1990

Preservice teacher beliefs related to mathematics and language arts.

David W. Kellenberger
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Preservice Teacher Beliefs Related to Mathematics and Language Arts

by

David W. Kellenberger

A Thesis
Submitted to the Faculty of Graduate Studies
and Research through the Faculty of Education in
Partial Fulfillment of the Requirements for the
Degree of Master of Education at the
University of Windsor

Windsor, Ontario, Canada
1990

ISBN 0-315-65166-0

ABSTRACT

PRESERVICE TEACHER BELIEFS RELATED TO

MATHEMATICS AND LANGUAGE ARTS

by

David W. Kellenberger

This study investigated the relationship between preservice teachers' mathematical and language arts learning histories and beliefs about their
1) attribution of students' achievement,
2) self-efficacy as future teachers, and
3) other subject-/topic-related perceptions. The term "learning history" was used to describe preservice teachers' perceived former achievement in association with the causal attributions they used to explain this achievement. The sample consisted of 167 Primary/Junior (grades K-6) preservice teachers enrolled in the teacher-training programme at the University of Windsor. Data were gathered at the end of the teacher-training programme by means of questionnaires.

The relationship between the subject-related learning history and teaching-related beliefs was

investigated by forming extreme groups. Perceived former achievement in mathematics and language arts was used as a criterion to identify groups with different learning histories. As achievement in language arts was generally higher than in mathematics, only two extreme groups could be identified. The group with a lower former achievement in mathematics attributed their mathematics achievement significantly more to lack of effort, lack of interest, and subject difficulty, while their high language arts achievement was attributed significantly more to ability, effort, and interest. The former achievement in association with the attributions used to explain this achievement, justified this group as having a less favourable learning history in mathematics and a more favourable learning history in language arts. The other group with a high former achievement in both subjects attributed their achievement in both mathematics and language arts more to their ability, effort, and interest. The former achievement in association with the causal attributions justified this group as having a favourable learning history in both subjects.

The belief most closely linked to the learning history was the self-efficacy as future teachers. The group with a less favourable mathematical learning history and a more favourable language arts learning history believed they were significantly less able to influence students' effort, interest, and achievement in mathematics compared to language arts. In addition, when groups were compared, preservice teachers with a less favourable mathematical learning history believed they were significantly less able to influence students' mathematical achievement compared to those with a more favourable mathematical learning history. Although the attribution of students' achievement was not directly influenced by whether or not the learning history was more or less favourable, the group of preservice teachers with a favourable learning history in both subjects consistently attributed effort or lack of effort as being more applicable in explaining students' achievement. Both groups were found to share the belief that a successful mathematics student would probably be male while a successful language arts student would probably be female.

ACKNOWLEDGEMENTS

First, I would like to thank the preservice teachers who participated in this study. I am also grateful to Professor Cathy Ebbs, Dr. Wilfred Innerd and Dr. Ian Crawford for supporting the data collection.

Most of all, I would like to extend my thanks to the members of my thesis committee, Dr. Erika Kuendiger, Dr. Rhona Rubenstein, and Dr. Ann McCabe, for their invaluable assistance and constructive suggestions during the course of this work.

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1. SCOPE

This study is related to the broader area of research on teachers' beliefs, which has been the topic of many studies since Rosenthal and Jacobson published Pygmalion in the Classroom in 1968. In particular, this study investigated the impact of Primary/Junior (P/J) preservice teachers' achievement-related beliefs about themselves and teaching-related perceptions.

During preservice teachers' own schooling, they have accumulated a number of experiences which have led to established beliefs of how well they have achieved in different subject areas together with the different reasons which explain this achievement. This perception of achievement and its causal attributions are called "learning history". In this study, the learning history related to the subjects of mathematics and language arts are considered. The study investigated to what degree these subject-related learning histories influence preservice teachers' (1) attribution of students' achievement, (2) self-efficacy as future teachers, and (3) other subject-/topic-related perceptions.

Since the attribution of achievement plays a central role in this research study, first in preservice teachers' explaining their own achievement, and second in their attribution of students' achievement, an overview of attribution theory is provided as it relates to school learning (Chapter 2). Moreover, a survey of research studies related to the specific teacher beliefs investigated in this study will be provided in Chapter 3.

The lack of research that focuses on preservice teachers and the need for such research has been expressed repeatedly (see e.g., Clark, 1988; Brown & Cooney, 1982). The research questions that should be addressed have come from a variety of areas. In a simplified manner, they can be grouped as follows: (1) questions related to the evaluation of preservice teacher programmes and (2) questions related to the individuals who intend to become teachers. This research study relates to the latter. The learning history constitutes a motivational framework that has been well established before preservice teachers enter the teacher-training programme. The teaching-related beliefs considered in this research were measured at

the end of the programme. Thus, this research study does not investigate how these teaching-related beliefs change during the programme. Instead, it is assumed that the learning history is such a powerful motivational framework that differences in teaching-related beliefs as they occur at the end of the programme can be traced back to differences in the learning history.

2. ATTRIBUTIONS AND ACHIEVEMENT-RELATED BEHAVIOUR

2.1 Weiner's Model

Attribution theories, in general, investigate which explanations individuals search for in understanding why an event has occurred, and how these causal attributions influence future expectations and behaviour. Commonly the origin of attribution theory is traced back to the works of Heider (1958), Rotter (1966) and Kelley (1967) (see e.g. Kloosterman, 1990, p. 98 ff.; Heckhausen, Schmalt, & Schneider, 1985, p. 125 ff.). Weiner and his colleagues (Weiner et al., 1971; Weiner & Kukla, 1970) deserve credit for recognizing the importance of causal attributions for the explanation of achievement behaviour. In 1970, Weiner and Kukla found that failure-motivated and success-motivated individuals use distinctively different attributions. Thus, a link between the achievement motive and attribution was established.

In Weiner's theory (see e.g. Weiner, 1976, pp. 180-184; 1979; 1984, p. 27 ff.; Weiner, Russell, & Lerman 1978, pp. 59-62), causal attributions form the

cognitive link between achievement outcome and expectancy of future success. For example, if a student attributes past success in school to his/her high level of ability, he/she is very likely to have a high expectancy to master successfully the next achievement situation. On the other hand, a student who thinks of himself/herself as not very able and attributes past success to the easiness of the task, he/she is very likely to expect to fail in future achievement situations.

Like Heider and Rotter, Weiner stressed that the specific reasons which were used to explain the outcome of an event (e.g. ability or easiness of the task) were less important than the underlying dimensions of the attributions (Weiner, 1979; 1984, p. 20). In the original model, Weiner distinguished between two dimensions by which attributional causes can be classified: locus and stability (see Table 2.1.1). For example, ability is considered as an internal, stable cause and immediate effort as an internal, unstable cause as the effort forwarded by a student can change from one achievement situation to another.

Table 2.1.1: Weiner's 2-Dimensional Causal Attribution Model

Dimension of Causality			
		Locus	
		Internal	External
Stability	Stable	ability	task difficulty
	Unstable	immediate effort	luck

(Weiner et al., 1971).

In later publications, Weiner pointed out that besides locus and stability other dimensions might be needed to classify specific causal attributions. Dimensions eventually added to the model were controllability (Weiner et al. 1978; Weiner, 1979) and intentionality which were together classified as responsibility (Weiner, 1984). Moreover, by linking causal dimensions to affective reactions, Weiner incorporated emotions into his attributional model of achievement motivation. So far only the 2-dimensional

model that does not include emotions has been extensively used in school- elated studies.

Weiner (1984) summed up the variables and sequences that describe the attributional process in an achievement situation as follows:

Causal Antecedents--->Causal Ascriptions---
--->Causal Dimensions---> Expectancy of---> Actions
Success

(Adopted from Weiner, 1984, p. 28)

The expectancy of success or failure on future tasks is highly dependent upon the attributions one uses to explain past events (see e.g. Kelley, 1967; Weiner, 1980).

Consider the following example to illustrate the relationship among the five factors in Weiner's model (above). Assume a student attributes success to his/her ability (a stable, internal cause) and failure to bad luck (an external, unstable cause). It is likely that in the next achievement situation he/she will expect success because ability is viewed as unchanging but bad luck can vary from situation to

situation. This expectancy of success together with these particular attributions will very likely lead to persistence if the task is more difficult than expected.

On the other hand, assume a student attributes success to good luck (an external, unstable cause) and failure to a lack of ability (a stable, internal cause). It is likely that in subsequent achievement situations which are similar to the last one, he/she expects failure because lack of ability is an internal, stable cause which will continue to be relevant in the next achievement situation, whereas luck varies.

Research has shown that the actual causal attributions chosen by an individual are not only influenced by the achievement motive but also by other antecedent variables. Thus, over time, researchers shifted their attention away from the question, "How do success- and failure-motivated individuals attribute their achievement?", towards the questions, "What are the causal ascriptions and the underlying dimensions used by an individual in a particular achievement situation?", "What antecedents cause the attribution patterns?", and "How do these attributions relate to

future expectations and behaviours?". (See e.g. Heckhausen et al., 1985, pp. 129-145; Weiner, 1984, pp. 23-24.)

One important antecedent, if not the most important one, is past achievement. Due to repeated past sequences of successes and failures an individual may develop a more positive or negative self-concept of ability. In the school situation, as content items taught are often hierarchical in nature, repeated successes and failures are likely. If a student, for example, has experienced consistent success, this leads to a distinctively different motivational framework and different causal attributions compared to a student who consistently experienced failure.

Kloosterman (1990, pp. 104-107) distinguished between students with two distinctively different motivational systems caused by repeated success and failure experiences. He called them the learned-helpless student and the mastery-oriented student.

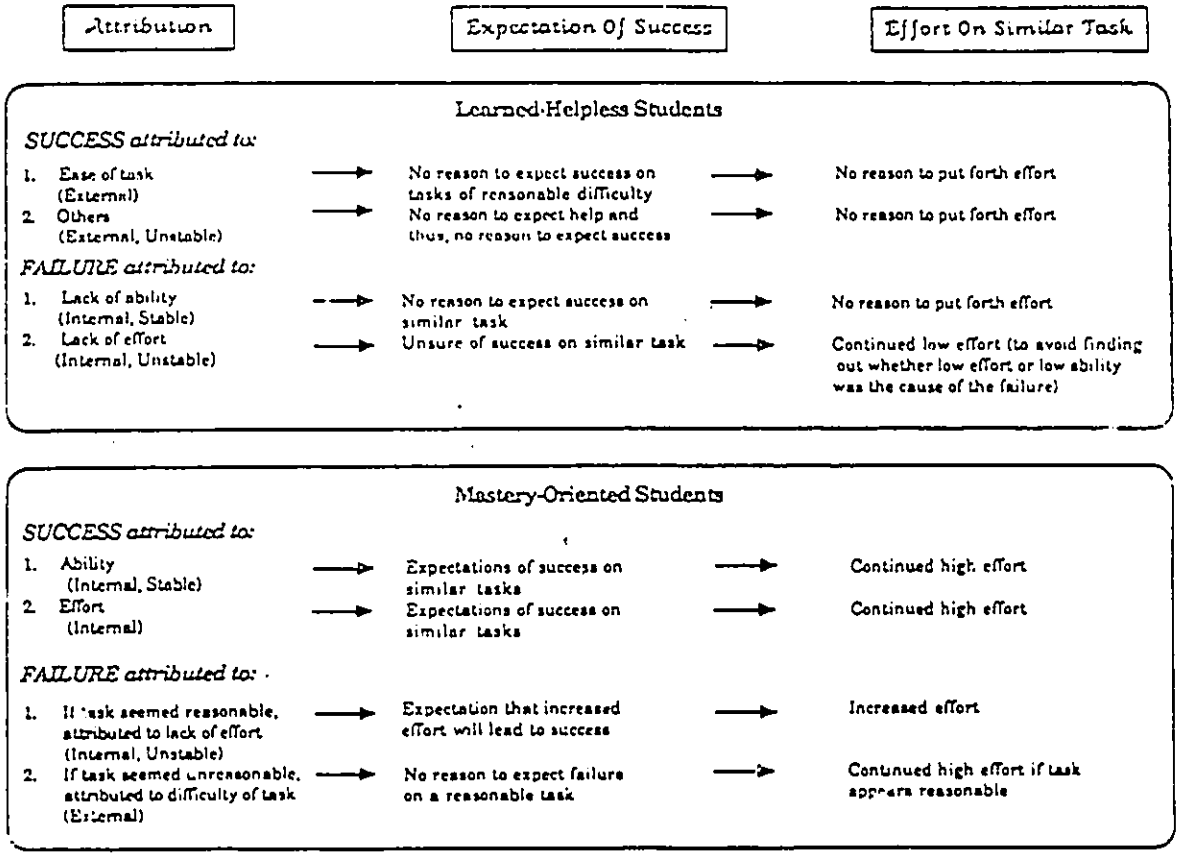
The term "learned helplessness" was used to describe a student who, due to his/her interpretation of past failures, believes that he/she is unable to

succeed in school. The attribution of this type of student in an achievement situation is as follows: The frequently occurring failure is attributed to a lack of ability (internal, stable) or a lack of effort (internal,unstable). If success occurs at all, it is attributed to external reasons like the ease of a task or help by others.

The term "mastery-oriented" student has been used to describe a student who has been generally successful in school and who is confident in his/her ability to master the next achievement situation and thus is not worried about failure. This type of student feels responsible for success and attributes these successes to ability and effort, whereas failure is attributed to difficulty of the task or lack of help by others.

Table 2.1.2 below describes how attributions, expectancy, and effort, one specific behaviourial consequence, differ between learned-helpless students and mastery-oriented students.

Table 2.1.2: Attributions, Expectations, and Effort for Learned-Helpless and Mastery-Oriented Students



(Kloosterman, 1990, p. 106)

In researching the relationship between achievement and attributions, asymmetric attribution patterns were often found. These asymmetric attributions could be explained by an individual's need to establish and maintain a positive self-esteem. Accordingly, people tend to take more credit for their successes but tend to take less responsibility for their failures, blaming the failure on situations or others (see Heckhausen et al., 1985, p. 131 ff.). Therefore, learned-helpless students would not be expected to attribute failure in subsequent achievement situations to lack of ability as mastery-oriented students would to ability. The learned-helpless students would also use reasons such as difficulty of the subject and/or lack of help by others.

It can be concluded that the causal explanations of repeated past achievement outcomes lead to different motivational systems which depend on whether or not the experiences generally were perceived by the student to be successes or failures. Moreover, these systems form a frame of reference for success/failure expectancies in subsequent achievement situations that are similar to past situations.

2.2 Studies related to Language Arts and Mathematics

In language arts there are very few research studies which investigate the relationship between achievement and attribution of this achievement. Those that are available focus on reading only and are conducted with very young children (see Hiebert, Winograd, & Danner, 1984). Therefore, these studies are not discussed here.

Numerous research studies related to mathematics have used attribution theory after gender-related differences in the attribution of mathematical achievement were found. These differences served to explain differences in either achievement, course-taking behaviour, or career choices. Overviews of research findings are provided in Eccles (1986), Fennema and Leder (1990), and Schildkamp-Kuendiger (1982), the latter of which offers an international review. Some studies are briefly described below as examples for the line of reasoning used.

The study of Wolleat, Pedro, Becker, & Fennema (1980) is frequently referenced by other researchers to document gender-related attribution differences. Their

sample consisted of 647 female and 577 male high school mathematics students. The attribution of success and failure in mathematics was measured as well as mathematical achievement. The data indicated that female students attributed success in mathematics less to ability and more to effort than did male students, while failure was attributed more to lack of ability and difficulty of the task.

Yet, regression analyses showed that achievement influenced attributions to a much higher degree than gender. A recent study by Fraser (1990) supports the finding that the achievement levels have to be taken into account when gender differences are investigated.

In Eccles (1986), based on a series of related studies, a link between attribution and career choices for females was established. One of these studies (Kane, 1986) involved 77 college women who were successful in mathematics in the past. They were asked to rank the importance of various causal attributions for success and failure on a mathematics test. The women were also asked about their career goals. The study found that women planning careers in mathematics-related fields, more than other women,

attributed mathematics success to stable, internal reasons and less to unstable, external reasons.

Kuendiger (1990) established a link between preservice teachers' perceived former mathematical achievement and their attributions by separating preservice teachers into two groups based upon their perceived former mathematical achievement. These groups were found to use distinctively different attributions to explain their mathematical achievement. Preservice teachers with an above average former mathematical achievement attributed their achievement more to ability and less to lack of ability than preservice teachers with an average or below average mathematical achievement. In addition, the group with a higher mathematical achievement believed that the easiness of the subject was more applicable in explaining their achievement and were more decisive when it came to reasons which were not applicable. In contrast, the group with a lower mathematical achievement believed that lack of effort, difficulty of the subject, and poor teachers' explanations were more applicable in explaining their achievement, thus showing more self-serving biases.

The former mathematical achievement in association with the causal attributions used to explain this achievement, justified to describe these two groups as having different mathematical learning histories. The group which had a higher perception of their mathematical achievement and a more positive attribution pattern was considered to have a more favourable mathematical learning history, whereas the group with a lower perception of their mathematical achievement and a more negative attribution pattern was considered to have a less favourable mathematical learning history.

In summary, it is of particular importance for this study that in investigating gender differences, the relationship between past performance and attributions was confirmed. Moreover, Kuendiger's study (1990) showed this relationship also exists for preservice teachers.

3. TEACHERS' BELIEFS

3.1 Teachers' Expectations and Attributions of Students' Achievement

Teachers' beliefs first became of interest to educational researchers after Rosenthal and Jacobson published their book, Pygmalion in the Classroom, in 1968. In their study, elementary school teachers were told that some of their students had demonstrated a remarkable potential for academic growth on a written test, when in reality the students had actually been selected at random. Eight months later, these same students for which teachers were led to hold artificially high expectations, showed greater-than-expected I.Q. scores.

These results, however, could not be duplicated by other researchers. Yet, Rosenthal and Jacobson's study initiated numerous other studies which investigated teachers' expectations and, in particular, how these expectations related to students' achievement (see e.g. Braun, 1976; Brophy, 1983; Brophy & Good, 1974; Cooper, 1979; Dusek, Hall & Meyer, 1985; Good, 1980; Persell, 1977). By now, a large body of research is available

which explains how teachers' expectations affect students, more specifically, students' attitudes, beliefs, attributions, achievement, and expectations.

In particular, teachers' attributions of students' achievement have been found to be important in understanding how teachers communicate their expectations to students. The different steps below describe how this communication process might take place.

1. Let us assume that a teacher and a student differ in the causal attributions they have for the student's achievement. The teacher perceives that a student's present results are below his/her potential.
2. The teacher comes to the conclusion that the poor performance is due to a lack of effort on the student's part and not due to lack of ability.
3. Therefore, when failure occurs, the teacher attributes it to insufficient effort. Success, however, is attributed to the student's ability.

4. Let us further assume that the student, on the other hand, has developed a low concept of his/her own ability due to a series of former failure experiences. Thus, the student believes that even an increased effort will not lead to success because of his/her low self-concept of ability.
5. The student very likely attributes failure as being due to lack of ability and success to external reasons like easiness of the task or luck.
6. The teacher and student interact in class. During this interaction, the teacher communicates his/her achievement expectations and attributions to the student. Brophy (1985, p. 180) points out that teachers communicate their beliefs either directly by telling the student, for example, "I know you can do this but you just have to try harder", or indirectly, for example, by staying with the student after a wrong answer has been given instead of moving on to another student

or by allowing the student more time to respond to a question.

