

Early Education May Bias Students Against Math and Science

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Abstract

Various advising tools can be used by students and advisors to aid in determining future career paths. The results from such assessments can provide insight to other factors that may be affecting the education system. In our case, there is evidence that the nature of teachers from kindergarten through middle school may cause a bias against math and science subjects.

The objective of this study was to examine how well post baccalaureate students seeking teacher certification matched in their choice of education majors from E-COACH (College Optimal Advisor & Career Helper) with their teaching position. E-COACH is designed as a tool to aid students by offering career and learning style assessments. Additionally, E-COACH offers an “ordering of teaching fields in Education” based on an interest assessment. This paper presents the results of E-COACH assessments for a group of seventy-one students seeking post baccalaureate certification. E-COACH career mapping is based on preferences regarding things, people, data, and ideas. Learning style assessments are based on preferences involving hearing, reading, somatic, and visual processing in the brain. The final assessment of teaching field interest is garnered from preference order in the following six teaching fields: business, early childhood, English, math, science, and visual and performing arts. For this study the students were divided into four groups, “early childhood - 4/human sciences”, “elementary education”,

“secondary education”, and “education other”. Of particular significance are the results of teaching field interest. For example, within the sub-group “early childhood/human sciences”, 89% displayed their first preferred interest to be early childhood (63%) or English (26%), which tended to verify the E-COACH career mapping process for education majors. As their last or least preferred interest, 85% selected math (32%) or science (53%). Although a strong interest in early childhood is expected and desired for this group, the negative interest toward math and science may be transferred to others causing a negative interest toward math and science by the students. Does lack of interest or preference in the fields of science or math impact teaching time and effort spent on these subjects? This study does not presume to answer this question, but rather to present the data as a potential starting point to encourage further investigation.

Introduction

At Texas Tech University, particularly in the College of Engineering, there is an increased interest in academic advising. Reasons vary, but undoubtedly retention is one. Student persistence may be impacted by both advising and major selection. To better serve needs of students, the College of Engineering at Texas Tech University has developed the E-COACH advising tool. The college has continued to work on refining E-COACH. The tool is comprised of several components including: ED DOCTOR (Education Development Decisions on Careers, Training, Operations, and Responsibilities), QUICK Advisor (Querying University Instructional Courses Key), and QUALITY Assessment (Questioning University Alumni and Lads/Lasses to Improve Teaching Yearly). As the tool has evolved, its use has increased. It is not only used by perspective engineering students, but also by current university students in various colleges as well as high school and junior high students. Previous studies have focused on E-COACH in correlation with engineering students.^{1,2} For this study, the component used was ED DOCTOR. This study began as an investigation of E-COACH assessments for students seeking post baccalaureate teacher certification. The focus of this study is to examine how well the certification students matched in their choice of major based on career and learning styles assessments as well as interest assessment for teaching fields. As the study evolved it became evident that there was perhaps valuable information in the area of teaching field preference.

Objective

As stated earlier, previous research has been conducted involving engineering students and the use of E-COACH. Fortunately, the tool is not limited for use to only engineering students. It is a Web-based electronic tool with free access. This paper presents information found in a study regarding post baccalaureate students seeking teacher certification with relation to career assessment, learning style assessment, and interest assessment. As the data were evaluated, questions arose, which will be discussed in a later section. This paper has four objectives:

1. Report the mean values for the career map coordinate for education majors and options within the major
2. Report the mean values for the learning style spectrum for education majors and options within the major
3. Evaluate the reliability of selecting options within the education major

4. Evaluate the degree of bias against math and science by early childhood and elementary teachers

Study and Assessments

The questionnaires for this study were provided by Dr. J. Gregory to Charlotte Smith. Smith conducted the student survey in fall 2002. Students involved were enrolled in education courses. The questionnaire, a printed form of the ED DOCTOR component of E-COACH, was collected from students seeking post baccalaureate teacher certification. Of the questionnaires collected, 71 were used for this study. Some questionnaires were eliminated because not all sections were filled out completely or correctly. Additionally, the 71 students were divided into four teaching categories based on questionnaire information. The four groups are: early childhood – 4th grade and human sciences (EC-4 & HS [19 people]), elementary education (ELED [18 people]), secondary education (SECED [10 people]), and education other (ED other [24 people]). This was done in an attempt to display groups according to current teacher certification grade/level areas. The 71 surveys were entered into E-COACH using alphabetical identifiers for each questionnaire. The first set of survey questions are geared toward student career mapping. The second set reflects learning style preference for assessment. The final set is indicative of teaching area preference/interest. This study presents some descriptive statistics (arithmetic mean and percentages) as a basis for evaluating the study groups.

