junior and senior high school teachers. Results showed also that the junior high teachers rated their school conditions as significantly poorer than did the senior high school teachers on eight of the 25 items. It was concluded that these science teachers are generally satisfied with their own abilities, but believe their school conditions need improvement. (HM)

RESEARCH PAPER #5

Science Teachers' Perceptions of Their Teaching Skills and Their School Conditions

Frances Lawrenz

Science Teachers' Perceptions of Their Teaching Skills and Their School Conditions*

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Problem

Knowledge of teachers' opinions of their own skills is important for the development of teacher education programs. It is necessary to know where teachers feel a need to improve themselves and where they believe they have expertise. Teacher participation in training programs is likely to occur if the program satisfies their perceived needs. Also, undergraduate teacher education programs need to know what areas their graduates believe were covered well and in which areas their program was weak.

In order to provide information to aid in the development of teacher education programs, this study sought to contrast the areas of teaching skills in which science teachers felt a need for improvement with those areas in which they were confident of their teaching skills. What type of learning situation science teachers preferred was also investigated.

Knowledge of teachers' opinions of their school working conditions is also important. Administrators must know what school facilities are considered inadequate by the faculty before they can consider implementing the desired improvements. The faculty should be allowed to develop their own opinions independently and then present their recommendations to the

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administration. Therefore to aid administrators, this study investigated science teachers' perceptions of various school conditions.

In summary this study provides information on science teachers' perceptions of themselves and their working conditions.

Procedure

The data for this study were collected as part of a National Science Foundation (NSF) evaluation project (Welch and Gullickson, 1973). A stratified random sample of junior and senior high school science teachers from three regions (12 states) of the United States was selected to respond to a questionnaire and an attitude measure. The regions included the states of Mississippi, Alabama, South Dakota, North Dakota, Nebraska, Minnesota, Iowa, Wyoming, Colorado, Utah, Idaho and Montana. The principals of the selected schools were contacted and asked to select randomly a science teacher to complete the instruments. (See Gullickson and Welch, 1973, for a description of the sampling concerns).

Part of the questionnaire contained items relating to demographic data on the teachers, to school situations, and to NSF institute participation. The sample descriptors which follow were obtained from these items and from the attitude measure. Of the 344 teachers who completed the instruments, 108 (31.4 percent) taught junior high school science and 236 (68.6 percent) taught senior high. There were three types of senior high school science teachers included: (1) biology teachers (35.6 percent), (2) chemistry teachers (47.3 percent), and (3) physics teachers (17.1 percent). A majority (81 percent) of the teachers were male and 62 percent of the junior high teachers and 79 percent of the senior high teachers held bachelor degrees in a science field. Biology was the most common field. Thirty-eight percent

responding teachers held master's degrees. All of the teachers' [illegible] on the attitude measure indicated positive attitudes towards science, and 92 percent chose to be identified with science. Both junior and senior high teachers spent an average of five hours per day teaching usually in a self-contained classroom situation. Most of the instructors (88 percent) had at least three years of teaching experience and 37 percent of the junior high teachers and 35 percent of the senior high teachers had over 11 years of experience. Sixty-six percent of the junior high teachers and 70 percent of the senior high teachers had attended some type of National Science Foundation Institute with the unitary summer institute being the most popular (39 percent).

The remainder of the questionnaire dealt with the teacher's opinion of his own skills and of his school's working conditions. The questionnaire items relating to teaching skills could be grouped into four general areas: (1) effectiveness in using a variety of classroom presentation techniques, (2) knowledge and ability in subject area, (3) ability to organize and change curriculum, and (4) effectiveness in evaluation tasks. The science teachers rated themselves on the items of each cluster as: 5=excellent, 4=good, 3=satisfactory, 2=some improvement needed, 1=much improvement needed.

The same five-point scale was used to respond to clusters of questionnaire items pertaining to existing school conditions: (1) course constraints, i.e., equipment, facilities, and quality and quantity of materials used for student learning in the classroom, (2) time constraints, (3) space constraints, and (4) personnel constraints, i.e., availability of consultants, secretaries, and assistants.

Mean ratings and standard deviations were obtained for all of the teacher opinion items and reported for junior and senior high school teachers.

Results

As shown by the ranked items in Table 1 junior high teachers reported their knowledge and abilities as satisfactory to good on all items. The lowest mean rating (3.1) was received by the "Knowledge of Curricular Techniques" item followed by "Knowledge of Career Opportunities (3.2)," "Effectiveness in Evaluating Difficulties (3.2)," and "Effectiveness in Evaluating Teaching Effectiveness (3.2)." The highest mean ratings were received by "Knowledge of Subject Matter (4.0)" and "Effectiveness in Evaluation of Students (3.8)."