7. The student becomes aware that his/her own achievement expectations and attributions differ from the one the teacher holds for the student.
8. Commonly a teacher is recognized as a "significant other" with regard to explaining a student's achievement. Therefore, the student's causal attributions of his/her own achievement is likely to shift in the direction of those of the teacher. By changing his/her causal ascriptions, the student is more likely to make an effort if required by the task, as effort is now perceived as instrumental for a successful outcome. Repeated success will then eventually lead to an enhancement of the student's self-concept of ability.

Process models that are similar to the above and that sum up research results have been suggested by others

as well (see e.g. Brophy & Good, 1970; Darley & Fazio, 1980).

An empirical study undertaken by Darom & Bar-Tal (1981) investigated directly the similarity between teachers' and students' attribution patterns of students' achievement. The study involved eight teachers and 235 students. Following an achievement test, students were asked to classify the grade they received as success or failure and to attribute the reasons for this outcome. At the same time, the teacher was asked to attribute students' achievement. In 75% of the cases, teachers and students agreed on classifying the outcome as a success or failure. In these cases, the students' attribution of their achievement was quite similar to those of the teachers.

Moreover, a study by Supersaxo, Perrez, & Kramis (1987) showed that by using consistent attribution patterns for students' achievement during classroom interactions teachers succeeded in altering the causal ascription used by students.

The above shows that teachers' attributions of student achievement are indeed an important link

between teachers' expectations and students' attributions and thus students' achievement.

3.2 Teachers' Efficacy

"Teacher efficacy" is described as the teachers' belief in their ability to have a positive affect on student learning (Bandura, 1977). Recent literature has focused on the importance of teacher efficacy in affecting classroom processes (see e.g. Ashton & Webb, 1986; Ashton, 1985). In addition, teacher efficacy has been related to students' achievement (Armor et al., 1976; Berman, McLaughlin, Bass, Pauly, & Zellman, 1977).

Some researchers (Ashton & Webb, 1982; Webb, 1982; Ashton, 1985, pp. 142-163) have proposed that efficacy is a two-dimensional concept: personal or self-efficacy, the belief that one personally can affect students, and teaching efficacy, the belief that teachers in general can be effective.

Gibson & Dembo (1984) examined the dimensionality of teachers' sense of efficacy. In their study, 208 elementary school teachers completed a piloted Teacher Efficacy Scale consisting of 30 items. In these items,

aspects of students' learning and behaviour were linked to general and specific teaching behaviour. Their findings supported the idea that the concept of efficacy has two components. These are: personal teaching efficacy (i.e. belief in their personal ability) and general teacher efficacy (i.e. the belief that the teacher, any teacher, had the ability to change students and that this was not overpowered by other external or environmental factors). The evidence of these two dimensions were confirmed in other studies as well (Armor et al., 1976; Berman et al., 1977).

Ashton & Webb (1986, pp. 125-144) related teachers' sense of personal and general efficacy to students' achievement. Forty-eight high school teachers and their corresponding students were involved in the study. The teachers completed a questionnaire in which only one statement dealt with each of the two efficacy aspects. These were:

1. If I really try hard, I can get through to even the most difficult or unmotivated students.

2. When it comes right down to it, a teacher really can't do much because most of a student's motivation and performance depends on his or her home environment. (Berman et al., 1977, pp. 136-137 as indicated in Ashton & Webb, 1986, p. 8)

They found that teachers' personal sense of self-efficacy was significantly related to students' language arts achievement and that general teacher efficacy was significantly related to mathematical achievement.

One recent study dealt with preservice teachers' sense of efficacy. Housego (1990) investigated preservice teachers' self-efficacy to determine the effect the teacher-training programme had on their feelings of their preparedness to teach. In this study, Housego operationalized the sense of self-efficacy by asking preservice teachers to rate their preparedness to perform specific sets of teaching-related tasks. These included their ability to write teaching objectives, develop unit plans, provide feedback to students, and establish class

rules. Housego found that preservice teachers' feelings of their preparedness to teach increased significantly over the one-year programme. However, some aspects (e.g. classroom management and instructional planning) increased more than others (e.g. questioning and record-keeping).

Kuendiger (1990) investigated the relationship between preservice teachers' mathematical learning history and their sense of future self-efficacy. Preservice teachers were asked to indicate whether or not they would be able to help students who were not doing well in mathematics if they were their regular teacher. Kuendiger found that preservice teachers with a less favourable mathematical learning history had a tendency to judge their personal self-efficacy in teaching mathematics as lower than those with a more favourable mathematical learning history.

The review of the above studies shows that beyond the general relevance of the construct of efficacy, there is a need both to differentiate between self-efficacy and general teacher efficacy and to differentiate between the domains for which efficacy is

applied (e.g. teaching behaviour or students' learning outcome).

4. CONCEPTUAL FRAMEWORK

This study investigated whether or not P/J preservice teachers' mathematical and language arts learning histories influenced certain subject-related beliefs relevant to teaching (see Graph 4.1.1). As outlined earlier, the term "learning history" was used to describe the perceived former achievement in association with the attributions that are used to explain this achievement. The subject-related learning history was assumed to form a cognitive framework that influences teaching-related beliefs which preservice teachers had developed by the end of their teacher-training programme. The relationship between the subject-related learning history and teaching-related beliefs was investigated by comparing groups of preservice teachers with different learning histories for differences in their beliefs. The beliefs considered in this research study were:

(1) teachers' attributions of students' achievement,
(2) teachers' perceived future self-efficacy as it relates to students' effort, interest, and achievement, and

(3) other subject-/topic-related beliefs:

a) the relevance of topics in mathematics and language arts for overall achievement and future success,

b) the relationship between achievement and gender of the student,

c) the inference of achievement in one subject to achievement in another,

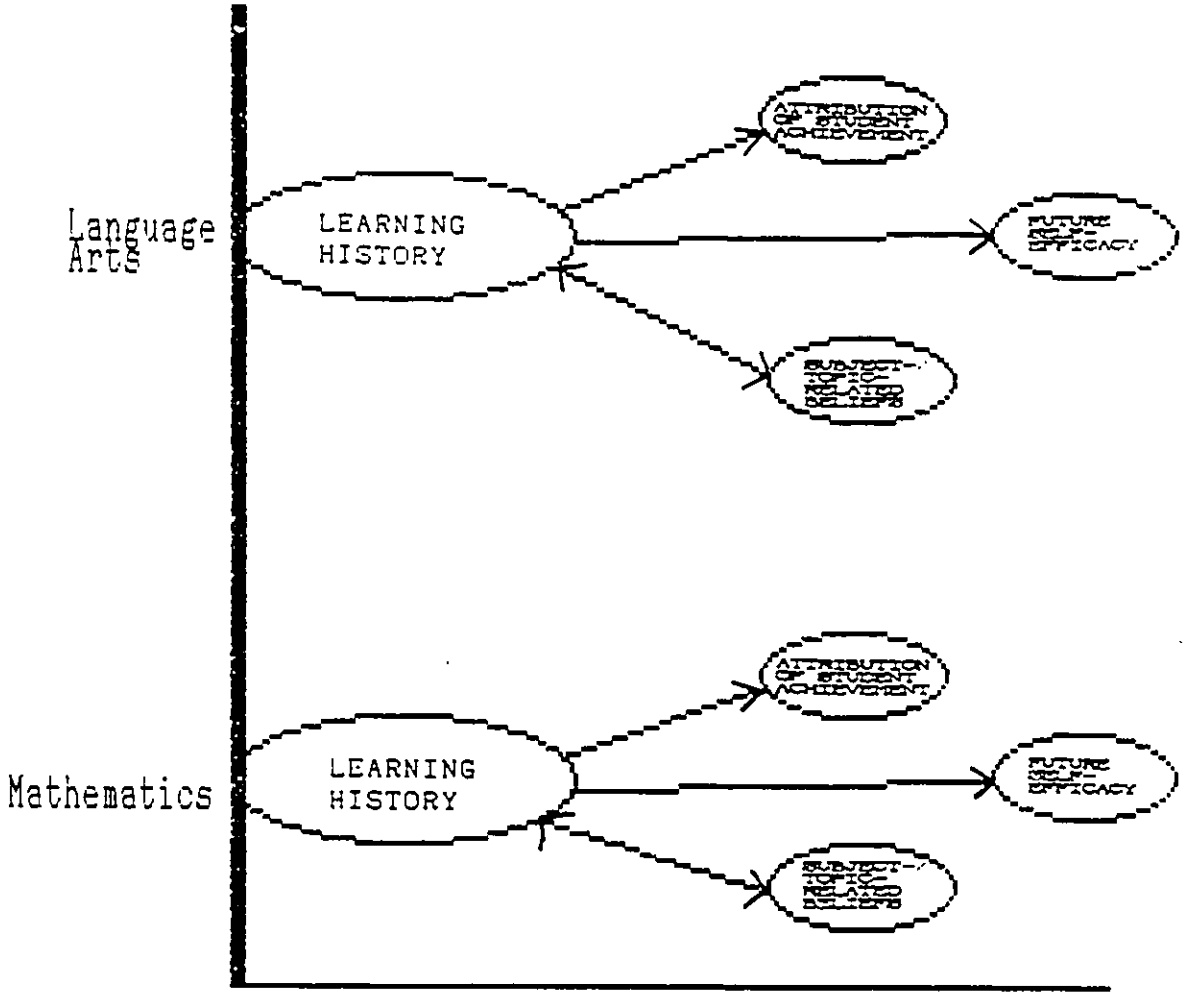
d) the necessity of a special ability for mathematics or language arts.

The above teaching-related beliefs were operationalized for mathematics and language arts separately (see Graph 4.1.1).

4.1 Identifying Groups of Preservice Teachers with Different Subject-Specific Learning Histories

Research summarized in Chapter 2 confirms the relationship between achievement and attributions. In particular, individuals with a generally high former achievement develop an attribution pattern which clearly differs from the attribution pattern of individuals with a generally low former achievement.

Graph 4.1.1: Learning History and Teaching Beliefs



The findings of Kuendiger (1990) confirmed this relationship for mathematics. She investigated the relationship between preservice teachers' former mathematical achievement and their at ·ibutıons by separating preservice teachers into two groups based upon their perceived former mathematical achievement. (Refer to Chapter 2.2 for results.)

In this study, similar to the procedure used by Kuendiger (1990), the variable "perceived former achievement" was used as a criterion to identify groups of P/J preservice teachers with different attribution patterns. As will be discussed in more detail in Chapter 6, preservice teachers' former achievement in language arts was generally higher than for mathematics (see Graph 6.2.1). Therefore, it was only possible to identify two extreme groups. The first extreme group, the Low-High group, had an average or lower achievement in mathematics and an above average or higher achievement in language arts. The second extreme group, the High-High group, had an above average or higher achievement in both mathematics and language arts. The names of the two groups indicate the achievement levels first in mathematics followed by

language arts. Within-group and between-group comparisons were used to investigate the relationship between achievement and attributions.

The attribution of achievement may not only be due to the achievement level, but also to the subject area in which the achievement was obtained. For example, as mathematics is often perceived as a particularly difficult subject, effort might play a larger role in explaining high mathematical achievement compared to high language arts achievement. To a certain degree, this study addresses this question.

Depending upon whether achievement alone or achievement together with the subject area influences attributions, the within- and between-group comparisons would lead to the various possible sets of results described below.

1) Regardless of whether the subject area in addition to achievement influences attributions, the following would be expected.

- Significant differences for the Low-High group's attributions when mathematics versus language arts

are compared (due to differences in average achievement; within-group comparisons).

- No significant differences in the attributions related to language arts when the Low-High versus High-High groups are compared (due to same average achievement in the same subject area; between-group comparisons).
- Significant differences in the attributions related to mathematics when the Low-High versus High-High groups are compared (due to differences in average achievement; between-group comparisons).

2) If achievement alone influences attributions, one would expect the following:

- No significant differences for the High-High group's attributions when mathematics versus language arts are compared (due to same average achievement; within-group comparisons).

3) Yet, if the subject area together with achievement influences attributions, one would expect the following instead:

- Significant differences for the High-High group's attributions when mathematics versus language arts are compared (due to different subject areas; within group comparisons).

The differences in attributions found in Kuendiger (1990) were in the direction that the group with a higher former mathematical achievement could be described as having a more favourable mathematical learning history, whereas, the group with lower former mathematical achievement could be described as having a less favourable mathematical learning history. (See Chapter 2.2 for a description of the two different learning histories.)

In line with the above results, the two groups in this study are expected to have different subject-related learning histories. In particular, the Low-High group was expected to have a less favourable learning history in mathematics and a more favourable learning history in language arts. This group was expected to attribute their higher language arts achievement more to ability, effort, and interest while attributing their lower mathematics achievement more to

lack of ability, lack of effort, and lack of interest. The High-High group, however, was expected to have a more favourable learning history in both mathematics and language arts, attributing both their higher mathematical and language arts achievement to ability, effort, and interest.

Obviously it is of interest to know how extensive the preservice teachers' subject experiences were before they entered the teacher-training programme. Therefore, the variable "formal training" was included to measure the high school and university subject training.

Moreover, P/J preservice teachers' interest in each subject was obtained. In this context, the interest in a subject is not used to attribute achievement but is considered to be a learning outcome which to a certain degree is related to achievement (e.g. one is interested to learn more about a subject in which one is strong) but might also include other aspects (e.g. interest in a subject because the subject is important). Due to the relationship between interest and achievement, a higher achievement in one

subject area is expected to be associated with a higher interest in the subject area and vice versa.

As far as these predecessor variables are concerned, the following research questions were considered in this study:

1. Do groups of P/J preservice teachers with different subject-related achievement levels have different subject-related causal attribution patterns? If so are these differences such that it is justified to describe the groups as having a more or less favourable subject-related learning history?

2. Do the extreme groups differ in their formal training in the two subjects?

3. Do the extreme groups differ in their interest in the two subjects?

4.2 Teaching-Related Beliefs

It is an important assumption of this research study, if not the most important one, that the learning

history provides a motivational framework that influences preservice teachers' beliefs about teaching. Kuendiger (1990) confirmed this assumption for beliefs related to mathematics teaching. Preservice teachers who had a less favourable mathematical learning history: (1) were less confident teaching mathematics, (2) considered their personal insufficiency in teaching mathematics as more relevant to explain students' lack of progress in mathematics, and (3) tended to judge their future efficacy to help students with learning difficulties as lower. When asked which aspects were important in teaching mathematics, the group with a more favourable mathematical learning history focused more on the aspects related to students' different ability levels than did those with a less favourable learning history.

To the knowledge of this researcher, the specific teaching-related beliefs considered in this study have not been related to the learning history in previous studies. Therefore, no specific hypotheses about the direction of differences for groups of teachers with different learning histories are made below.
Table 4.2.1 gives an overview of the variables

considered in this study. The predecessor variables have already been explained. The successor variables are explained along with the related research questions in the next section.

Table 4.2.1: Variables Considered in Study

Predecessor Variables		Successor Variables
Background Information -age -gender Formal Subject Training -grade through which subject was taken in high school -number of university courses taken in the subject Interest in Subjects Learning History -perceived former achievement -causal attributions	==>	Attribution of Students' Achievement Perceived Future Self-Efficacy Subject-/Topic-Related Beliefs -relevance of topics to student assessment -relationship of gender and achievement -inference of achievement between subjects -special ability required

Except for background information, all variables were obtained for both mathematics and language arts.

4.2.1 Attribution of Student Achievement

It has been shown that teachers' attribution of students' achievement is an important means of explaining how teachers' expectations are communicated to students (See Chapter 3). Obviously teachers' attributions are based on students' behaviour. Yet it is assumed here that the learning history forms a framework which, in addition to students' performance, influences which reasons are used to explain students' achievement. In this study, preservice teachers were asked to attribute reasons for the different achievement levels of two fictitious students in each subject area.

Differences in the attribution of studerts' achievement as they relate to differences in learning histories, were examined by making separate within-group and between-group comparisons. The within-group comparisons compared the two different subject areas (mathematics versus language arts) for each group (Low-High and High-High). Between-group comparisons compared different groups (Low-High versus High-High) for each subject area. The within- and between-group comparisons were made separately for the

two different student achievement levels. The research question addressed was:

4. Do P/J preservice teachers with different subject-related learning histories attribute students' achievement in mathematics and language arts differently?

4.2.2 Perceived Future Self-Efficacy

The importance of investigating teacher self-efficacy as it relates to students' achievement was indicated in Chapter 3.2. Different operaticnalizations of preservice teachers' self-efficacy have been used.

This study investigated P/J preservice teachers' perceived ability as future teachers to influence students' effort. interest, and achievement in the two subjects. Again, separate within- and between-group comparisons were made.

The research question addressed was:

5. Do P/J preservice teachers with different subject-related learning histories have different

perceptions of their ability to influence students' effort, interest, and achievement in the two subject areas?

4.2.3 Other Subject-/Topic-Related Beliefs

a) Relevance of Topics in Mathematics and Language Arts for Overall Achievement and Future Success

Up until now mathematics and language arts have been considered as constituting distinct whole units. Yet at a closer look, both mathematics and language arts are subjects composed of different topics which differ in both the skills required from the student and the importance these skills hold for future success.

The two mathematical topics investigated were computation and problem solving while the two language arts topics investigated were the combination of reading and writing and the combination of grammar and spelling. The topics were chosen based on the differences in skills required from students in order to be successful. Four fictitious students whose achievement in the two topics differed were presented

for each subject area. The assessment of the four students was operationalized in two ways. First, preservice teachers assessed the students' overall achievement in the subject by assigning typical grades. Second, they indicated the students' probable future success in the subject. Only between-group comparisons were carried out, as it is not feasible to compare topics between subjects directly. This would assume, for example, that computational skills play an equivalent role for mathematics as spelling does for language arts.

The research question addressed was:

6. Does the learning history influence preservice teachers' perception of the role different topics have within each subject area on the overall achievement and future success of students?

b) Relationship Between Achievement and Gender of Students

Teachers may have stereotyped perceptions about gender and achievement in different subjects. For

example, males may be expected to be better in mathematics while females may be expected to be better in language arts. Teachers who hold these perceptions may offer different encouragement to boys and girls in a subject. Kuendiger (1990) addressed this possibility by asking preservice teachers whether or not the encouragement of girls was important in mathematics. Her findings showed that preservice teachers did not perceive that the encouragement of girls was particularly important.

In this study a different approach was taken. Preservice teachers were asked to assign a probable gender to the four fictitious students described above. The study investigated whether a typical gender was assigned for the student who did well in both topics and for the student who did fair in both topics in each subject. Within- and between-group comparisons were done.

The research question addressed here was:

7. Does the learning history influence the gender typically assigned to students with different

performance levels in mathematics and language arts?

c) Inference of Achievement in one Subject to Achievement in Another

Success in one subject often infers success in other subjects particularly if the subject is perceived as difficult. For example, a teacher may expect that a student who is successful in mathematics may be expected to also be successful in language arts, or vice versa. Preservice teachers were asked to indicate which other subjects successful mathematics and language arts students would also be successful in. Within- and between-group comparisons were made.