Career Mapping/Assessment

ED DOCTOR career mapping uses an interest questioning process to determine an individual's possible area for career match. Questions are based on interest in things, people, data, and ideas. The process is related to the Myers Briggs Type Instrument excluding the introvert and extrovert typing. It also relates to left- and right-brain function in the front lobes of the brain. The study and processing of things and data tend to be left-brain dominate functions. Right-brain processes include emotions or people functions and ideas or creativity. A numeric value or coordinate on a career map is assigned to indicate preference areas which map toward career areas. For this study group, most people mapped toward having a preference of people over things and ideas over data. The four groups were compared. The comparison is available in Figure 1. The mapping is consistent with what has been reported for people interested in pursuing careers in education.³

The career map coordinates also tended to be similar across all options. From a practical point of view, there was more individual scatter than difference in mean values between options. In other words, education majors of all options tended to have a common coordinate—a preference to study and work with people over things. There was a slight interest in ideas over data, but in a global sense education majors are nearly neutral in interest toward data and ideas. It can be concluded that education majors can be described with one career map value.

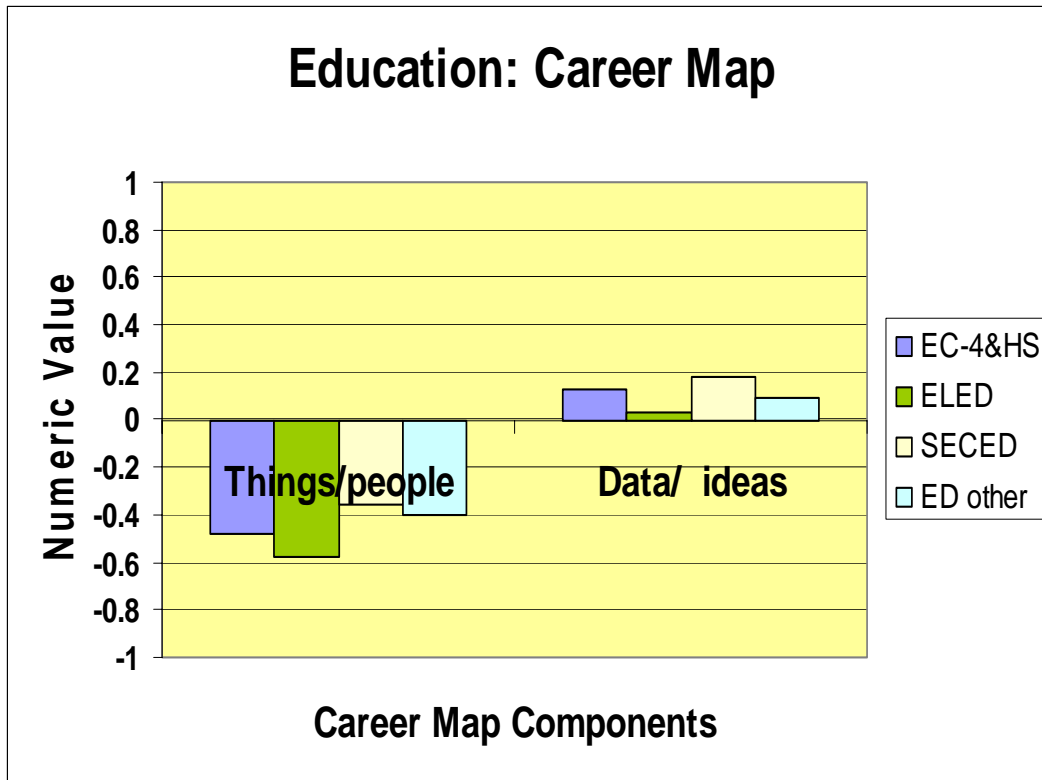


Figure 1. Education career map coordinates for four options.