Insert Table 1 about here

The senior high teachers also rated their knowledge and abilities as satisfactory to good, and as shown by Table 2, they also rated the "Knowledge of Curricular Techniques (3.1)" item lowest. Next lowest were "Effectiveness in Individualized Instruction (3.2)" and "Effectiveness in Evaluating Difficulties (3.3)." Similar to the junior high teachers, the senior high teachers rated "Knowledge of Subject Matter (4.1)" and "Effectiveness in Evaluation of Students (3.8)" highest. The "Effectiveness of Curriculum Evaluation" item also received a rating of 3.8.

Insert Table 2 about here

Five of the 20 ability items showed a significant difference between the ratings of the junior and senior high school teachers. The junior high school teachers rated themselves significantly higher than the senior high school teachers on "Effectiveness in Audio-Visual Presentation," while the senior high school teachers rated themselves higher than the junior high school teachers on the other four items: (1) "Effectivenss in Lecture,"

TABLE 1

Junior High Teacher Satisfaction on Teaching Variables

Questionnaire Items	N=108 $\bar{X}$	s_x
Knowledge of Curricular Techniques	3.1	1.0
*Knowledge of Career Opportunities	3.2	.9
Effectiveness in Evaluating Difficulties	3.2	.9
*Effectiveness in Evaluating Teaching Effectiveness	3.2	.8
**Effectiveness in Lecture	3.3	1.0
*Knowledge of Allied Subjects	3.3	.9
Effectiveness in Individualized Instruction	3.4	1.2
Knowledge of Current Curricular Matter	3.4	.9
Knowledge of Test Construction	3.4	.8
Ability to Adapt Curriculum to Student	3.4	.8
Effectiveness in Group Discussion	3.5	1.0
Effectiveness in Evaluating Superior Student	3.5	1.0
Effectiveness in Laboratory Demonstration	3.6	1.0
Ability to Organize Laboratory Investigation	3.6	1.0
*Effectiveness in Audio-Visual Presentation	3.6	.9
Knowledge of Teaching Technique	3.7	.8
Ability to Organize Subject Content	3.7	.8
Effectiveness in Curriculum Evaluation	3.7	.8
Effectiveness in Evaluation of Students	3.8	.7
Knowledge of Subject Matter	4.0	.8

*Differences between junior and senior high school-teacher ratings significant at .05.

**Differences between junior and senior high school teacher ratings significant at .01.

TABLE 2

Senior High Teacher Satisfaction on Teaching Variables

Questionnaire Items	N=236 $\bar{X}$	$s_{\bar{X}}$
Knowledge of Curricular Techniques	3.1	1.0
Effectiveness in Individualized Instruction	3.2	1.2
Effectiveness in Evaluating Difficulties	3.3	.7
*Effectiveness in Audio-Visual Presentation	3.4	.9
*Knowledge of Career Opportunities	3.4	.9
Ability to Adapt Curriculum to Student	3.4	.8
*Effectiveness in Evaluating Teaching Effectiveness	3.4	.8
Effectiveness in Group Discussion	3.5	.9
Knowledge of Current Curricular Matter	3.5	.9
*Knowledge of Allied Subjects	3.5	.9
Effectiveness in Evaluating Superior Student	3.5	.9
Knowledge of Test Construction	3.5	.8
Ability to Organize Laboratory Investigation	3.6	.9
Effectiveness in Laboratory Demonstration	3.7	.9
**Effectiveness in Lecture	3.7	.8
Ability to Organize Subject Content	3.7	.8
Knowledge of Teaching Technique	3.7	.7
Effectiveness in Curriculum Evaluation	3.8	.7
Effectiveness in Evaluation of Students	3.8	.7
Knowledge of Subject Matter	4.1	.8

*Differences between junior and senior high school teacher ratings significant at .05.

**Differences between junior and senior high school teacher ratings significant at .01.

(2) "Knowledge of Allied Subjects," (3) "Knowledge of Career Opportunities," and (4) "Effectiveness in Evaluating Teaching Effectiveness."

The junior and senior high science teachers' ratings of the school condition items shown in Tables 3 and 4 were, on the whole, lower than their ratings of the ability items with an average rating of 2.7 for school condition items compared to an average rating of 3.5 for ability items. Both the junior and senior high school teachers rated the "Availability of Paraprofessional Help" item lowest and rated the "Student Classroom Behavior" item highest. The junior high teachers also felt dissatisfied with the lack of secretaries and laboratory assistants while the senior high teachers wanted more consultants and laboratory assistants. Both felt that the space provided for offices and student conferences was inadequate. The junior high teachers rated their school conditions as significantly poorer than the senior high school teachers on eight of the 25 items.