The research question addressed here was:

8. Does the learning history influence the inference made from success in mathematics or language arts to other school subjects?

d) Necessity of a Special Ability for Mathematics or Language Arts

Individuals who are not successful in a particular subject area may rationalize their lack of success by assuming that some special ability may be required to be successful in that particular subject. If a teacher holds this rationalization then this might influence his/her achievement expectations. For example, assume a teacher thinks that a special ability is required to be successful in mathematics. He/she may attribute the failure in this subject of a generally good student to a lack of special ability, expecting the student to fail in the future.

In this study, P/J preservice teachers were asked to indicate whether a special ability was required in mathematics or language arts in order to be successful in the subject. The research question investigated here was:

9. Is the learning history related to belief in the requirement of a special ability in mathematics or language arts for success in the subject area?

In Chapter 6, the sample of P/J preservice teachers is described using some of the predecessor variables and the extreme groups are identified. Thereafter, results are presented in the order of the research questions outlined above.

5. OPERATIONALIZATION OF THE VARIABLES, DATA GATHERING AND PROCESSING

5.1 The Sample

The subjects of this study were students enrolled in the Primary/Junior division of the preservice programme at the Faculty of Education, University of Windsor, during the 1989/90 academic year. The P/J division prepares students to be teachers in grades K-6. The P/J preservice programme provides future teachers with training in all subject areas, but no specialization in any one subject. All programme applicants possess an undergraduate degree. As enrolment is very limited, the minimum overall average required for admission in 1989-90 was about 75%. Upon completion of the programme, successful candidates receive a Bachelor of Education degree and an Ontario Teacher's Certificate allowing them to teach in an Ontario school system.

Preservice teachers have three two-week practice teaching sessions in October, November, and February and one three-week session in April, during which time they teach in four classroom settings. Throughout the

year they also spend two days per week in one school assisting the normal classroom teacher and learning about school functions beyond the classroom.

5.2 Data Gathering

Data were gathered at the end of the teacher-training programme during the week of March 5, 1990. By this time, the preservice teachers had already worked in three practice teaching sessions.

Questionnaires (see Appendix A1 and A2) were delivered to the P/J preservice teachers during their General Methodology class taught in groups of about 35-45 students. Participation in the study was voluntary with anonymity guaranteed. The preservice teachers were instructed to answer the questions truthfully reflecting their own personal feelings leaving a question blank if they did not wish to answer it.

5.3 The Questionnaire

A copy of the questionnaire can be found in the Appendix. Individuals required approximately 20 minutes to complete the questionnaire. All 14 items in

the questionnaire were asked for both mathematics and language arts at the same time.

Two versions of the questionnaire were used in order to randomize the effects of subject order and gender. In the first version, items related to mathematics came first. Additionally, for the items related to success in other subjects (i.e. items #11 and #12), the successful mathematics student had a male name (i.e. Jim), while the successful language arts student had a female name (i.e. Jeanette). In the other version, language arts items came first while the names of the students mentioned above were reversed.

The variables which were obtained from the questionnaire are given below. Except for background information, all variables were obtained for both mathematics and language arts. The questionnaire item numbers appear in parentheses. While data were collected for students in divisions beyond Primary/Junior, only preservice teachers in this division were the subjects of this study. Thus, some items in the questionnaire do not apply here.

- Background Information: division, gender, age, and teachable subject (not applicable for P/J division)

-Formal Subject Training (Items #1 and #2): highest grade taken in high school, and number of university courses taken in the two subjects

-Interest in Subjects (Item #3; 5-point continuous rating scale).

-Learning History

a) Perceived Former Achievement (Item #4; 5-point continuous rating scale).

b) Attribution of Former Achievement (Item # 5): The item listed five positive, and correspondingly, five negative reasons for explaining achievement as shown below.

ability/lack of ability

effort/lack of effort

interest/lack of interest

easy subject/difficult subject

good teaching/poor teaching

Reasons were selected as being "most applicable" and "somewhat applicable" in explaining achievement.

Space for an open-ended response was also provided. Only about 1% of the preservice teachers used the open-ended response to indicate very specialized reasons which could not be generalized to all preservice teachers (e.g. frequently moving from school to school or illness for a long period of time). This gives an indication of the validity of the reasons listed in the questionnaire to explain preservice teachers' achievement. Due to the limited response and specific nature of the reasons provided, the open-ended responses were not analyzed further. In comparison to the reasons used in Kuendiger's study (1990), good/bad luck and help/lack of help by others were omitted as they were rarely considered by preservice teachers in Kuendiger's study. Interest/lack of interest were added as reasons in this study.

-Attribution of Students' Achievement (Items #6 and #7): The items listed six positive reasons for explaining a student's very good achievement, and correspondingly, six negative reasons for

explaining a student's very poor achievement as shown below.

ability/lack of ability

effort/lack of effort

interest/lack of interest

easy subject/difficult subject

good teaching/poor teaching

advanced/lagging cognitive development

Reasons were selected as being "most applicable" and "somewhat applicable" in explaining students' achievement.

Space for open-ended responses were provided. Again only about 1% of the preservice teachers used the open-ended response to indicate very specialized reasons. This gives an indication of the validity of the reasons listed to explain students' achievement. Due to the limited response and specific nature of the reasons provided, the open-ended responses were not analyzed further.

-Perceived Future Self-Efficacy (Item #8): Preservice teachers indicated their ability as future teachers to influence students' effort, interest,

and achievement. (5-point continuous rating scale).

-Other Subject-/Topic-Specific Beliefs

a) Relevance of Topics in Mathematics and Language Arts for Overall Achievement and Future Success and

b) Relationship between Achievement and Gender of Students (Items #9 and #10): Short descriptions were given about four mathematics students whose achievement in computation and problem solving differed and four language arts students whose achievement in the combination of grammar and spelling and the combination of reading and writing differed. Each of the four students in the two subject areas were assessed by the preservice teachers for the following:

-assigned grades (0 to 100 continuous rating scale),

-future success in subject area (5-point continuous rating scale).

In addition, preservice teachers were asked to assign a probable gender for each of the four students in the two subject areas.

c) Inference of Achievement in one Subject to Achievement in Another (Items #11 and #12): This item provided a list of eight other elementary school subjects. Preservice teachers were asked to indicate whether or not a successful mathematics or language arts student would also be successful in these subjects.

d) Necessity of a Special Ability for Mathematics or Language Arts (Items #13 and #14): Preservice teachers were asked to indicate whether or not a special ability was required by a student to be successful in mathematics or language arts.

5.4 Data Processing and Analysis

Preservice teachers who did not answer the questions pertaining to the learning history, were excluded from any analysis. The remaining 167 students formed the sample of this study.

The statistical analysis was done on a personal computer using the SYSTAT computer package. Tables in which absolute frequencies are shown have percentages indicated in parentheses. A significance level of 0.05

was chosen throughout the study. Moreover, differences which reached the 0.01 level are indicated.

For the fifth research question dealing with self-efficacy (see Chapter 4.2.2) within-group comparisons were made using the Wilcoxon test. The between-group comparisons of the fifth and sixth research questions dealing with self-efficacy and the role of different topics (see Chapters 4.2.2 and 4.2.3) were made using the Mann-Whitney U test with the χ^2 approximation values being reported (see Table 9.2.1).

All other variables were analyzed using likelihood ratio χ^2 tests for both within- and between-group comparisons. In cases where the observed frequencies were smaller than required, categories were collapsed with a subsequent reduction in the degrees of freedom.

Sometimes values are presented graphically to provide a quick overview. In these cases, categorical data were transposed to numerical values of equal intervals in order to calculate arithmetic means to characterize the central tendency of the distribution. The decision on significant differences, however, was always based on χ^2 tests.

6. THE SAMPLE AND FORMATION OF THE EXTREME GROUPS

6.1 The Sample of P/J Preservice Teachers

The distribution of the sample of Primary/Junior (P/J) preservice teachers by age and gender is provided in Table 6.1.1. As can be seen, most of the P/J preservice teachers in this study were between 24 and 26 years of age. In addition, an overwhelming majority, almost 75%, were female.

Examining their high school training (see Table 6.1.2), one notices that over 85% took English up to grade 13, compared to only 64% who took mathematics up to the same grade. The difference in high school training between the two subjects was significant ($p < 0.01$). The better high school English training was expected as more English courses are required for an Ontario high school diploma compared to mathematics.

Table 6.1.1: Age and Gender of P/J Preservice Teachers

Gender	Years of Age					N
	21-23	24-26	27-29	30-34	35 and Older	
Male	5 (3.03)	15 (9.09)	10 (6.06)	7 (4.24)	5 (3.03)	42 (25.45)
Female	27 (16.36)	45 (27.27)	16 (9.70)	18 (10.91)	17 (10.31)	123 (74.55)
	32 (19.39)	60 (36.36)	26 (15.76)	25 (15.15)	22 (13.34)	165 (100)

Table 6.1.2: Highest Grade In Which Mathematics and English Were Taken In High School By P/J Preservice Teachers

Subject	Grade 11 and Below	Grade 12	Grade 13	N
Mathematics	9 (5.49)	50 (30.49)	105 (64.02)	164 (100)
English	1 (0.61)	23 (14.02)	140 (85.37)	164 (100)

$\chi^2(2, \underline{N} = 328) = 22.606, \underline{p} < 0.01$

This same trend continues when examining their subject training in university (see Table 6.1.3). About 15% of the P/J preservice teachers in the study took seven or more English courses in university compared to a little over 1% who took seven or more mathematics courses. The differences in the number of university courses between the two subjects were significant at the 0.01 level.

Table 6.1.4 shows that 90% of P/J preservice teachers were either interested or very interested in language arts. In contrast, there were 43% with a low interest in mathematics. The differences in interest between the two subjects were significant ($p < 0.01$).

About 81% of the P/J preservice teachers perceived their achievement in language arts as either above average or excellent, whereas 51% perceived their former mathematical achievement as either average or below average (see Table 6.1.5). The differences in the perceived former achievement between the two subjects were significant at the 0.01 level.

Table 6.1.3: Number of Mathematics and English Courses Taken in University By P/J Preservice Teachers

Subject	0	1	2	3	4	5	6	7 or more	N
Mathematics	53 (31.93)	27 (16.27)	39 (23.49)	16 (9.64)	14 (8.43)	8 (4.82)	7 (4.22)	2 (1.20)	166 (100)
English	50 (30.12)	38 (22.89)	22 (13.25)	11 (6.63)	9 (5.42)	2 (1.20)	9 (5.42)	25 (15.06)	166 (100)

$\chi^2(7, N = 332) = 36.063, p < 0.01$

Table 6.1.4: Interest in Mathematics and Language Arts of P/J Preservice Teachers

Subject	Not * Interested	Neutral	Interested	Very Interested	N
Mathematics	30 (17.96)	42 (25.15)	74 (44.31)	21 (12.57)	167 (100)
Language Arts	4 (2.40)	12 (7.19)	77 (46.11)	74 (44.31)	167 (100)

$\chi^2(3, N = 334) = 71.548, p < 0.01$

* Includes Not at all Interested

Table 6.1.5: Perceived Former Achievement in Mathematics and Language Arts of P/J Preservice Teachers

Subject	Below * Average	Average	Above Average	Excellent	N
Mathematics	14 (8.38)	72 (43.11)	52 (31.14)	29 (17.37)	167 (100)
Language Arts	- -	32 (19.16)	80 (47.90)	55 (32.93)	167 (100)

$\chi^2(3, N = 334) = 49.363, p < 0.01$

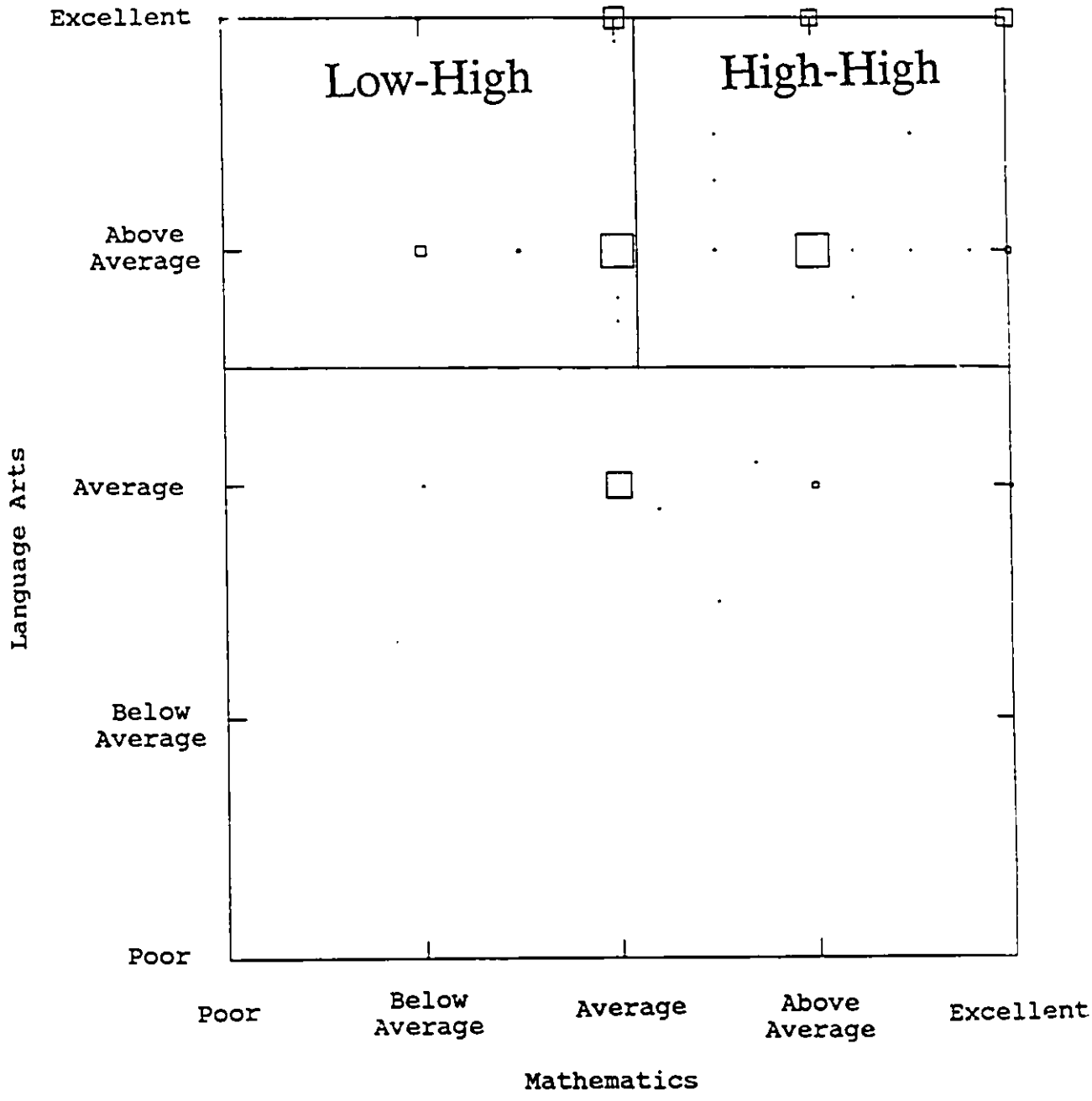
* Includes Poor Achievement

From Chapter 4.1.1, it was expected that interest and achievement would be related. This was indeed the case. There was a significant relationship between interest and perceived former achievement for both mathematics and language arts ($p < 0.01$) (see Appendix Tables B.1 and B.2).

6.2 Formation of the Extreme Groups

Graph 6.2.1 provides a scatter plot for the variable "perceived former achievement" in mathematics and language arts, on the basis of which the extreme groups were formed. The criteria for the extreme groups are indicated on the graph. As the graph shows, there were too few P/J preservice teachers with relatively low achievement in language arts to allow the formation of extreme groups with differing language arts achievement.

Graph 6.2.1: Perceived Former Achievement in Mathematics and Language Arts of P/J Preservice Teachers



The Low-High extreme group included those P/J preservice teachers whose perceived former achievement in mathematics was relatively low and whose perceived former achievement in language arts was relatively high. The High-High extreme group included those P/J preservice teachers whose perceived former achievement in both mathematics and language arts were relatively high. The specific values of perceived former achievement levels in mathematics and language arts separating these groups were:

Low-High:	mathematics	$\leq$	average
	language arts	>	midpoint between average and above average
High-High:	mathematics	>	average
	language arts	>	midpoint between average and above average

Sixty-three preservice teachers were included in the Low-High group (low mathematics achievement, high language arts achievement) while 70 preservice teachers made up the High-High group (high mathematics and language arts achievement). Preservice teachers in

both groups were comparable in age ($p > 0.05$, see Table 6.2.1) and in the proportion of males and females ($p > 0.05$, see Table 6.2.2). The majority in each group were females (about 70-80%).

Table 6.2.1: Age of Low-High and High-High Groups

Preservice Teacher Group	Years of Age 21-23	24-26	27-29	30-34	35 and Older	N
Low-High	13 (9.92)	26 (19.85)	6 (4.58)	9 (6.87)	8 (6.11)	62 (47.33)
High-High	14 (10.69)	21 (16.03)	13 (9.92)	13 (9.92)	8 (6.11)	69 (52.67)
	27 (20.61)	47 (35.88)	19 (14.50)	22 (16.79)	16 (12.22)	131 (100)

$\chi^2(4, \underline{N} = 131) = 3.568, \underline{p} > 0.05$

Table 6.2.2: Gender of Low-High and High-High Groups

Preservice Teacher Group	Male	Female	N
Low-High	18 (29.03)	44 (70.97)	62 (100)
High-High	15 (21.43)	55 (78.57)	70 (100)

$\chi^2(1, \underline{N} = 132) = 1.013, \underline{p} > 0.05$

7. RESULTS RELATED TO THE PREDECESSOR VARIABLES

The following research questions will be addressed in the first part of this chapter:

> Do groups of P/J preservice teachers with different subject-related achievement levels have different subject-related causal attribution patterns? If so, are these differences such that it is justified to describe the groups as having a more or less favourable subject-related learning history?