Learning Styles

The learning style assessment in ED DOCTOR asks for information according to an individual's preferred learning method. Preferences are divided into four groups: hearing, reading, somatic, and visual. For the learning style assessment, the four education groups (EC – 4 & HS, ELED, SECED, and ED other) were fairly similar. One difference noted was that the elementary education and the other or mixed group showed a lower preference for hearing as a learning style than the other groups (Figure 2).

The learning style assessment is based on processing of sensory input to the brain. To our knowledge, no prior data for education majors have been published. Learning styles do vary by major;⁴ thus, either career map coordinate or learning style spectrum values can be used to define career interest. Both of these assessments together should be better than either alone. Thus, knowing the learning style characteristics of education majors is an important contribution to better assessment and a more reliable assessment of career interest.

Teaching Field Preference/Interest

In this ED DOCTOR assessment, the students were asked to order three separate lists from most to least desired. Each list contained descriptors from the following teaching areas: business, early childhood, English, math, science, and visual and performing arts. For this study each of the four student groups were analyzed separately. The preferred order for each teaching area was

charted as a percentage. The initial objective was to test the reliability of the process in matching interest to career choice. In addition to verifying that the process was reliable, the distribution of career interest also revealed a bias against math and science. These results are discussed for each career group in this study.

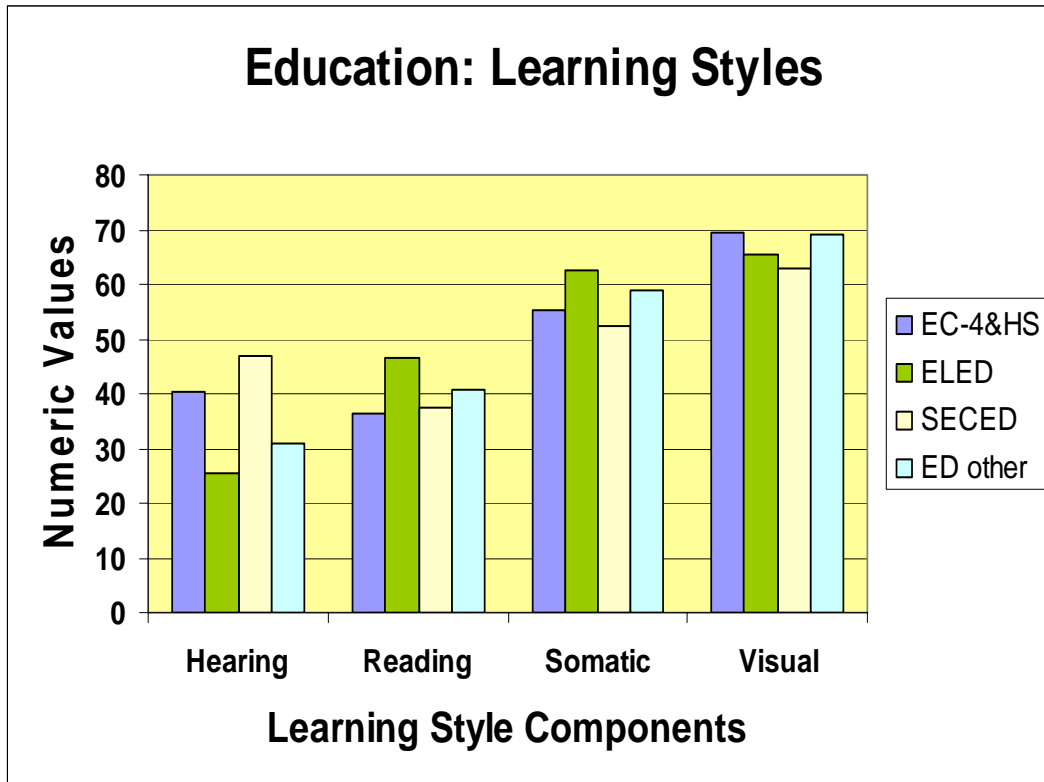


Figure 2. Learning style distribution for education options.