Insert Tables 3 and 4 about here

Discussion

It is difficult for anyone to rate himself critically and accurately. A study by Guiler (1970) suggested that teachers may report a higher perception of their ability than they actually possess. Therefore, in examining the results this bias must be considered. The ratings of the individual items had fairly high standard deviations which indicated differing self-opinions. Because of this variability and the possibility of bias, the reader is cautioned against overinterpretation of the mean scores.

There are at least three possible causes for the generally high ratings on all of the teaching ability variables. Results by Chiu (1972) support

TABLE 3

Junior High Teacher Satisfaction on School Conditions

Questionnaire Items	N=108 $\bar{X}$	s_x
Availability of Paraprofessional Help	1.7	.9
**Availability of Laboratory Assistants	1.8	.9
Area Provided for Student Conferences	2.1	1.1
Availability of Secretarial Help	2.2	1.1
Specialists or Consultants Available	2.2	1.0
Office Space	2.3	1.3
Time Available for Meeting With Individual Students	2.3	1.1
**Student Laboratory Working Area	2.4	1.2
**Student Laboratory Facilities	2.4	1.2
Professional School Library	2.4	1.0
*Storage Facilities for Equipment and Supplies	2.5	1.2
Time Available for Reading Professional Literature	2.5	.9
**Space Provisions for Present Class Sizes	2.6	1.1
Area of Teacher Work Space	2.6	1.1
Equipment for Curricular Needs	2.8	1.2
Amount of Equipment to Meet Enrollment Needs	2.8	1.2
Time Available for Classroom Preparation	2.8	1.0
Preparation Area Free of Students	2.9	1.4
Amount and Quality of Laboratory Equipment	2.9	1.2
Availability and Appropriateness of Courses to Student Ability	2.9	.9
*Availability and Appropriateness of Courses to Student Needs	2.9	.9
**Your Teaching Load	3.0	1.1
Variety of Instructional Materials (Text, Films, etc.)	3.1	1.0
Content of Instructional Materials	3.3	.9
**Student Classroom Behavior	3.5	.9

*Differences between junior and senior high school teacher ratings significant at .05.

**Differences between junior and senior high school teacher ratings significant at .01.

TABLE 4

Senior High Teacher Satisfaction on School Conditions

Questionnaire Items	N=236 $\bar{X}$	s_x
Availability of Paraprofessional Help	1.8	1.0
Office Space	2.2	1.4
Specialists or Consultants Available	2.2	1.1
**Availability of Laboratory Assistants	2.2	1.1
Area Provided for Student Conferences	2.2	1.0
Availability of Secretarial Help	2.3	1.2
Professional School Library	2.4	1.1
Time Available for Meeting With Individual Students	2.4	1.1
Time Available for Reading Professional Literature	2.4	1.0
Preparation Area Free of Students	2.7	1.4
Area of Teacher Work Space	2.7	1.2
*Storage Facilities for Equipment and Supplies	2.8	1.3
**Student Laboratory Facilities	2.9	1.2
Amount of Equipment to Meet Enrollment Needs	2.9	1.2
Equipment for Curricular Needs	2.9	1.1
Amount and Quality of Laboratory Equipment	3.0	1.2
**Student Laboratory Working Area	3.0	1.2
Time Available for Classroom Preparation	3.0	1.1
Variety of Instructional Materials (Text, Films, etc.)	3.1	1.1
Availability and Appropriateness of Courses to Student Ability	3.1	.9
*Availability and Appropriateness of Courses to Student Needs	3.1	.9
**Space Provisions for Present Class Sizes	3.2	1.1
Content of Instructional Materials	3.4	.9
**Your Teaching Load	3.5	1.2
**Student Classroom Behavior	3.9	.9

*Differences between junior and senior high school teacher ratings significant at .05.

**Differences between junior and senior high school teacher ratings significant at .01.

the length of the respondents' teaching experience as a potential source. He found a direct relationship between perceived ability and experience. Another possible cause for confidence in their ability and especially the high rating on the "Knowledge of Subject Matter" item was the depth of the academic backgrounds. All of the responding teachers held at least a bachelor's degree, 73 percent with a science major, and 38 percent with master's degrees. Certainly this group might be expected to feel that their knowledge was more than satisfactory. In addition to being experienced and adequately academically prepared, most of the responding teachers reported attending NSF institutes. Participation in these institutes should also improve a teacher's self-confidence.