7.1 Perceived Former Achievement

The extreme groups were formed on the basis of their perceived former achievement (see Chapter 6.2). As intended, the Low-High group had a significantly lower achievement in mathematics when compared with language arts ($p < 0.01$; see Table C.1 in Appendix). No significant differences were found for the High-High group, meaning this group had the same level of achievement in both subjects ($p > 0.05$; see Table C.2 in Appendix). Moreover, when the subject areas were

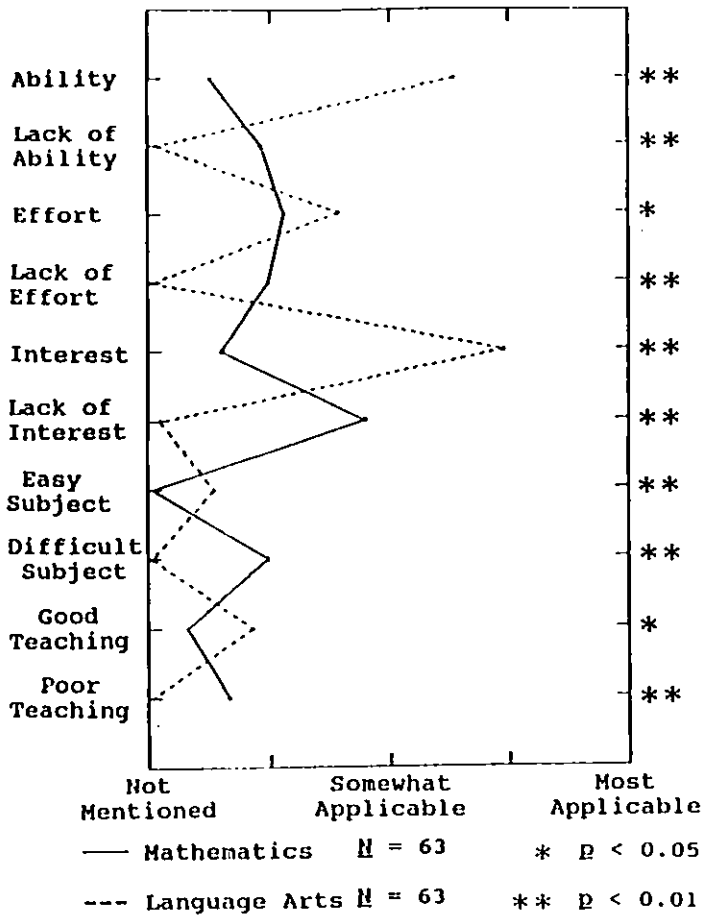
compared between groups, the Low-High group had a significantly lower achievement in mathematics ($p < 0.01$; see Table C.3 in Appendix) and a comparable achievement in language arts ($p > 0.05$; see Table C.4 in Appendix).

7.2 Attribution of Achievement in Mathematics and Language Arts

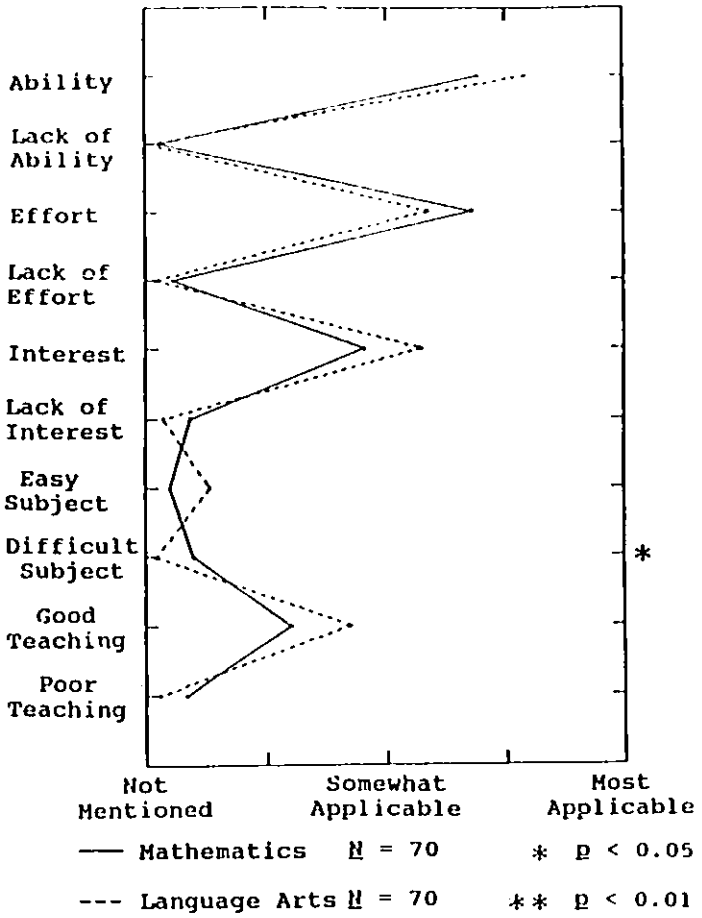
The Low-High group explained their low mathematics achievement distinctively different from their high language arts achievement. All differences were significant (see Graph 7.2.1). In explaining their mathematics achievement, lack of effort, lack of interest, and difficulty of the subject were more applicable while ability, easiness of the subject, and good teaching were less applicable. Thus, both internal and external reasons were used. In contrast, in explaining their language arts achievement, internal reasons such as ability, effort, and interest were more applicable than external reasons such as easiness of the subject or good teaching. The negative attribution reasons were almost never mentioned.

Graph 7.2.2 shows the High-High group used very similar attributions to explain their high mathematics and high language arts achievement. For both subjects, internal reasons such as ability, effort and interest were perceived as being more applicable than external reasons such as easiness of the subject or good teaching. Moreover, the negative reasons were rarely mentioned. Only for subject difficulty were significant differences found between the two subjects ($p < 0.05$). As only one significant difference was found, it is concluded, according to the line of reasoning pointed out in Chapter 4.1, that the subject area did not play a major role in influencing attributions.

Graph 7.2.1: Attribution of Achievement by the Low-High Group



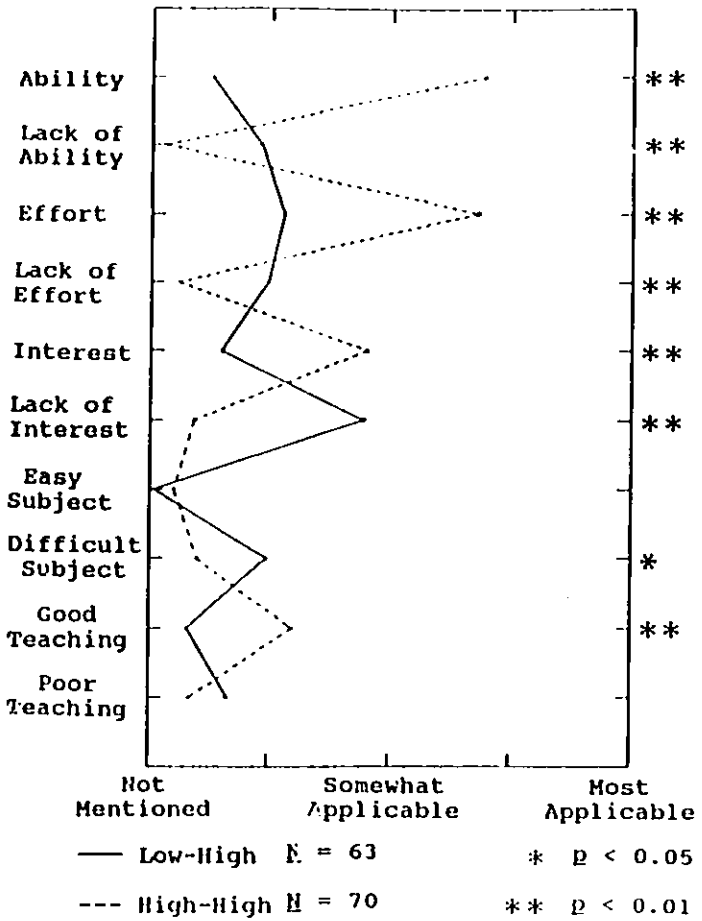
Graph 7.2.2: Attribution of Achievement by the High-High Group



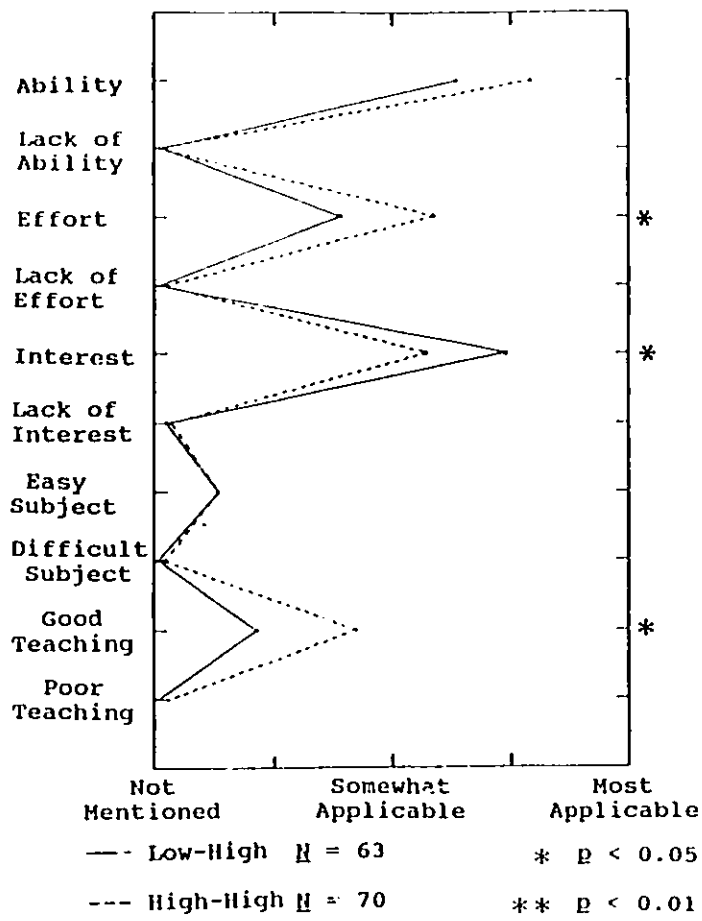
In mathematics, the low achievement of the Low-High group was attributed very differently from the high achievement of the High-High group. In fact, significant differences were found for most attribution reasons (see Graph 7.2.3). Only for easiness of the subject and poor teaching did the two groups agree ($p > 0.05$).

In language arts though, the high achievements of both groups were attributed in a similar manner. The two groups agreed for most attribution reasons (see Graph 7.2.4). The groups only differed in the degree effort, interest, and good teaching were called upon as reasons ($p < 0.05$).

Graph 7.2.3: Attribution of Mathematics Achievement Between Groups



Graph 7.2.4: Attribution of Language Arts Achievement Between Groups



Overall, groups of P/J preservice teachers with different subject achievement levels had different causal attribution patterns. The Low-High group attributed their mathematics achievement differently than their language arts achievement, while the High-High group attributed both their mathematics and language arts achievement in similar ways. Comparing groups in each subject, the Low-High and High-High groups had different attribution patterns in mathematics, but similar attribution patterns in language arts.

7.3 Learning History

As indicated above, a higher achievement was associated with a more positive attribution pattern and a better self-image of ability, while a lower achievement was associated with a more negative attribution pattern and poorer perception of one's own ability. In addition, preservice teachers with a higher achievement in a subject also had a more pronounced attribution pattern in which negative reasons were more decisively attributed as being less applicable.

Therefore, it follows that the Low-High group had a less favourable learning history in mathematics and a more favourable learning history in language arts. For the High-High group, the high achievement and positive attributional patterns in both subjects justified this group as having favourable learning histories in both mathematics and language arts.

Overall, the differences in the subject-related achievement levels, in association with the different subject-related causal attribution patterns, justified describing these groups in terms of a more or less favourable subject-related learning history.

7.4 Formal Subject Training

The research question addressed in this section is:

> Do the extreme groups differ in their formal training in the two subjects?

Only 42% of the preservice teachers in the Low-High group took mathematics up to grade 13 compared to 82% who took English up to the same grade (see Table 7.4.1). Differences in the high school training between the two subjects were significant ($p < 0.01$). In contrast, 82% of High-High group took mathematics up to grade 13 with a comparable majority taking English up to the same grade ($p > 0.05$; see Table 7.4.2). When the two groups were compared, the groups differed significantly in their high school mathematics training ($p < 0.01$), but not in their high school English training ($p > 0.05$). (See Tables C.5 and C.6 respectively in Appendix).

Table 7.4.1: Highest Grade In Which Mathematics and English Were Taken In High School By Low-High Group

Subject	Grade 11 and Below	Grade 12	Grade 13	N
Mathematics	6 (9.84)	29 (47.54)	26 (42.62)	61 (100)
English	1 (1.61)	10 (16.13)	51 (82.26)	62 (100)

$\chi^2(1, N = 123) = 21.420, p < 0.01$

Table 7.4.2: Highest Grade In Which Mathematics and English Were Taken In High School By High-High Group

Subject	Grade 11 and Below	Grade 12	Grade 13	N
Mathematics	1 (1.45)	11 (15.94)	57 (82.61)	69 (100)
English	- -	6 (8.82)	62 (91.18)	68 (100)

$\chi^2(1, N = 137) = 2.242, p > 0.05$

Somewhat similar results were found when the subject training in university was examined. The Low-High group took significantly more university courses in English compared to mathematics ($p < 0.05$; see Table 7.4.3). The High-High group took a comparable number of university courses in both subjects ($p > 0.05$; see Table 7.4.4). Yet, when the two groups were compared, there were no significant differences between the groups for either mathematics or English ($p > 0.05$; see Tables C.7 and C.8 respectively in the Appendix).

Overall, the Low-High and High-High groups had different formal training in mathematics, but had similar formal training in English. The differences in formal mathematics training were more pronounced in high school than in university.

Table 7.4.3: Number of Mathematics and English Courses Taken in University By Low-High Group

Subject	0	1	2	3	4	5	6	7 or more	N
Mathematics	23 (36.51)	14 (22.22)	13 (20.63)	7 (11.11)	5 (7.94)	- -	1 (1.59)	- -	63 (100)
English	14 (22.22)	15 (23.81)	9 (14.29)	5 (7.94)	- -	- -	8 (12.70)	12 (19.05)	63 (100)

$\chi^2(4, N = 126) = 11.265, p < 0.05$

Table 7.4.4: Number of Mathematics and English Courses Taken in University By High-High Group

Subject	0	1	2	3	4	5	6	7 or more	N
Mathematics	18 (26.09)	11 (15.94)	18 (26.09)	6 (8.70)	7 (10.14)	4 (5.80)	3 (4.35)	2 (2.89)	69 (100)
English	22 (31.88)	17 (24.64)	8 (11.59)	3 (4.35)	6 (8.70)	1 (1.45)	1 (1.45)	11 (15.94)	69 (100)

$\chi^2(5, N = 138) = 7.471, p > 0.05$

7.5 Interest in Subjects

The research question addressed in this section is:

> Do the extreme groups differ in their interest in the two subjects?

Both the Low-High and High-High groups were significantly more interested in language arts compared to mathematics ($p < 0.01$; see Tables 7.5.1 and 7.5.2 respectively). Yet, when interest in mathematics was compared between the two groups, the High-High group was significantly more interested than the Low-High group ($p < 0.01$; see Table C.9 in Appendix). As could be inferred above, both groups had similar interests in language arts ($p > 0.05$; see Table C.10 in Appendix).

The two extreme groups differed in their mathematical interest but did not differ in their language arts interest. Overall, language arts was considered to be more interesting than mathematics.

Table 7.5.1: Interest of Low-High Group

Subject	Not Interested *	Neutral	Interested	Very Interested	N
Mathematics	20 (31.75)	19 (30.16)	22 (34.92)	2 (3.17)	63 (100)
Language Arts	- -	2 (3.17)	28 (44.44)	33 (52.38)	63 (100)

$\chi^2(3, N = 126) = 77.539, p < 0.01$

* Includes Not at all Interested

Table 7.5.2: Interest of High-High Group

Subject	Not Interested *	Neutral	Interested	Very Interested	N
Mathematics	8 (11.43)	16 (22.86)	31 (44.29)	15 (21.43)	70 (100)
Language Arts	1 (1.43)	6 (8.57)	30 (42.86)	33 (47.14)	70 (100)

$\chi^2(3, N = 140) = 17.848, p < 0.01$

* Includes Not at all Interested

8. RESULTS RELATED TO THE ATTRIBUTION OF STUDENTS' ACHIEVEMENT

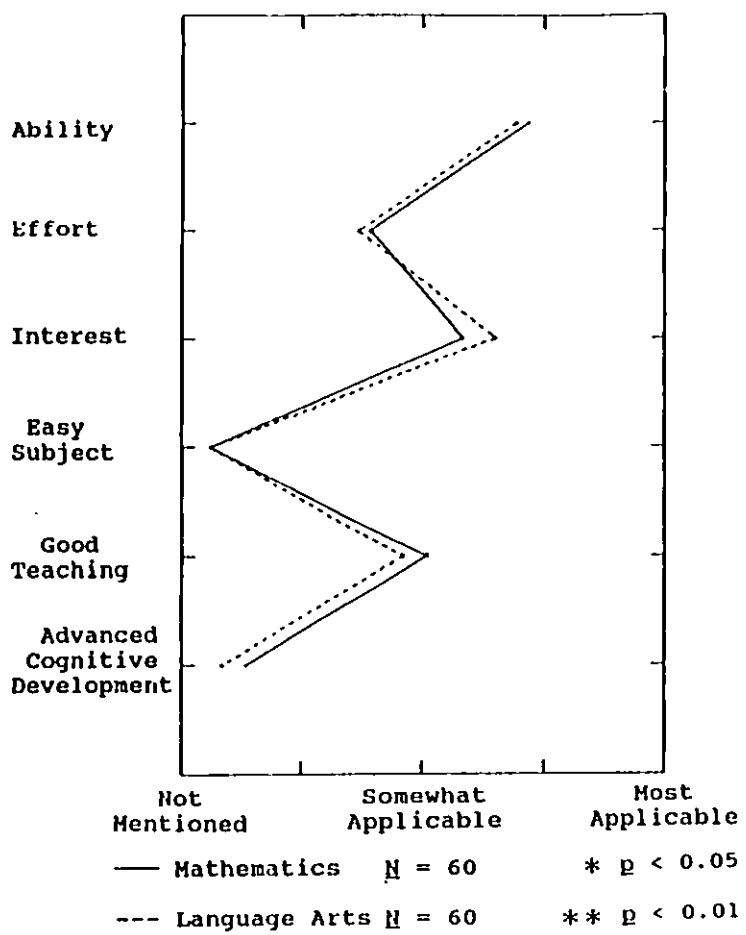
The research question addressed in this chapter is:

> Do P/J preservice teachers with different subject-related learning histories attribute students' achievement in mathematics and language arts differently?