Early Childhood – 4 & Human Sciences

In the EC – 4 & HS group, the early childhood field was identified as a first choice (Figure 3) by 12 of the 19 students (63%). This high percentage selecting an interest that matched the early childhood profession was desirable and encouraging. Yet, inversely, six of the 19 teachers chose math as least preferred (32%) and 10 of the 19 chose science last (53%). The second preferred area was English (five out of the 19 or 26%). In reviewing the preference list for EC – 4 & HS, one discovers that 19 of 19 (100%) ranked early childhood as first, second, or third choice. This 100-percent match is a positive, desired, and expected result. Within the limits of this relatively small data set, it can be concluded that the ordering of options within the education major is a reliable process. It should be noted that this data set was independent of the calibration process used to develop E-COACH.

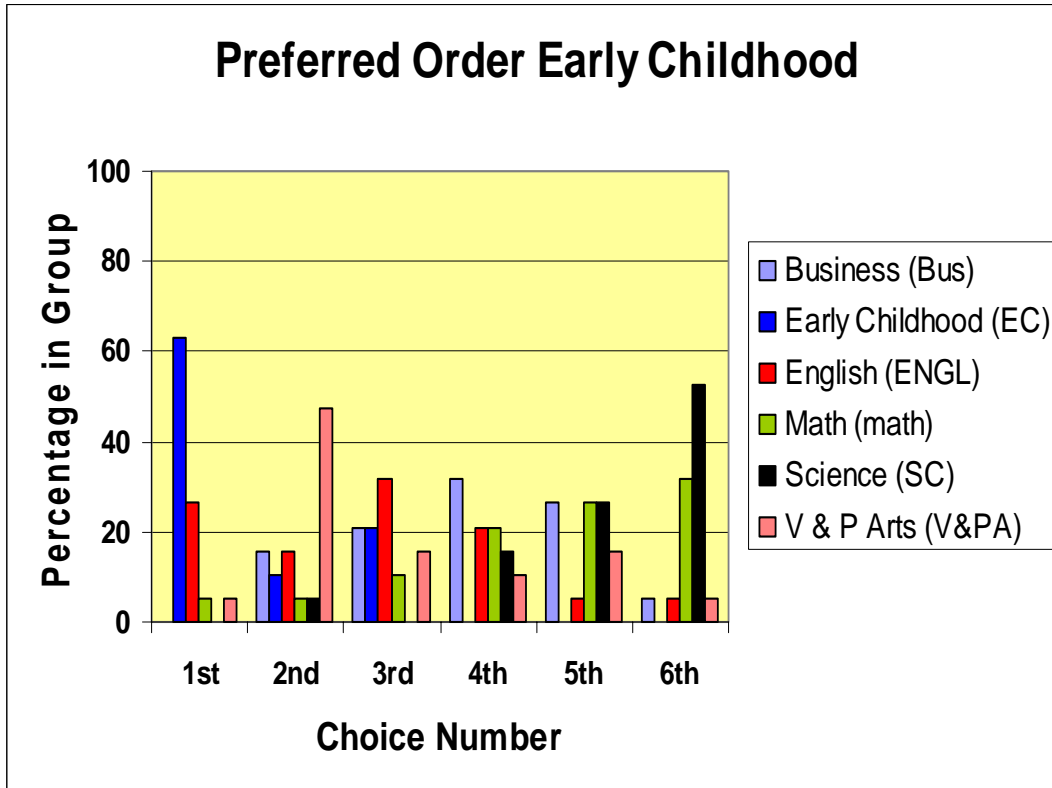


Figure 3. Preferred education option by teachers working in early childhood.

Only four of 19 people (21%) selected math as a first, second, or third choice. For science, one student out of the 19 (5%) ranked the field as a second choice. No students chose the field as a first or third preference. Additionally, 15 of the 19 students (79%) chose math as a fourth, fifth, or sixth choice. For science, 18 of the 19 (95%) selected the area as a fourth, fifth, or sixth choice. While teachers seeking certification would be expected to prefer early childhood as a field, it should be noted that lack of preference for math and science could cause a significant problem of negative attitude and lack of interest toward math and science for the students. If the process of selecting an education option is highly reliable as it appears to be, then the process also indicates that teachers of young children have a non-random and strong bias against math and science.