Teachers were asked to indicate all teaching techniques for which they had experience. Results of that categorization show that even a teacher not teaching in a traditional classroom situation has probably had experience with only one new curriculum technique. The lack of personal experience with a variety of new techniques would contribute to a feeling of inadequacy in this area and perhaps contributed to the low rating on the "Knowledge of Curricular Techniques" item.

The junior high teachers rated themselves significantly higher than the senior high teachers on only one item "Effectiveness in Audio-Visual Presentation." This might be because audio-visual equipment is generally more available in the junior high and therefore these teachers would know more about how to utilize it effectively (Battram, 1963). Also since the use of audio-visual equipment has been shown to be an effective motivational technique for junior high students (Soverly, 1971), junior high teachers might be more inclined to employ this method.

The data suggested a relationship between teaching load and teacher opinion of student behavior. The senior high school teachers were fairly happy with their teaching load and considered their students well behaved. The junior high teachers, on the other hand, were less satisfied ($p \leq .01$) with their teaching load and also had a lower opinion ($p \leq .01$) of their students' behavior. This seems consistent with the findings of Elliott (1971) who reported that science teachers felt heavy work loads prevented better teaching.

"Availability and Appropriateness of Courses to Student Needs" was rated significantly lower by the junior high school teachers. Because junior high science classes are required for all students, these classes are more heterogeneous than the elective senior high classes; therefore, student needs would be more varied and it would be more difficult for a course to meet all of them. Also, the new junior high science curriculums have not been available as long as the senior high ones.

Both junior and senior high school teachers would appreciate administrative improvements in the areas of time, space, and personnel. The responding teachers were particularly dissatisfied with the availability of outside assistance. Check (1971) also reported teacher dissatisfaction at the lack of teacher aides and paraprofessionals. Response to this need is shown by the recent trend toward the preparation and hiring of assistants to aid teachers. This has been taking place primarily in the senior high school laboratories which may explain the significantly higher rating of "Availability of Laboratory Assistants" by the senior high school teachers.

There were four items related to space considerations that were rated significantly lower by the junior high teachers. Apparently, there was not adequate space for the junior high science classes in general and

specifically the laboratory space was insufficient. In contrast, the senior high school teachers felt that their space allowances were satisfactory. Although both the junior and senior high school teachers felt that there was not enough storage space, the junior high school teachers were significantly less satisfied.

Conclusions

Because all of the ratings for the teaching ability variables were above the satisfactory level, it might appear that there would be no great need for teacher improvement programs. However, these ratings must be viewed in light of possible biases and the large individual variability. Certainly those who score below the mean with regard to any competency would provide a clientele for inservice programs which would attract others as well. Data show that more teachers have participated in unitary summer institutes than in any other type. Consequently, the most effective method of presenting the desired information may be in short summer institutes.

Junior high school teachers might be more willing to attend educational programs than senior high teachers because their opinions of their skills are generally lower. It is likely that programs in the areas of curricular techniques and in using evaluation to diagnose difficulties would be well received by both types of teachers. Senior high teachers may appreciate extra help in the area of individual instruction while junior high teachers would probably rather learn about career opportunities. The efficacy of a program designed solely to improve knowledge of subject matter is doubtful, primarily because the teachers rated themselves exceptionally high in this area.

Undergraduate teacher education programs apparently provided their graduates with good backgrounds in their subject matter and in how to evaluate students and curriculums. However, these programs should probably provide more background in different curricular techniques i.e. modular scheduling, team teaching and programmed instruction. The low ratings of this area might be because these curricular techniques were not known when many of the participating teachers were attending school. More time could also be spent on the use of evaluation in assessing teaching effectiveness and in diagnosing difficulties for remedial work. Finally, more emphasis could be given on how to individualize instruction and on what career opportunities are available.

There is a perceived need for improvement regarding time, space, and especially personnel conditions in both junior and senior high schools. These less than satisfactory ratings certainly indicate a need for a better look at school conditions than the preliminary view this survey afforded. Obviously, these science teachers were particularly unsatisfied with the amount of help they received and with the space provided for offices and student conferences. School administrators should see if this dissatisfaction is justified and if improvements in these areas would improve the quality of instruction. The junior high school administrator should be aware of the generally lower teacher ratings of junior high school conditions and particularly of the inadequate classroom-laboratory space. Most of the items relating to course needs were rated "just satisfactory" so administrative complacency in these regards is unwarranted.

In conclusion it appears that these science teachers are generally satisfied with their own abilities, but that they believe their school conditions need improvement.

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