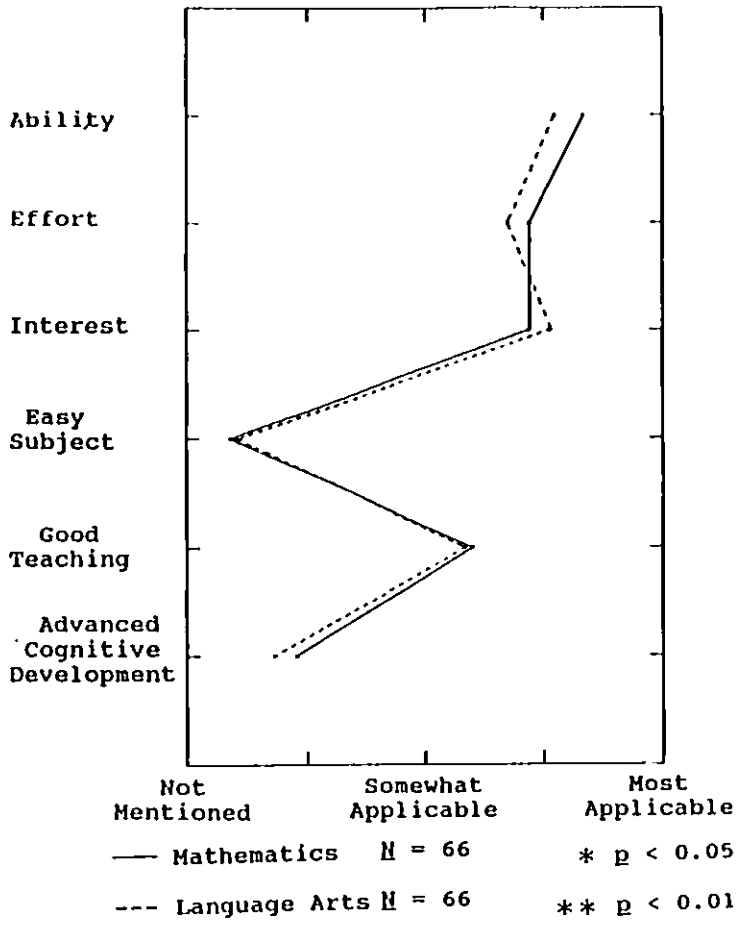
8.1 Very Good Student Achievement

Comparing subject areas within groups, the Low-High group used very similar attributions to explain very good student achievement in mathematics and language arts (see Graph 8.1.1). For both subject areas, ability, interest, and good teaching were attributed as being more applicable than other reasons. No significant differences were found between the two subjects ($p > 0.05$ for all reasons). The High-High group also used similar attributions for both subjects ($p > 0.05$ for all reasons; see Graph 8.1.2).

Graph 8.1.1: Attribution of Very Good Student Achievement by the Low-High Group



Graph 8.1.2: Attribution of Very Good Student Achievement by the High-High Group



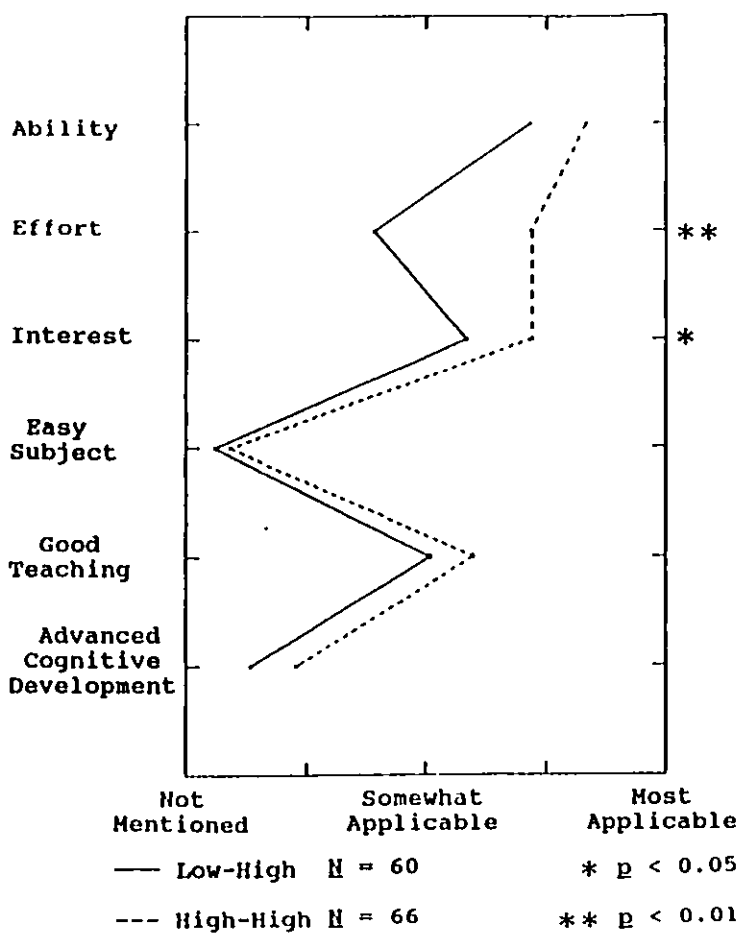
Here however, effort also played a large role in addition to ability, interest and good teaching.

When the attributions for mathematics (see Graph 8.1.3) and language arts (see Graph 8.1.4) were compared between groups, both groups used similar attributions in both subjects. The groups agreed as to ability, easiness of the subject, good teaching and advanced cognitive development in both subjects. The groups only differed in two aspects. First, the High-High group indicated that effort was significantly more applicable than the Low-High group in both subjects ($p < 0.01$ for both subjects). Second, the High-High group believed interest was significantly more applicable in mathematics than the Low-High group ($p < 0.05$).

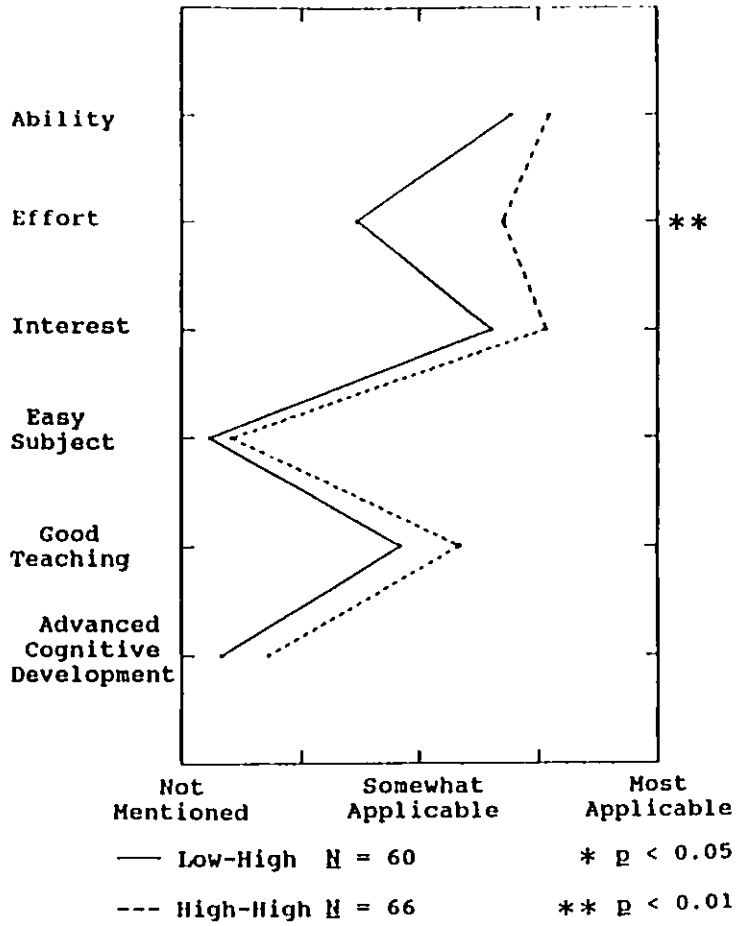
8.2 Very Poor Student Achievement

The Low-High group attributed very poor student achievement similarly for both subjects (see Graph 8.2.1). Only one significant difference was found. Mathematics was perceived as being more difficult than language arts ($p < 0.01$).

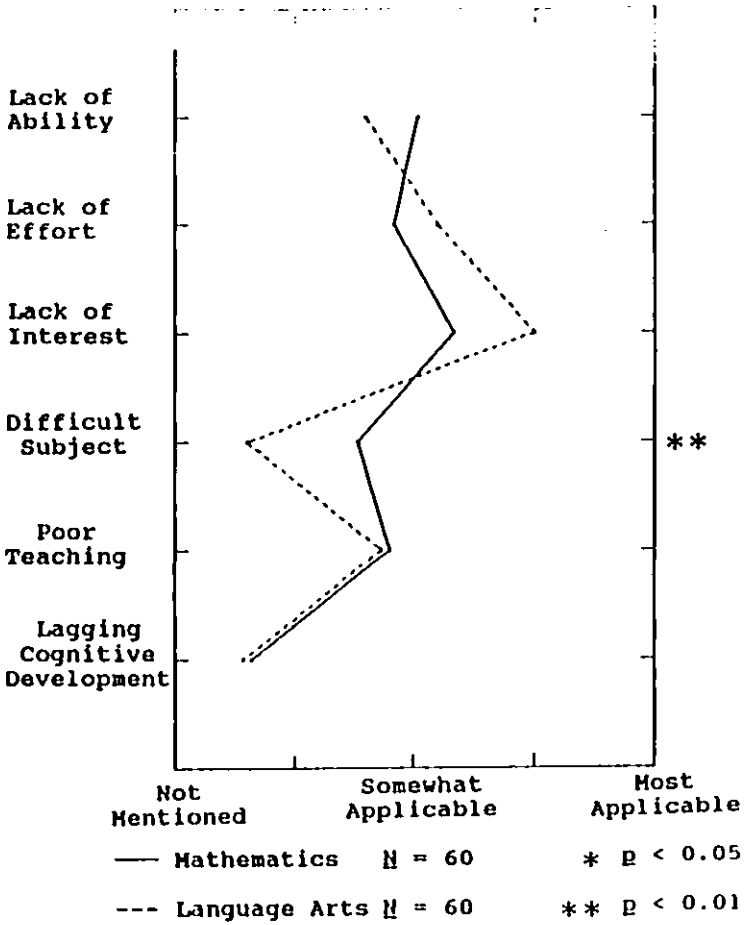
Graph 8.1.3: Attribution of Very Good Student Achievement in Mathematics Between Groups



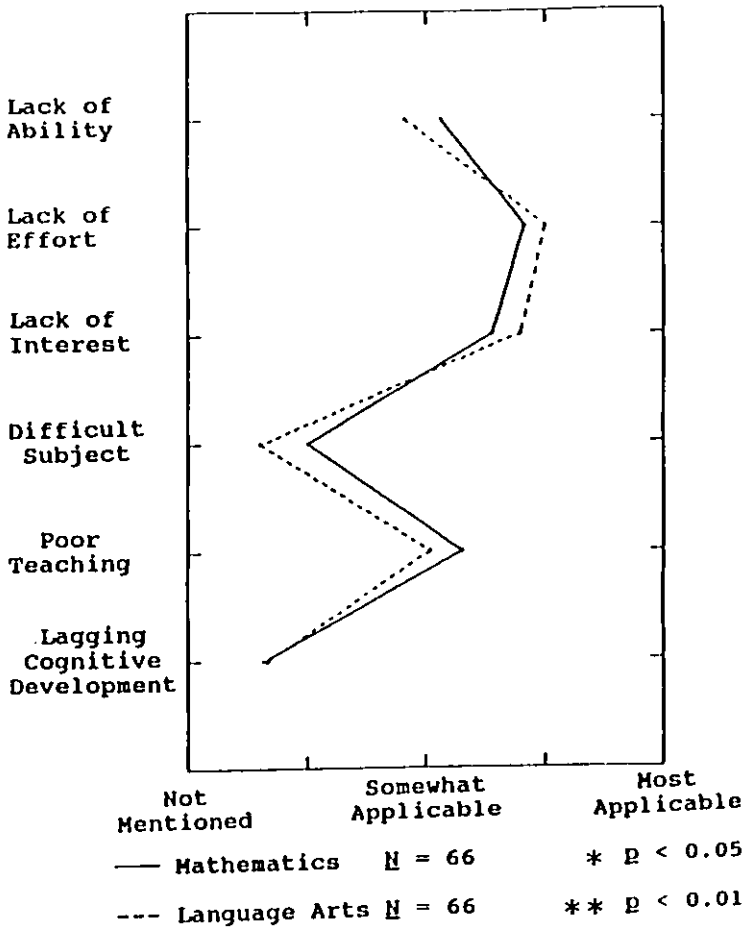
Graph 8.1.4: Attribution of Very Good Student Achievement in Language Arts Between Groups



Graph 8.2.1: Attribution of Very Poor Student Achievement by the Low-High Group



Graph 8.2.2: Attribution of Very Poor Student Achievement by the High-High Group

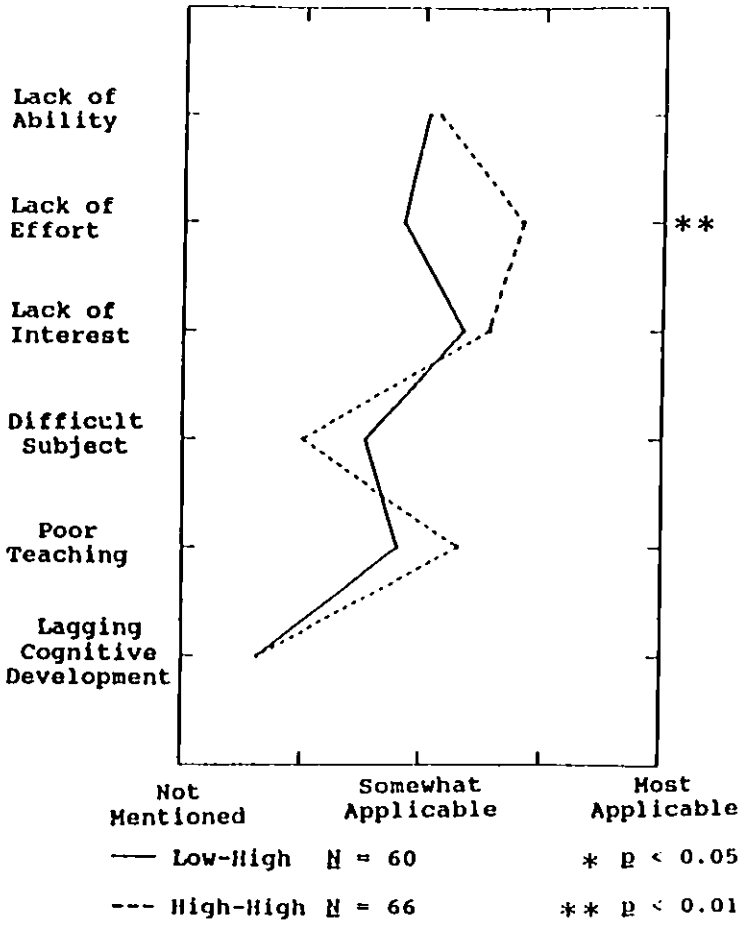


The High-High group had comparable attribution patterns for both subjects ($p > 0.05$ for all reasons; see Graph 8.2.2).

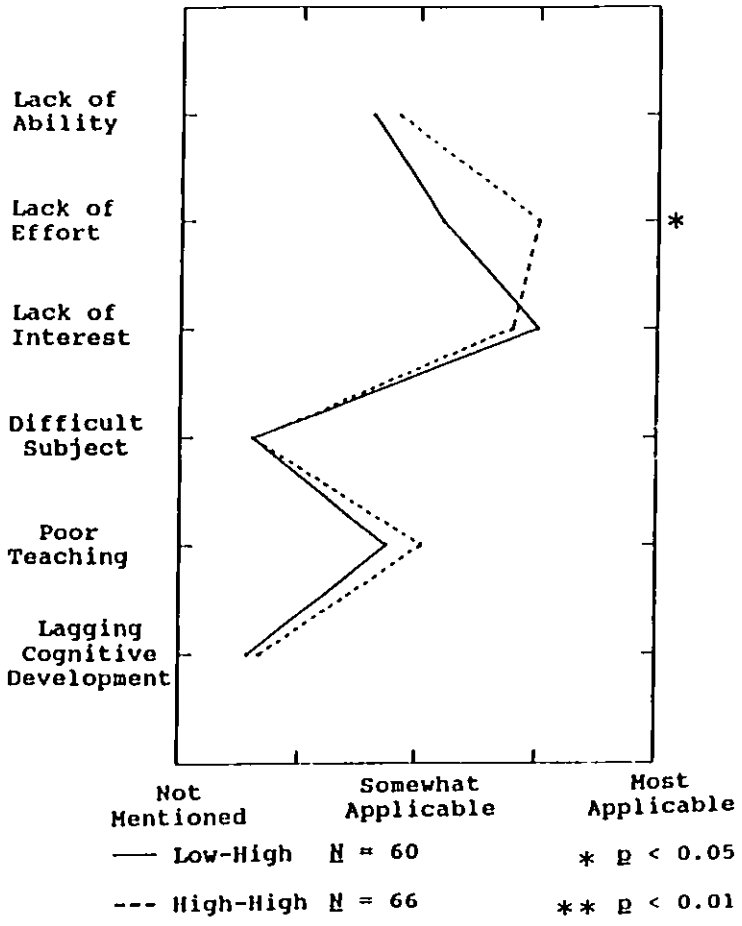
When between-group comparisons were made, the attribution patterns of the groups were much alike in both mathematics and language arts (see Graph 8.2.3 and 8.2.4 respectively). The only differences found were the High-High group attributed lack of effort as being significantly more applicable in both mathematics ($p < 0.01$) and language arts ($p < 0.05$) compared to the Low-High group.

Overall, P/J preservice teachers with different learning histories did not attribute students' achievement differently in mathematics or language arts. Yet, the High-High group attributed effort and lack of effort as being more applicable than the Low-High group for the two levels of student achievement.

Graph 8.2.3: Attribution of Very Poor Student Achievement in Mathematics Between Groups



Graph 8.2.4: Attribution of Very Poor Student Achievement in Language Arts Between Groups



9. RESULTS RELATED TO PERCEIVED FUTURE SELF-EFFICACY

In this chapter the following research question will be addressed:

> Do P/J preservice teachers with different subject-related learning histories have different perceptions of their ability to influence students' effort, interest, and achievement in the two subject areas?

As Tables D.1 and D.2 in the Appendix show, some preservice teachers indicated the same value for two of the three student aspects (i.e. effort, interest, and achievement). Yet, only about 20% of the preservice teachers who answered this question indicated the same value for all three aspects.

9.1 Aspects Perceived to be Influenced the Most

Table 9.1.1 indicates that there were no significant differences between subject areas in the student aspect the Low-High group believed they could

influence the most ($p > 0.05$). About half of the group believed they could most influence students' effort, while the other half believed they could most influence students' interest. Students' achievement was almost never indicated as being able to be influenced the most by the Low-High group.

The High-High group did not differ between subject areas either ($p > 0.05$; see Table 9.1.2). Here however, more of the group believed they could most influence students' interest than either students' effort or achievement. Yet, some preservice teachers in the High-High group indicated they could most influence students' achievement.

When the groups were compared, the two groups did not differ significantly in either mathematics or language arts ($p > 0.05$; see Tables D.3 and D.4 respectively in Appendix).

Table 9.1.1: Student Aspect Believed to be Influenced the Most by Low-High Group

Subject	Effort	Interest	Achievement	N
Mathematics	13 (46.43)	14 (50.00)	1 (3.57)	28 (100)
Language Arts	13 (43.33)	15 (50.00)	2 (6.67)	30 (100)

$\chi^2(2, N = 58) = 0.305, p > 0.05$

Table 9.1.2: Student Aspect Believed to be Influenced the Most by High-High Group

Subject	Effort	Interest	Achievement	N
Mathematics	11 (30.56)	19 (52.78)	6 (16.67)	36 (100)
Language Arts	10 (29.41)	20 (58.82)	4 (11.76)	34 (100)

$\chi^2(2, N = 70) = 0.419, p > 0.05$

9.2 Level of Influence of Students' Aspects

From within-group comparisons made using Wilcoxon tests, the Low-High group believed they were significantly less able to influence students' effort, interest, and achievement in mathematics compared to language arts ($p < 0.05$, $p < 0.01$, and $p < 0.05$, respectively). For the High-High group, students' interest was believed to be influenced significantly more in language arts compared to mathematics ($p < 0.01$). This may be due to the fact that the High-High group was also more interested in language arts compared to mathematics (see Chapter 7.5).