Elementary Education

In the elementary education group, the preferred option again was early childhood (Figure 4). Twelve of the 18 teachers (67%) selected the area as first choice. No students in this group chose math as a first preference. Two of the 18 (11%) preferred science first. Additionally, early childhood was first, second, or third for 17 of the 18 teachers (94%). Only three of the 18 teachers (17%) selected math as a second or third choice. For the science area no teacher selected it as a second or third choice. For fourth, fifth, and sixth preferences, early childhood was selected as fourth choice by one student (6%). No students selected early childhood as a fifth or last preference. Math was chosen by 15 teachers (83%) as a fourth, fifth, or sixth choice. For the science field, 16 of the 18 (89%) ranked it fourth, fifth, or sixth (11 ranked the field last).

Again, early childhood is likely to rank high in preference among the elementary education group, but the ranking of math and science as last choices probably indicates an undesired bias against math and science education.

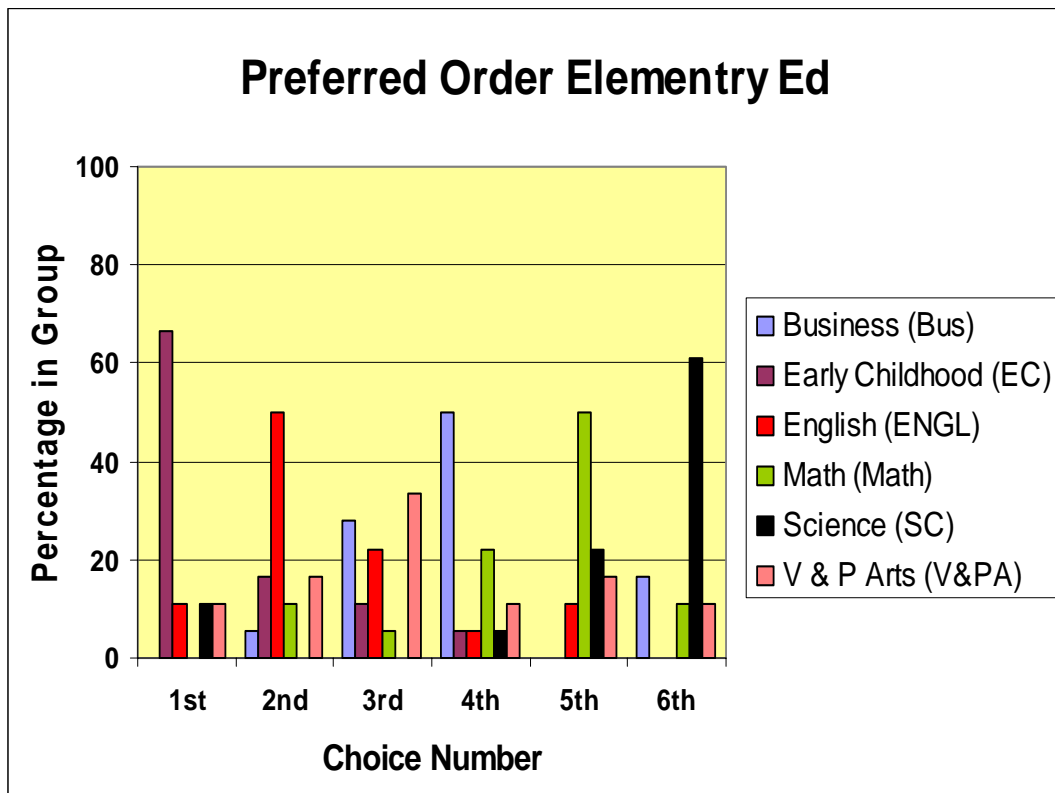


Figure 4. Preferred order of education options by elementary teachers.

Secondary Education

The secondary education group was the smallest. This group ranked English highest (Figure 5) as first preference (six out of 10 teachers or 60%). Two students selected early childhood first (20%). One student selected math (10%) and no student selected science as a first choice. In comparing early childhood ranking, eight students chose it as first, second, or third preference. Two students selected it as fourth, fifth, or sixth. Four students chose math as first, second, or third choice, while three students deemed it fifth choice and three students chose it as least preferred. For science, three students selected as a top three preference, but seven students (70%) placed it in the fourth, fifth, and sixth rankings. In this group, early childhood was still a more preferred field than math or science.