When the two groups were compared using Mann-Whitney U tests, the High-High group believed they were able to influence students' mathematical achievement significantly more than the Low-High group ($p < 0.05$; see Table 9.2.1).

Table 9.2.1: Future Self-Efficacy in Influencing Students in Mathematics and Language Arts Between Groups

Student Aspect	Low-High versus High-High Preservice Teachers			
	Mathematics		Language Arts	
	χ^2	p	χ^2	p
Effort	0.213		2.154	
Interest	0.003		0.295	
Achievement	4.435	*	0.189	

N = 97
df = 1

** p < 0.01
* p < 0.05

Overall, preservice teachers with different learning histories differed in their perceived level of influence of students' aspects but did not differ for the student aspect they could influence the most. Preservice teachers with a less favourable mathematical learning history believed they were less able to influence students' effort, interest, and achievement in mathematics compared to language arts. In addition, the two groups also differed in their perceived ability to influence students' mathematical achievement, with the Low-High group having the lower perception.

10. RESULTS RELATED TO OTHER SUBJECT-/TOPIC-SPECIFIC BELIEFS

10.1 Relevance of Topics in Mathematics and Language Arts For Overall Achievement and Future Success

The research question addressed in this section is:

> Does the learning history influence preservice teachers' perception of the role different topics have within each subject area on the overall achievement and future success of students?

10.1.1 Mathematics Topics

Table 10.1.1 shows how the Low-High group ranked the grades of each of the four mathematics students with different achievements in computation and problem solving. As expected, the highest grade was assigned to the student who did well in both topics, while the lowest grade was assigned to the student who did fair in both topics. The relationship between student achievement and grades assigned by preservice teachers was significant overall ($\chi^2 = 390.794$; $p < 0.01$).

Moreover, it was of interest to know whether or not the grades assigned to the two students who only did well in one of the two topics contributed to this significant result as well. Therefore, an individual χ^2 test was performed for the indicated centre cell. The results showed that the Low-High group assigned a significantly higher grade to the student who only did well in computation compared to the student who only did well in problem solving ($\chi^2 = 7.685$; $p < 0.01$).

When the High-High group was examined, similar overall significant differences were found as well ($p < 0.01$; see Table 10.1.2). This group, however, assigned comparable grades to the two students who only did well in one topic as indicated in the table ($p > 0.05$).

Yet, when the groups were compared using Mann-Whitney U tests, no significant differences were found between the groups for either of these two students ($p > 0.05$).

Table 10.1.1: Student Achievement in Computation/Problem Solving in Mathematics versus Rank of Grades Assigned By Low-High Group

Achievement Computation/ Problem Solving	Rank of Grade Lowest	Second Lowest	Second Highest	Highest	N
Good/Good	-	-	-	53	53
	-	-	-	(100.00)	(100)
Good/Fair *	1	13	24	-	38
	(2.63)	(34.21)	(63.16)	-	(100)
Fair/Good	-	26	13	-	39
	-	(66.67)	(33.33)	-	(100)
Fair/Fair	54	-	1	-	55
	(98.18)	-	(1.82)	-	(100)

$\chi^2(9, N = 185) = 390.794, p < 0.01$

* $\chi^2(1, N = 76) = 7.685, p < 0.01$

Table 10.1.2: Student Achievement in Computation/Problem Solving in Mathematics versus Rank of Grades Assigned By High-High Group

Achievement Computation/ Problem Solving	Rank of Grade Lowest	Second Lowest	Second Highest	Highest	N
Good/Good	-	1	1	53	55
	-	(1.82)	(1.82)	(96.36)	(100)
Good/Fair	2	21	21	1	45
	(4.44)	(46.67)	(46.67)	(2.22)	(100)
Fair/Good	-	21	21	1	43
	-	(48.84)	(48.84)	(2.33)	(100)
Fair/Fair	55	2	-	-	57
	(96.49)	(3.51)	-	-	(100)

$\chi^2(9, N = 200) = 362.455, p < 0.01$

* $\chi^2(1, N = 84) = 0.000, p > 0.05$

Results similar to those above were found for the perceived future success of students as well. The Low-High group believed that the student who only did well in computation would have a significantly better future success than the student who only did well in problem solving ($p < 0.01$; see Table E.1 in Appendix).

The High-High group perceived similar success for both students in the future ($p > 0.05$; see Table E.2 in Appendix). When the groups were compared, no significant differences were found for either of these two students ($p > 0.05$).

Overall, the group with a less favourable mathematical learning history assigned higher grades and perceived that the student who did well in computation would have more success in the future compared to the student who did well in problem solving. Yet when groups with different mathematical learning histories were compared, no significant differences were found between the groups. Therefore, one can conclude that the learning history had some influence in the perceived role different topics have

within mathematics on the overall achievement and future success of students.

10.1.2 Language Arts Topics

Both the Low-High and High-High groups assigned significantly higher grades to the student who only did well in reading and writing compared the student who only did well in spelling and grammar ($p < 0.01$; see Tables 10.1.3 and 10.1.4 respectively). As expected from the above, when the two groups were compared for each student, both groups assigned similar grades to both students ($p > 0.05$).

Likewise, when the perceived success of students was examined, both the Low-High and High-High groups believed that the student who was better in reading and writing would be more successful than the student who only did well in grammar and spelling ($p > 0.01$; see Tables E.3 and E.4 in Appendix). From the between-group comparisons of the two students, both groups shared the same perceived success for both students ($p > 0.05$).

Table 10.1.3: Student Achievement in Reading and Writing/Grammar and Spelling in Language Arts versus Rank of Grades Assigned By Low-High Group

Achievement Reading and Writing/ Grammar and Spelling	Rank of Grade Lowest	Second Lowest	Second Highest	Highest	N
Good/Good	1 (1.89)	- -	- -	52 (98.11)	53 (100)
Good/Fair *	- -	5 (12.82)	34 (87.18)	- -	39 (100)
Fair/Good *	- -	35 (87.50)	5 (12.50)	- -	40 (100)
Fair/Fair	53 (98.15)	- -	- -	1 (1.85)	54 (100)

$\chi^2(9, N = 186) = 431.555, p < 0.01$

* $\chi^2(1, N = 79) = 49.492, p < 0.01$

Table 10.1.4: Student Achievement in Reading and Writing/Grammar and Spelling in Language Arts versus Rank of Grades Assigned By High-High Group

Achievement Reading and Writing/ Grammar and Spelling	Rank of Grade Lowest	Second Lowest	Second Highest	Highest	N
Good/Good	-	1	1	53	55
	-	(1.82)	(1.82)	(96.36)	(100)
Good/Fair	-	8	35	1	44
	-	(18.18)	(79.55)	(2.27)	(100)
Fair/Good	1	34	8	1	44
	(2.27)	(77.27)	(18.18)	(2.27)	(100)
Fair/Fair	54	1	-	-	55
	(98.18)	(1.82)	-	-	(100)

$\chi^2(9, N = 198) = 405.763, p < 0.01$

* $\chi^2(1, N = 85) = 35.605, p < 0.01$

Clearly, the learning history did not influence the perceived role different topics have within language arts on overall achievement and future success of students. Both groups of preservice teachers believed that the student who only did well in reading and writing would have a better overall achievement and success in the future compared to the student who only did well in spelling and grammar.

10.2 Relationship Between Achievement and Gender of Students

The research question addressed in this section is:

> Does the learning history influence the gender typically assigned to students with different performance levels in mathematics and language arts?

Only 46% of the Low-High group and 27% of the High-High group answered the question on gender. In fact, many preservice teachers remarked that this question was inappropriate. This is a good indication that many preservice teachers were aware that differences in achievement should not be based on a particular gender. Despite this, gender differences based on achievement in subjects were indicated by those preservice teachers who did answer the question.

In mathematics, both the Low-High and High-High groups believed that a student who did well would probably be male, while a student who only did fair would probably be female ($p < 0.01$;

Table 10.2.1: Student Achievement in Mathematics versus Gender for Low-High Group

Achievement in Both Topics	Gender		N
	Male	Female	
Good	20 (68.97)	9 (31.03)	29 (100)
Fair	6 (20.69)	23 (79.31)	29 (100)

$\chi^2(1, N = 58) = 14.290, p < 0.01$

Table 10.2.2: Student Achievement in Mathematics versus Gender for High-High Group

Achievement in Both Topics	Gender		N
	Male	Female	
Good	15 (78.95)	4 (21.05)	19 (100)
Fair	4 (21.05)	15 (78.95)	19 (100)

$\chi^2(1, N = 38) = 13.566, p < 0.01$

see Tables 10.2.1 and 10.2.2 respectively). When the groups were compared for each student with different mathematics achievement, both groups were found to share the same above belief ($p > 0.05$; see Tables E.5 and E.6 in Appendix).

In contrast, for language arts, both the Low-High and High-High groups believed that a student who did well would probably be female, while a student who only did fair would probably be male ($p < 0.01$; see Tables 10.2.3 and 10.2.4). Comparing groups for each of the two language arts students, the two groups were found to be in agreement with the above belief ($p > 0.05$; see Tables E.7 and E.8 in Appendix).

Overall, it was encouraging that most preservice refused to answer the question. The learning history was not found to influence the gender typically assigned to students with different performance levels in mathematics and language arts. Instead, both groups believed that a successful mathematics student would probably be male while a successful language arts student would be female.

Table 10.2.3: Student Achievement in Language Arts versus Gender for Low-High Group

Achievement in Both Topics	Gender		N
	Male	Female	
Good	5 (17.24)	24 (82.76)	29 (100)
Fair	23 (79.31)	6 (20.69)	29 (100)

$\chi^2(1, N = 58) = 24.105, p < 0.01$

Table 10.2.4: Student Achievement in Language Arts versus Gender for High-High Group

Achievement in Both Topics	Gender		N
	Male	Female	
Good	5 (26.32)	14 (73.68)	19 (100)
Fair	15 (78.95)	4 (21.05)	19 (100)

$\chi^2(1, N = 38) = 11.116, p < 0.01$

10.3 Inference of Achievement in one Subject to Achievement in Another

The research question addressed in this section is as follows:

> Does the learning history influence the inference made from success in mathematics or language arts to other school subjects?

Tables 10.3.1 and 10.3.2 indicate those subjects chosen by the Low-High and High-High groups respectively, where significant differences between the successful mathematics and language arts students were found. Both groups believed that a successful mathematics student would do well in science, while a successful language arts student would do well in history, music, French, and art ($p < 0.01$). Of particular interest was that the Low-High group believed that a successful mathematics student would do well in language arts, but not the reverse ($p < 0.05$).

Table 10.3.1: Differences between Successful Mathematics and Language Arts Students in Low-High Group as to Success in Other Subjects

Subject Chosen	Mathematics versus Language Arts χ^2	p
Science	69.794	**
History	21.489	**
Language Arts/ Mathematics	6.009	*
Geography	0.883	
Music	9.180	**
French	24.628	**
Physical Education	0.000	
Art	25.081	**

N = 114
df = 1

* $p < 0.05$
** $p < 0.01$

Table 10.3.2: Differences between Successful Mathematics and Language Arts Students in High-High Group as to Success in Other Subjects

Subject Chosen	Mathematics versus Language Arts χ^2	p
Science	59.570	**
History	10.508	**
Language Arts/ Mathematics	1.365	
Geography	0.314	
Music	6.710	**
French	25.984	**
Physical Education	0.000	
Art	8.065	**

$N = 118$
$df = 1$

* $p < 0.05$
** $p < 0.01$

Comparing the two groups in mathematics, the only significant difference found was that the High-High group more strongly believed that a successful mathematics student would do well in history compared to the Low-High group ($p < 0.05$; see Table E.9 in Appendix). The groups agreed on the subjects chosen for the successful language arts student ($p > 0.05$ for all subjects; see Table E.10 in Appendix).

Overall, there was some indication that the learning history influenced the inference made between success in mathematics and language arts. The group with a less favourable learning history believed that a student who was successful in mathematics would also be successful in language arts. Yet, the two groups chose similar subjects in which successful mathematics and language arts students would also do well.

10.4 Necessity of a Special Ability for Mathematics or Language Arts

In this section the following research question will be addressed:

> Is the learning history related to belief in the requirement of a special ability in mathematics or language arts for success in the subject area?

Most preservice teachers in both groups were either undecided or did not believe that a special ability was required in mathematics or language arts (see Tables 10.4.1 and 10.4.2). No significant differences were found between subjects for either group ($p > 0.05$). When the two groups were compared, the groups had comparable beliefs in both mathematics and language arts ($p > 0.05$; see Tables E.11 and E.12 in Appendix respectively).

Overall, the learning history was not related to the belief that a special ability in mathematics or language arts was required in order to be successful in the subjects. In fact, relatively few preservice

teachers, only about 25%, believed a special ability was even required.

Table 10.4.1: Student Special Ability Required in Mathematics and Language Arts By Low-High Group

Subject	No	Undecided	Yes	N
Mathematics	21 (35.00)	24 (40.00)	15 (25.00)	60 (100)
Language Arts	23 (38.33)	25 (41.67)	12 (20.00)	60 (100)

$\chi^2(2, N = 120) = 0.445, p > 0.05$

Table 10.4.2: Student Special Ability Required in Mathematics and Language Arts By High-High Group

Subject	No	Undecided	Yes	N
Mathematics	23 (36.51)	21 (33.33)	19 (3C.16)	63 (100)
Language Arts	25 (39.68)	21 (33.33)	17 (26.98)	63 (100)

$\chi^2(2, N = 126) = 0.195, p > 0.05$

11. SUMMARY AND CONCLUSIONS

The purpose of this study was to investigate whether P/J preservice teachers' mathematical and language arts learning histories influenced specific teaching-related perceptions in the two subjects. The term "learning history" was used to describe preservice teachers' perceived former achievement in association with the attributions they used to explain this achievement. In a previous study, Kuendiger (1990) related differences in preservice teachers' learning history in mathematics to differences in their perceptions about mathematics teaching. This research, a follow-up study of Kuendiger's initial investigation, extended the investigation of preservice teachers' learning history across the two subject areas of mathematics and language arts. In addition to investigating other teaching-related beliefs from Kuendiger (1990), preservice teachers' future self-efficacy was investigated in more detail by specifically examining their beliefs in their ability to influence students' effort, interest, and achievement.

The relationship between the subject-related learning history and teaching-related beliefs was investigated by comparing groups of P/J preservice teachers with different learning histories to identify differences in their beliefs. The variable "perceived former achievement" in mathematics and language arts was used as the criterion to identify groups with different learning histories. The sample of P/J preservice teachers in this study had a higher interest and a higher overall former achievement in language arts compared to mathematics, which meant that only two extreme groups could be identified. As intended, the Low-High group had a significantly lower former achievement in mathematics compared to language arts, while the High-High group had comparably high former achievement in both subjects. When groups were compared in both subjects, the Low-High group had a significantly lower achievement and interest in mathematics than the High-High group, while in language arts the achievement and interest of both groups were similarly high. Moreover, the High-High group also had a significantly better formal training in mathematics than the Low-High groups, but both groups had a

comparably good formal training in language arts. From the data collected during the first year of Kuendiger's investigation (1990), groups of preservice teachers with different mathematical learning histories also had significantly different formal mathematical training. However, no differences were found from the data collected during the second year of the investigation. Therefore, in summary, no decisive conclusion can be made concerning the relationship between the formal training of preservice teachers and their learning history.

11.1 Learning History

From the reviewed literature, as well as the results from Kuendiger (1990), a higher former achievement was expected to be attributed more to ability and effort, while a lower former achievement was expected to be attributed more to lack of effort and subject difficulty. This was indeed the case.

The Low-High group used distinctively different attributions to explain their different achievements in the two subjects. Low mathematics achievement was attributed significantly more to lack of effort, lack

of interest, and subject difficulty, while high language arts achievement was attributed significantly more to ability, effort and interest.

In contrast, the High-High group used very similar attributions to explain their comparable achievements in both subjects. Both high mathematical and language arts achievement were attributed more to ability, effort, and interest, while the negative attribution reasons were almost never mentioned. Only one significant difference was found; mathematics was perceived as more difficult than language arts.

The groups were also compared in each subject. In mathematics, the two groups used significantly different attributions to explain their mathematical achievement, which confirmed the results of Kuendiger (1990). The higher mathematical achievement of the High-High group was attributed significantly more to ability and effort and significantly less to lack of ability, lack of effort, and lack of interest than the lower mathematical achievement of the Low-High group. In language arts though, both groups had very similar attribution patterns, although significant differences

occurred in the degree that effort, interest, and good teaching were called upon as reasons.

It can be concluded from the above that a higher achievement was associated with a more positive attribution pattern and a better self-image of ability, while a lower achievement was associated with a more negative attribution pattern and poorer perception of one's ability. The former achievement in association with attributions used to explain this achievement, justifies that the Low-High group had a less favourable learning history in mathematics and a more favourable learning history in language arts, while the High-High group had a favourable learning history in both mathematics and language arts. Thus, the variable "perceived former achievement" was suitable as a criterion to form groups of different learning histories.

Attributions seemed to be mostly influenced by achievement, with the subject area only playing a role in that mathematics was considered a more difficult subject. The fact that Low-High and High-High groups differed in the degree they called upon some reasons when explaining language arts achievement, indicates

that attributions were not only influenced by the achievement level and subject area. One possible explanation is that the High-High group may generally be more success oriented as they did well in the two subjects. Obviously further studies are required to investigate this conjecture.

11.2 Teaching Beliefs

This study investigated the relationship between groups of P/J preservice teachers with different learning histories and beliefs about their

(1) attribution of students' achievement,
(2) self-efficacy as future teachers, and
(3) other subject-/topic-related perceptions.

The belief which was most closely linked to the learning history was the self-efficacy as future teachers. The Low-High group, having a less favourable mathematical learning history and a more favourable language arts learning history, believed they were significantly less able to influence students' effort, interest, and achievement in mathematics compared to language arts. In addition, when the Low-High and High-High groups were compared in mathematics,

preservice teachers with a less favourable mathematical learning history believed they were significantly less able to influence students' mathematical achievement compared to those with a more favourable mathematical learning history. Kuendiger (1990) also found that P/J preservice teachers with a less favourable mathematical learning history were not only less confident teaching mathematics, but also considered their personal insufficiency in teaching as a more relevant reason to explain students' lack of progress in mathematics. The results of both studies indicate that the learning history influences the expected self-efficacy as future teachers. As a result, preservice teachers with a less favourable mathematical learning history may give up more easily on students who are having difficulty in mathematics since they themselves feel less able to influence students' achievement in the subject. The lack of persistent assistance by the teacher may, in turn, cause the achievement levels of these students to fall further. Further studies are needed to determine whether or not differences in preservice teachers' learning histories are related to differences in

classroom behaviour such as giving up easily on students with difficulties.

Although the attribution of students' achievement was not directly influenced by whether or not the learning history was more or less favourable, results showed that preservice teachers' attribution of their own achievement may be related to their attribution of students' achievement. The High-High group consistently attributed effort (or lack of effort) as being more applicable in explaining students' achievement (or lack of achievement) in both mathematics and language arts compared to the Low-High group. The High-High group was also found to attribute effort to a greater degree than the Low-High group to explain their own mathematics and language arts achievement. This indicates that preservice teachers may attribute students' achievement based upon the attributions of their own achievement. If so, it would provide valuable insight in explaining how teachers attribute students' acnievement. In addition, since the reviewed literature has shown that a student often adopts the teachers' attribution pattern of the student and that attributions and achievement are related, the

teachers' attribution of their own achievement may indirectly affect student achievement.

There was some indication that the learning history influenced preservice teachers' perceptions of the role different topics had on overall achievement and future success of students in mathematics but not in language arts. Preservice teachers with a less favourable mathematical learning history (i.e. Low-High group) assigned higher grades and perceived higher future success for a student who did well in computation compared to a student who did well in problem solving. In contrast, preservice teachers with a favourable mathematical learning history (i.e. High-High group) assigned similar grades and perceived a similar future success for these two students. Computation skills are often considered as requiring less mathematical ability than problem solving skills. Therefore, the group with a less favourable mathematical learning history may hold different perceptions for easier and more difficult topics. In fact, Kuendiger (1990) found that preservice teachers with a less favourable mathematical learning history more strongly agreed that teaching multiplication and

division was more enjoyable than teaching geometry or fractions. Another possibility is the Low-High group may view computation skills as more important than problem solving skills, while the High-High group may perceive both skills as equally important. As a result, preservice teachers with a less favourable mathematical learning history may stress computation skills more than problem solving skills. The National Council of Teachers of Mathematics (NCTM), a highly recognized group of mathematics educators, recommends emphasizing problem solving so that students can: 1) use problem-solving approaches to investigate and understand mathematical content, 2) formulate problems from everyday situations, 3) develop and apply strategies to solve a variety of problems, 4) verify and interpret results with respect to the original problem, and 5) acquire confidence in using mathematics meaningfully (1989, p. 23). This emphasis on problem solving is also expressed by the Ontario Ministry of Education in the mathematics curriculum guidelines (pp. 19-20, 1985). Thus, the possible stress of computation skills over problem solving skills by preservice teachers with a less favourable mathematical

learning history would be in contrast with the recommendations of the NCTM and the Ontario Ministry of Education guidelines. Clearly, further research is needed to explain why mathematics topics are viewed differently by preservice teachers with different mathematical learning histories.

There was some indication that the learning history may influence the inference made from success between mathematics and language arts. The Low-High group believed that a student who was successful in mathematics would also be successful in language arts, but not the reverse. Therefore, preservice teachers with a less favourable mathematical learning history may expect successful mathematics students to also do well in language arts. This means that differences in preservice teachers' learning histories may affect differences in their expectations of students.

Finally, preservice teachers were asked to assign a probable gender to students with different achievement levels in mathematics and language arts. Many preservice teachers did not answer this question. In fact, some remarked that this question was inappropriate. This means that many preservice

teachers believed that a high achievement in a subject was not associated with any one particular gender. The learning history was not found to influence the gender typically assigned to students with different performance levels in mathematics or language arts. Yet, both groups believed that a successful mathematics student would be male, while a successful language arts student would be female. From the literature reviewed, we know that teachers' expectations are often communicated to students either explicitly or implicitly. If the teacher holds the above perception that boys and girls have different strengths in subjects, the teacher may encourage boys to try harder in mathematics while girls are encouraged more to be successful in language arts. As students, in turn, often respond to meet the expectations of the teacher, it is clear that this problem requires further attention by the educational community.

In summary, the learning history has been most closely linked to preservice teachers' beliefs about their future self-efficacy, which have important implications for teaching and student learning. Moreover, it is necessary to investigate whether the

learning history influences actual teaching behaviour in the classroom. Since the learning history provides a motivational framework which future teachers take into the classroom, differences in preservice teachers' learning history may be related to differences in the way they interact with students throughout instruction in particular subjects.

In addition, the learning history may also affect the overall structuring and planning of lessons in a subject. Since the preservice teachers' learning history has been linked to their perceived self-efficacy and general confidence in teaching, the learning history may affect preservice teachers' willingness to try different teaching ideas or to vary the mode of instruction in a subject (e.g. guided discovery, experiments, lecture, group work, etc.). Moreover, since preservice teachers with a less favourable subject-related learning history were also found to be less interested in this subject, these preservice teachers may show less motivation to seek other teaching resources to enhance their classroom instruction in a subject.

11.3 Limitations of the Study

All the limitations inherent in empirical research studies apply for this study as well. For example, one cannot exclude the possibility that a significant result occurs by chance. To the knowledge of this researcher, this study and the research done by Kuendiger (1990) are the first two studies which relate preservice teachers' learning history to their teaching-related beliefs. In both studies, samples of preservice teachers from the University of Windsor only were investigated. Although these studies were embedded in the conceptual framework of attribution theory, there is a need to confirm the individual results reported before they can be generalized as to preservice teachers in general and as to the consistency of the results over time.

REFERENCES

Armor, D., Conry-Oseguera, P., Cox, M., King, N., McDonnell, L., Pascall, A., Pauly, E., & Zellman, G. (1976). Analysis of the school preferred reading program in selected Los Angeles minority schools. (Report No. R-2007-LAUSD). Santa Monica, CA: The Rand Corporation. (ERIC Document Reproduction Service No. ED 130 243).

Ashton, P. (1985). Motivation and the teacher's sense of efficacy. In C. Ames & R. Ames, Research on motivation in education: Vol. 2. The classroom milieu (pp. 141-171). Toronto: Academic Press.

Ashton, P., & Webb, R. (1982, March). Teachers sense of efficacy: Toward an ecological model. Paper presented at the annual meeting of the American Educational Research Association, New York.

Ashton, P., & Webb, R. (1986). Making a difference. New York: Longman.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review, 84, 191-215.

Berman, P., McLaughlin, M.W., Bass, G., Pauly, E., & Zellman, G. (1977). Federal programs supporting educational change: Vol. 7. Factors affecting implementation and continuation. Santa Monica, CA: The Rand Corporation. (ERIC Documentation Reproduction Service No. ED 140 432).

Braun, C. (1976). Teacher expectation: Sociopsychological dynamics. Review of Educational Research, 48, 185-213.

Brophy, J. (1983). Research on the self-fulfilling prophesy and teacher expectations. Journal of Educational Psychology, 75, 631-661.

Brophy, J. (1985). Teachers' expectations, motives, and goals for working with problem students. In C. Ames & R. Ames, Research on motivation in education: Vol. 2. The classroom milieu (pp. 175-214). Toronto: Academic Press.

Brophy, J., & Good, T. (1970). Teachers' communication of differential expectations for children's classroom performance: Some behavioral data. Journal of Educational Psychology, 61, 365-374.

Brophy, J., & Good, T. (1974). Teacher-student relationships: Causes and consequences. New York: Holt, Rinehart & Winston.

Brown, C.A., & Cooney, T.J. (1982). Research on teacher education: A philosophical orientation. Journal of Research and Development in Education, 15(4), 13-18.

Clark, C.M. (1988). Asking the right questions about teacher preparation: Contributions of research on teacher thinking. Educational Researcher, 17(2), 5-12.

Cooper, H. (1979). Pygmalion grows up: A model for teacher expectation communication and performance influence. Review of Educational Research, 49, 398-410.

Darley, J., & Fazio, R. (1980). Expectancy confirmation processes arising in the social interaction sequence. American Psychologist, 35, 867-881.

Darom E., & Bar-Tal, D. (1981). Causal perception of pupils' success or failure by teachers and pupils: A comparison. Journal of Educational Research, 74, 233-239.

Dusek, J., Hall, V., & Meyer, W. (Eds.) (1985). Teacher expectancies. Hillsdale, NJ: Erlbaum.

Eccles, J.E. (1986). Gender-roles and women's achievement. Educational Researcher, 15(6), 15-19.

Fennema, E., & Leder, G.C. (1990). Mathematics and Gender. New York: Teachers College Press, Columbia University.

Fraser, B.E. (1990). Causal attribution: A study of grade nine mathematics attitudes. Field Research Report, University of Windsor, Windsor, ON.

Gibson, S., & Dembo, M.H. (1984). Teacher efficacy: A construct validation. Journal of Educational Psychology, 76, 569-582.

Good, T. (1980). Classroom expectations: Teacher-pupil interactions. In J. McMillan (Ed.), The social psychology of school learning. New York: Academic Press.

Heckhausen, H., Schmalt, H., & Schneider, K. (1985). Achievement motivation in perspective (M. Woodruff & R. Wicklund, Trans.). Toronto: Academic Press.

Heider, F. (1958). The psychology of interpersonal relations. New York: Wiley.

Hiebert, E., Winograd, P., & Danner, F. (1984). Children's attribution for failure and success in different aspects of reading. Journal of Educational Psychology, 76, 1139-1148.

Housego, B.E.J. (1990). Student teachers' feelings of preparedness to teach. Canadian Journal of Education, 15, 37-56.

Kane (1986). [Attribucional patterns and careers of college women]. Unpublished raw data.

Kelley, H.H. (1967). Attribution theory in social psychology. In D. Levine (Ed.), Nebraska Symposium on Motivation: 1967. Lincoln: University of Nebraska Press.

Kloosterman, P. (1990). Attributions, performance following failure, and motivation in mathematics. In E. Fennema & G.C. Leder (Eds.), Mathematics and gender, (pp. 96-127). New York: Teachers College Press, Columbia University.

Kuendiger, E. (1990). Preservice teachers' perceptions about their own mathematical achievement and about teaching of mathematics. Windsor, ON: University of Windsor, Faculty of Education.

National Council of Teachers of Mathematics, Commission on Standards for School Mathematics (1989). Curriculum and evaluation standards for school mathematics. Reston, VA: The Council.

Ontario Ministry of Education (1985). Curriculum guidelines: Mathematics (Part 1). Toronto: Queen's Printer for Ontario.

Persell, C. (1977). Education and inequality: The roots and results of stratification in American schools. New York: The Free Press.

Rosenthal, R., & Jacobson, L. (1968). Pygmalion in the classroom: Teacher expectations and pupils' intellectual development. New York: Holt, Rinehart and Winston.

Rotter, J.B. (1966). Generalized expectancies for internal versus external control of reinforcement. Psychological Monographs, 80, 1-28.

Schildkamp-Kuendiger, (1982). Introduction. In Schildkamp-Kuendiger (Ed.), An international review of gender and mathematics (pp. 1-14). Columbus, OH: ERIC.

Supersaxo, A., Perrez, M., & Kramis, J. (1987). The influence of teacher attributions on tendencies of causal attribution and anxiety in pupils. Switzerland: Fribourg University. (ERIC Documentation Reproduction Service No. ED 289 618).

Webb, R. (1982, March). Teaching and the domains of efficacy. Paper presented at the annual meeting of the American Educational Research Association, New York.

Weiner, B. (1976). An attributional approach for education psychology. In L.S. Shulman (Ed.), Review of research in education 4 (pp. 179-209). Itasca, IL: Peacock.

Weiner, B. (1979). A theory of motivation for some classroom experiences. Journal of Educational Psychology, 71, 3-25.

Weiner, B. (1980). Human motivation. New York: Holt, Rinehart & Winston.

Weiner, B. (1984). Principles for a theory of student motivation and their application within an attributional framework. In R. Ames & C. Ames (Eds.), Research on motivation in education: Vol. 1. Student motivation (pp. 15-38). Toronto: Academic Press.

Weiner, B., Frieze, I.H., Kukla, A., Reed, L., Rest, S., & Rosenbaum, R.M. (1971). Perceiving the causes of success and failure. Morristown, NJ: General Learning Press.

Weiner, B., & Kukla, A. (1970). An attributional analysis of achievement motivation. Journal of Personality and Social Psychology, 15, 1-20.

Weiner, B., Russell, D., & Lerman, D. (1978). Affective consequences of causal ascriptions. In J.H. Harvey, W. Ickes, & R.F. Kidd (Eds.), New directions in attribution research (Vol. 2, pp. 59-90). Hillsdale, NJ: Erlbaum.

Wolleat, P.L., Pedro, J.D., Becker, A., & Fennema, E. (1980). Students' causal attributions of performance in mathematics. Journal for Research in Mathematics Education, 11, 356-368.

APPENDIX

Appendix A1: Questionnaire (Form 1)

QUESTIONNAIRE

Division _____ Gender _____ Age _____

Teachable Subject (if applicable) _____

1. Up to which grade did you take mathematics and English in high school?

Mathematics _____ English _____

2. How many mathematics (including statistics) and English courses did you take at the university level?

Mathematics _____ English _____

3. Indicate your level of interest in mathematics and language arts below.

MATHEMATICS:

Very Interested	Interested	Neutral	Not Interested	Not at All Interested

LANGUAGE ARTS:

Very Interested	Interested	Neutral	Not Interested	Not at All Interested

4. Looking back at your own learning of mathematics and language arts, indicate your general achievement by placing an X on the scales below.

MATHEMATICS:

Excellent	Above Average	Average	Below Average	Poor

LANGUAGE ARTS:

Excellent	Above Average	Average	Below Average	Poor

5. Below are some reasons which are used to explain achievement.

A = Ability	B = Lack of Ability
C = Effort	D = Lack of Effort
E = Interest	F = Lack of Interest
G = Easy Subject	H = Difficult Subject
I = Good Teaching	J = Poor Teaching
K = Other Reason _____	

Indicate those reasons which are most applicable/somewhat applicable in explaining your achievement. MORE THAN ONE REASON MAY BE INDICATED.

MATHEMATICS	LANGUAGE ARTS
Most Applicable _____	Most Applicable _____
Somewhat Applicable _____	Somewhat Applicable _____

6. Assume a student does VERY WELL in mathematics/language arts. Indicate those reasons which are applicable/somewhat applicable in explaining the student's achievement. MORE THAN ONE REASON MAY BE INDICATED.

Reasons: A = Ability B = Effort
C = Interest D = Easy Subject
E = Good Teaching F = Advanced Cognitive Development
G = Other Reason _____

MATHEMATICS	LANGUAGE ARTS
Most Applicable _____	Most Applicable _____
Somewhat Applicable _____	Somewhat Applicable _____

7. Assume a student does VERY POORLY in mathematics/language arts. Indicate those reasons which are applicable/somewhat applicable in explaining the student's lack of achievement. MORE THAN ONE REASON MAY BE INDICATED.

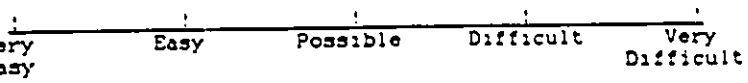
Reasons: A = Lack of Ability B = Lack of Effort
C = Lack of Interest D = Difficult Subject
E = Poor Teaching F = Lagging Cognitive Development
G = Other Reason _____

MATHEMATICS	LANGUAGE ARTS
Most Applicable _____	Most Applicable _____
Somewhat Applicable _____	Somewhat Applicable _____

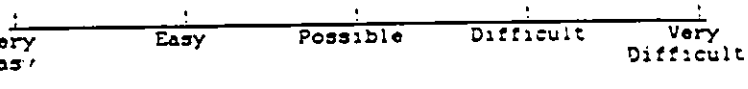
8. Once you become a full-time teacher, how easy will it be for you to influence your students' effort, interest, and achievement in mathematics/language arts? Answer the question by placing each of the letters shown in the appropriate places below.

A = Effort
B = Interest
C = Achievement

MATHEMATICS:



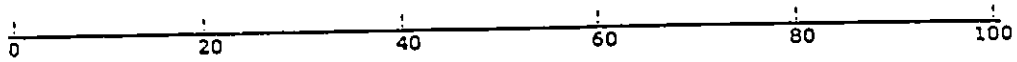
LANGUAGE ARTS:



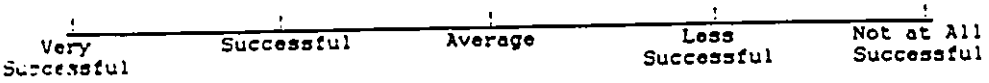
9. Imagine you have four students 1.2.3 and 4 in your mathematics class whose achievement in computations and problem solving are as indicated below.

Student 1: Computations - GOOD Problem Solving - GOOD
Student 2: Computations - GOOD Problem Solving - FAIR
Student 3: Computations - FAIR Problem Solving - GOOD
Student 4: Computations - FAIR Problem Solving - FAIR

a) Indicate the grades out of 100 you would assign to each of the four students by placing the numbers 1.2.3. and 4 on the scale below.



b) Indicate below how successful each of these students will be in mathematics in the future.



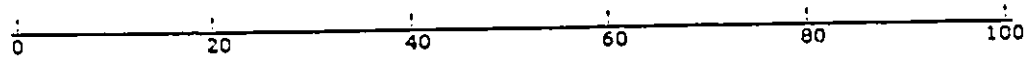
c) Indicate the probable gender of each of the four students.

male _____ female _____

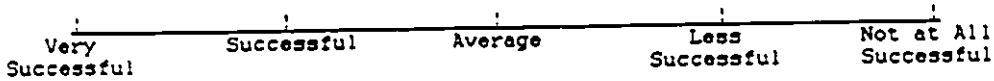
10. Imagine you have four students 1.2.3. and 4 in your language arts class whose achievement in reading & writing and grammar & spelling are as indicated below.

Student 1: Reading & Writing - GOOD Grammar & Spelling - GOOD
Student 2: Reading & Writing - GOOD Grammar & Spelling - FAIR
Student 3: Reading & Writing - FAIR Grammar & Spelling - GOOD
Student 4: Reading & Writing - FAIR Grammar & Spelling - FAIR

a) Indicate the grades out of 100 you would assign to each of the four students by placing the numbers 1.2.3. and 4 on the scale below.



b) Indicate below how successful each of these students will be in language arts in the future.



c) Indicate the probable gender of each of the four students.

male _____ female _____

11. Jim is one of your students who does well in **mathematics**. Indicate what other subjects you think Jim would also do well in.

___ Science
___ Language Arts
___ Music
___ Physical Education
___ History
___ Geography
___ French
___ Art

12. Jeanette is one of your students who does well in **language arts**. Indicate what other subjects you think Jeanette would also do well in.

___ Science
___ Mathematics
___ Music
___ Physical Education
___ History
___ Geography
___ French
___ Art

13. To do very well in **mathematics**, does one need a special ability?

___ Yes ___ Undecided ___ No

14. To do very well in **language arts**, does one need a special ability?

___ Yes ___ Undecided ___ No

THANK-YOU FOR YOUR TIME.

Appendix A2: Questionnaire (Form 2)

QUESTIONNAIRE

Division _____ Gender _____ Age _____

Teachable Subject (if applicable) _____

1. Up to which grade did you take English and mathematics in high school?

English _____ Mathematics _____

2. How many English and mathematics (including statistics) courses did you take at the university level?

English _____ Mathematics _____

3. Indicate your level of interest in language arts and mathematics below.

LANGUAGE ARTS:

Very Interested	Interested	Neutral	Not Interested	Not at All Interested

MATHEMATICS:

Very Interested	Interested	Neutral	Not Interested	Not at All Interested

4. Looking back at your own learning of language arts and mathematics, indicate your general achievement by placing an X on the scales below.

LANGUAGE ARTS:

Excellent	Above Average	Average	Below Average	Poor

MATHEMATICS:

Excellent	Above Average	Average	Below Average	Poor

5. Below are some reasons which are used to explain achievement.

A = Ability	B = Lack of Ability
C = Effort	D = Lack of Effort
E = Interest	F = Lack of Interest
G = Easy Subject	H = Difficult Subject
I = Good Teaching	J = Poor Teaching
K = Other Reason _____	

Indicate those reasons which are most applicable/somewhat applicable in explaining your achievement. MORE THAN ONE REASON MAY BE INDICATED.

LANGUAGE ARTS	MATHEMATICS
Most Applicable _____	Most Applicable _____
Somewhat Applicable _____	Somewhat Applicable _____

6. Assume a student does VERY WELL in language arts/mathematics. Indicate those reasons which are applicable/somewhat applicable in explaining the student's achievement. MORE THAN ONE REASON MAY BE INDICATED.

Reasons: A = Ability B = Effort
C = Interest D = Easy Subject
E = Good Teaching F = Advanced Cognitive Development
G = Other Reason _____

LANGUAGE ARTS	MATHEMATICS
Most Applicable _____	Most Applicable _____
Somewhat Applicable _____	Somewhat Applicable _____

7. Assume a student does VERY POORLY in language arts/mathematics. Indicate those reasons which are applicable/somewhat applicable in explaining the student's lack of achievement. MORE THAN ONE REASON MAY BE INDICATED.

Reasons: A = Lack of Ability B = Lack of Effort
C = Lack of Interest D = Difficult Subject
E = Poor Teaching F = Lagging Cognitive Development
G = Other Reason _____

LANGUAGE ARTS	MATHEMATICS
Most Applicable _____	Most Applicable _____
Somewhat Applicable _____	Somewhat Applicable _____

8. Once you become a full-time teacher, how easy will it be for you to influence your students' effort, interest, and achievement in language arts/mathematics? Answer the question by placing each of the letters shown in the appropriate places below.

A = Effort
B = Interest
C = Achievement

LANGUAGE ARTS:

Very Easy	Easy	Possible	Difficult	Very Difficult

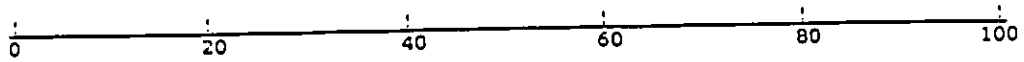
MATHEMATICS:

Very Easy	Easy	Possible	Difficult	Very Difficult

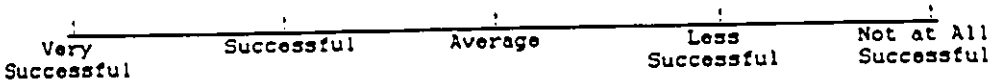
9. Imagine you have four students 1,2,3, and 4 in your language arts class whose achievement in reading & writing and grammar & spelling are as indicated below.

Student 1:	Reading & Writing - GOOD	Grammar & Spelling - GOOD
Student 2:	Reading & Writing - GOOD	Grammar & Spelling - FAIR
Student 3:	Reading & Writing - FAIR	Grammar & Spelling - GOOD
Student 4:	Reading & Writing - FAIR	Grammar & Spelling - FAIR

a) Indicate the grades out of 100 you would assign to each of the four students by placing the numbers 1,2,3, and 4 on the scale below.



b) Indicate below how successful each of these students will be in language arts in the future.



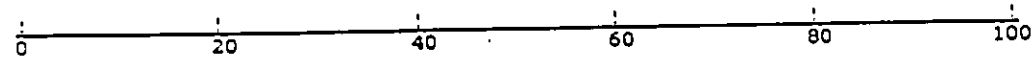
c) Indicate the probable gender of each of the four students.

male _____ female _____

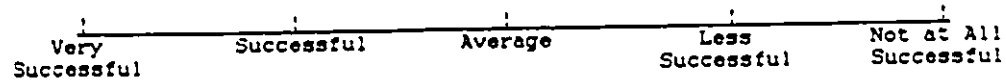
10. Imagine you have four students 1,2,3 and 4 in your mathematics class whose achievement in computations and problem solving are as indicated below.

Student 1:	Computations - GOOD	Problem Solving - GOOD
Student 2:	Computations - GOOD	Problem Solving - FAIR
Student 3:	Computations - FAIR	Problem Solving - GOOD
Student 4:	Computations - FAIR	Problem Solving - FAIR

a) Indicate the grades out of 100 you would assign to each of the four students by placing the numbers 1,2,3, and 4 on the scale below.



b) Indicate below how successful each of these students will be in mathematics in the future.



c) Indicate the probable gender of each of the four students.

male _____ female _____

11. Jeanette is one of your students who does well in **mathematics**. Indicate what other subjects you think Jeanette would also do well in.

___ Science
___ Language Arts
___ Music
___ Physical Education
___ History
___ Geography
___ French
___ Art

12. Jim is one of your students who does well in **language arts**. Indicate what other subjects you think Jim would also do well in.

___ Science
___ Mathematics
___ Music
___ Physical Education
___ History
___ Geography
___ French
___ Art

13. To do very well in **mathematics**, does one need a special ability?

___ Yes ___ Undecided ___ No

14. To do very well in **language arts**, does one need a special ability?

___ Yes ___ Undecided ___ No

THANK-YOU FOR YOUR TIME.

Table B.1: Interest versus Perceived Former Achievement in Mathematics of P/J Preservice Teachers

Interest	Perceived Former Achievement				N
	Below ** Average	Average	Above Average	Excellent	
Not * Interested	8 (4.79)	14 (8.38)	5 (2.99)	3 (1.80)	30 (17.96)
Neutral	3 (1.80)	22 (13.17)	15 (8.98)	2 (1.20)	42 (25.15)
Interested	2 (1.20)	34 (20.36)	24 (14.37)	14 (8.38)	74 (44.31)
Very Interested	1 (0.60)	2 (1.20)	8 (4.79)	10 (5.99)	21 (12.57)
N	14 (8.38)	72 (43.11)	52 (31.14)	29 (17.17)	167 (100)

$\chi^2(6, N = 167) = 28.140, p < 0.01$

* Includes Not at all Interested

** Includes Poor Achievement

Table B.2: Interest versus Perceived Former Achievement in Language Arts of P/J Preservice Teachers

Interest	Perceived Former Achievement				N
	Below ** Average	Average	Above Average	Excellent	
Not * Interested	-	3	1	-	4
	-	(1.80)	(0.60)	-	(2.40)
Neutral	-	4	6	2	12
	-	(2.40)	(3.59)	(1.20)	(7.19)
Interested	-	17	47	13	77
	-	(10.18)	(28.14)	(7.78)	(46.11)
Very Interested	-	8	26	40	74
	-	(4.79)	(15.57)	(23.95)	(44.31)
N	-	32	80	55	167
	-	(19.16)	(47.90)	(32.93)	(100)

$\chi^2(4, N = 167) = 30.994, p < 0.01$

* Includes Not at all Interested

** Includes Poor Achievement

Table C.1: Perceived Former Achievement of Low-High Group

Subject	Below Average *	Average	Above Average	Excellent	N
Mathematics	13 (20.63)	50 (79.37)	- -	- -	63 (100)
Language Arts	- -	- -	40 (63.49)	23 (36.51)	63 (100)

$\chi^2(3, N = 126) = 174.675$, $p < 0.01$

* Includes Poor Achievement

Table C.2: Perceived Former Achievement of High-High Group

Subject	Below Average *	Average	Above Average	Excellent	N
Mathematics	-	-	44	26	70
	-	-	(62.86)	(37.14)	(100)
Language Arts	-	-	38	32	70
	-	-	(54.29)	(45.71)	(100)

$\chi^2(1, N = 140) = 1.061, p > 0.05$

* Includes Poor Achievement

Table C.3: Perceived Former Achievement in Mathematics Between Groups

Preservice Teacher Group	Below Average *	Average	Above Average	Excellent	N
Low-High	13 (20.63)	50 (79.37)	- -	- -	63 (100)
High-High	- -	- -	44 (62.86)	26 (37.14)	70 (100)

$\chi^2(3, N = 133) = 184.009, p < 0.01$

* Includes Poor Achievement

Table C.4: Perceived Former Achievement in Language Arts Between Groups

Preservice Teacher Group	Below Average *	Average	Above Average	Excellent	N
Low-High	-	-	40	23	63
	-	-	(63.49)	(36.51)	(100)
High-High	-	-	38	32	70
	-	-	(54.29)	(45.71)	(100)

$\chi^2(3, N = 133) = 1.162, p > 0.05$

* Includes Poor Achievement

Table C.5: Highest Grade In Which Mathematics was Taken In High School Between Groups

Preservice Teacher Group	Grade 11 and Below	Grade 12	Grade 13	N
Low-High	6 (9.84)	29 (47.54)	26 (42.62)	61 (100)
High-High	1 (1.45)	11 (15.94)	57 (82.61)	69 (100)

$\chi^2(1, N = 130) = 23.125, p < 0.01$

Table C.6: Highest Grade In Which English was Taken In High School Between Groups

Preservice Teacher Group	Grade 11 and Below	Grade 12	Grade 13	N
Low-High	1 (1.61)	10 (16.13)	51 (82.26)	62 (100)
High-High	- -	6 (8.82)	62 (91.18)	68 (100)

$\chi^2(1, N = 130) = 2.288, p > 0.05$

Table C.7: Number of Mathematics Courses Taken in University Between Groups

Preservice Teacher Group	0	1	2	3	4	5	6	7 or more	N
Low-High	23 (36.51)	14 (22.22)	13 (20.63)	7 (11.11)	5 (7.94)	- -	1 (1.59)	- -	63 (100)
High-High	18 (26.09)	11 (15.94)	18 (26.09)	6 (8.70)	7 (10.14)	4 (5.80)	3 (4.35)	2 (2.89)	69 (100)

$\chi^2(5, N = 132) = 9.282, p > 0.05$

Table C.8: Number of English Courses Taken in University Between Groups

Preservice Teacher Group	0	1	2	3	4	5	6	7 or more	N
Low-High	14 (22.22)	15 (23.81)	9 (14.29)	5 (7.94)	- -	- -	8 (12.70)	12 (19.04)	63 (100)
High-High	22 (31.88)	17 (24.64)	8 (11.59)	3 (4.35)	6 (8.70)	1 (1.45)	1 (1.45)	11 (15.94)	69 (100)

$\chi^2(4, N = 132) = 2.235, p > 0.05$

Table C.9: Interest in Mathematics Between Groups

Preservice Teacher Group	Not Interested *	Neutral	Interested	Very Interested	N
Low-High	20 (31.75)	19 (30.16)	22 (34.92)	2 (3.17)	63 (100)
High-High	8 (11.43)	16 (22.86)	31 (44.26)	15 (21.43)	70 (100)

$\chi^2(3, N = 133) = 17.990, p < 0.01$

* Includes Not at all Interested

Table C.10: Interest in Language Arts Between Groups

Preservice Teacher Group	Not Interested *	Neutral	Interested	Very Interested	N
Low-High	- -	2 (3.17)	28 (44.44)	33 (52.38)	63 (100)
High-High	1 (1.43)	6 (8.57)	30 (42.86)	33 (47.14)	70 (100)

$\chi^2(1, N = 133) = 0.364, p > 0.05$

* Includes Not at all Interested

Table D.1: Answer Pattern For Future Self-Efficacy of Low-High Group

Subject	All Different	Effort and Interest Same	Effort and Achievement Same	Interest and Achievement Same	All Same	N
Mathematics	23 (51.11)	8 (17.78)	4 (8.89)	4 (8.89)	6 (13.33)	45 (100)
Language Arts	25 (55.56)	6 (13.33)	3 (6.67)	5 (11.11)	6 (13.33)	45 (100)

Table D.2: Answer Pattern For Future Self-Efficacy of High-High Group

Subject	All Different	Effort and Interest Same	Effort and Achievement Same	Interest and Achievement Same	All Same	N
Mathematics	30 (57.69)	2 (3.85)	4 (7.69)	3 (5.77)	13 (25.00)	52 (100)
Language Arts	33 (63.46)	1 (1.92)	2 (3.85)	1 (1.92)	15 (28.85)	52 (100)

Table D.3: Student Aspect Believed to be Influenced the Most in Mathematics Between Groups

Preservice Teacher Group	Effort	Interest	Achievement	N
Low-High	13 (46.43)	14 (50.00)	1 (3.57)	28 (100)
High-High	11 (30.56)	19 (52.78)	6 (16.67)	36 (100)

$\chi^2(2, N = 64) = 3.887, p > 0.05$

Table D.4: Student Aspect Believed to be Influenced the Most in Language Arts Between Groups

Preservice Teacher Group	Effort	Interest	Achievement	N
Low-High	13 (43.33)	15 (50.00)	2 (6.67)	30 (100)
High-High	10 (29.41)	20 (58.82)	4 (11.76)	34 (100)

$\chi^2(2, N = 64) = 1.539, p > 0.05$

Table E.1: Student Achievement in Computation/Problem Solving in Mathematics versus Perceived Success in Future By Low-High Group

Achievement Computation/ Problem Solving	Rank of Perceived Success in Future: Lowest	Second Lowest	Second Highest	Highest	N
Good/Good	-	-	1	46	47
	-	-	(2.13)	(97.87)	(100)
Good/Fair	-	10	26	-	36
	-	(27.78)	(72.22)	-	(100)
Fair/Good	-	26	9	1	36
	-	(72.22)	(25.00)	(2.78)	(100)
Fair/Fair	47	-	-	-	47
	(100.00)	-	-	-	(100)

$\chi^2(9, N = 166) = 356.064, p < 0.01$

* $\chi^2(1, N = 71) = 15.969, p < 0.01$

Table E.2: Student Achievement in Computation/Problem Solving in Mathematics versus Perceived Success in Future By High-High Group

Achievement Computation/ Problem Solving	Rank of Perceived Success in Future				N
	Lowest	Second Lowest	Second Highest	Highest	
Good/Good	1 (2.17)	- -	1 (2.17)	44 (95.65)	46 (100)
Good/Fair *	- -	17 (44.74)	21 (55.26)	- -	38 (100)
Fair/Good	1 (2.70)	20 (54.05)	15 (40.54)	1 (2.70)	37 (100)
Fair/Fair	42 (95.45)	- -	1 (2.27)	1 (2.27)	44 (100)

$\chi^2(9, N = 165) = 299.389, p < 0.01$

* $\chi^2(1, N = 73) = 1.125, p > 0.05$

Table E.3: Student Achievement in Reading and Writing/Grammar and Spelling in Language Arts versus Perceived Success in Future By Low-High Group

Achievement Reading and Writing/ Grammar and Spelling	Rank of Perceived Success in Future: Lowest	Second Lowest	Second Highest	Highest	N
Good/Good	-	-	2	44	46
	-	-	(4.35)	(95.65)	(100)
Good/Fair *	-	3	32	1	36
	-	(8.33)	(88.89)	(2.78)	(100)
Fair/Good *	-	32	2	1	35
	-	(91.43)	(5.71)	(2.86)	(100)
Fair/Fair	45	-	-	-	45
	(100.00)	-	-	-	(100)

$\chi^2(9, N = 162) = 376.296, p < 0.01$

* $\chi^2(1, N = 69) = 59.951, p < 0.01$

Table E.4: Student Achievement in Reading and Writing/Grammar and Spelling in Language Arts versus Perceived Success in Future By High-High Group

Achievement Reading and Writing/ Grammar and Spelling	Rank of Perceived Success in Future				N
	Lowest	Second Lowest	Second Highest	Highest	
Good/Good	2 (4.44)	1 (2.22)	2 (4.44)	40 (88.89)	45 (100)
Good/Fair	1 (2.78)	3 (8.33)	31 (86.11)	1 (2.78)	36 (100)
Fair/Good	1 (2.78)	32 (88.89)	2 (5.56)	1 (2.78)	36 (100)
Fair/Fair	42 (93.33)	1 (2.22)	- -	2 (4.44)	45 (100)

$\chi^2(9, N = 162) = 307.300, p < 0.01$

* $\chi^2(1, N = 68) = 58.703, p < 0.01$

Table E.5: Good Student Achievement in Mathematics versus Gender between Groups

Preservice Teacher Group	Gender		N
	Male	Female	
Low-High	20 (68.97)	9 (31.03)	29 (100)
High-High	15 (78.95)	4 (21.05)	19 (100)

$\chi^2(1, N = 48) = 0.592, p > 0.05$

Table E.6: Fair Student Achievement in Mathematics versus Gender between Groups

Preservice Teacher Group	Gender		N
	Male	Female	
Low-High	6 (20.69)	23 (79.31)	29 (100)
High-High	4 (21.05)	15 (78.95)	19 (100)

$\chi^2(1, N = 48) = 0.001, p > 0.05$

Table E.7: Good Student Achievement in Language Arts versus Gender between Groups

Preservice Teacher Group	Gender		N
	Male	Female	
Low-High	5 (17.24)	24 (82.76)	29 (100)
High-High	5 (26.32)	14 (73.68)	19 (100)

$\chi^2(1, N = 48) = 0.564, p > 0.05$

Table E.8: Fair Student Achievement in Language Arts versus Gender between Groups

Preservice Teacher Group	Gender		N
	Male	Female	
Low-High	23 (79.31)	6 (20.69)	29 (100)
High-High	15 (78.95)	4 (21.05)	19 (100)

$\chi^2(1, N = 48) = 0.001, p > 0.05$

Table E.9: Differences between Groups of Other Subjects a Successful Mathematics Student would do Well In

Subject Chosen	Low-High versus High-High χ^2	p
Science	0.002	
History	4.275	*
Language Arts/ Mathematics	0.401	
Geography	0.540	
Music	0.419	
French	0.235	
Physical Education	0.004	
Art	0.584	

N = 116
df = 1

* $p < 0.05$
** $p < 0.01$

Table E.10: Differences between Groups of Other Subjects a Successful Language Arts Student would do Well In

Subject Chosen	Low-High versus High-High χ^2	p
Science	0.881	
History	0.318	
Language Arts/ Mathematics	3.818	
Geography	0.117	
Music	0.023	
French	0.290	
Physical Education	0.004	
Art	2.411	

$N = 116$
$df = 1$

* $p < 0.05$
** $p < 0.01$

Table E.11: Student Special Ability Required in Mathematics between Groups

Preservice Teacher Group	No	Undecided	Yes	N
Low-High	21 (35.00)	24 (40.00)	15 (25.00)	60 (100)
High-High	23 (36.51)	21 (33.33)	19 (30.16)	63 (100)

$\chi^2(2, \underline{N} = 123) = 0.690, \underline{p} > 0.05$

Table E.12: Student Special Ability Required in Language Arts between Groups

Preservice Teacher Group	No	Undecided	Yes	N
Low-High	23 (38.33)	25 (41.67)	12 (20.00)	60 (100)
High-High	25 (39.68)	21 (33.33)	17 (26.98)	63 (100)

$\chi^2(2, \underline{N} = 123) = 1.225, \underline{p} > 0.05$

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