Education Other

Education other is the largest group. This group is a mix of certification levels from early childhood through high school. Some in the group are possibly seeking all level certification in an area. Again, English had the highest number of first choice selections (eight out of twenty-four students). Science had the second highest number as first choice (six out of twenty-four

students). Early childhood was selected as a first, second, or third choice by sixteen of the twenty-four students. Ten of the students (42%) ranked math as first, second, or third. Nine students of the twenty-four chose the area of science as a top three preference. For bottom three rankings, eight out of the twenty-four chose early childhood. Fourteen (58%) of the group ranked math in the three least preferred. Fifteen students (63%) selected science as fourth, fifth, or sixth preference. Although the discrepancy between teaching field preference is not as pronounced in this group it is still evident that math and science fall lower on the teaching field preference scale than early childhood.

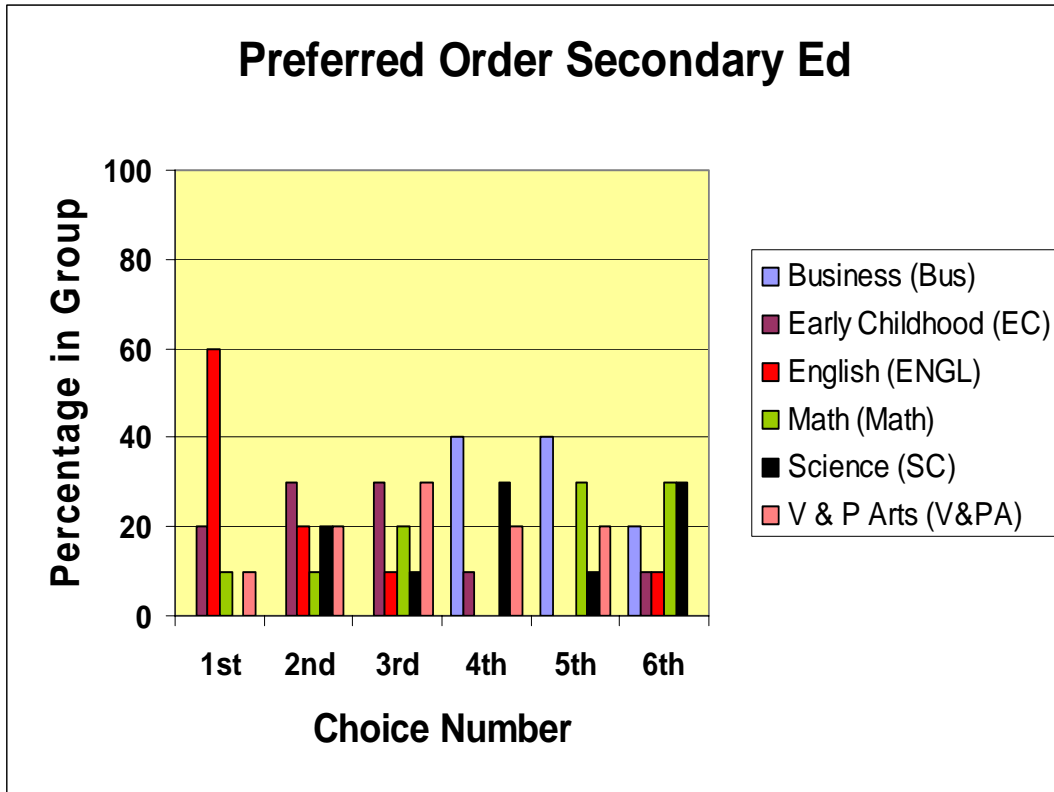


Figure 5. Preferred order for secondary education teachers.

Bias Against Math and Science

Based on Figures 3 thru 6, there appears to be bias against math and science. As a further comparison and analysis, the concept of moments was used to develop an interest index to compare interest toward major or away from a major. The number of people making a first choice were multiplied by the quantity of 6 minus the choice number, 1, in this example. This product or moment was added to the product of the number in second choice times the Quantity of 6 minus 2, etc. The sum of the moments was then divided by the total number of people in the set, such as 19 for the Early Childhood certification. The results are shown in Figure 7. This index quickly illustrates the bias against math and science for the Early Childhood and Elementary teachers. Even business has a higher interest than math and science.

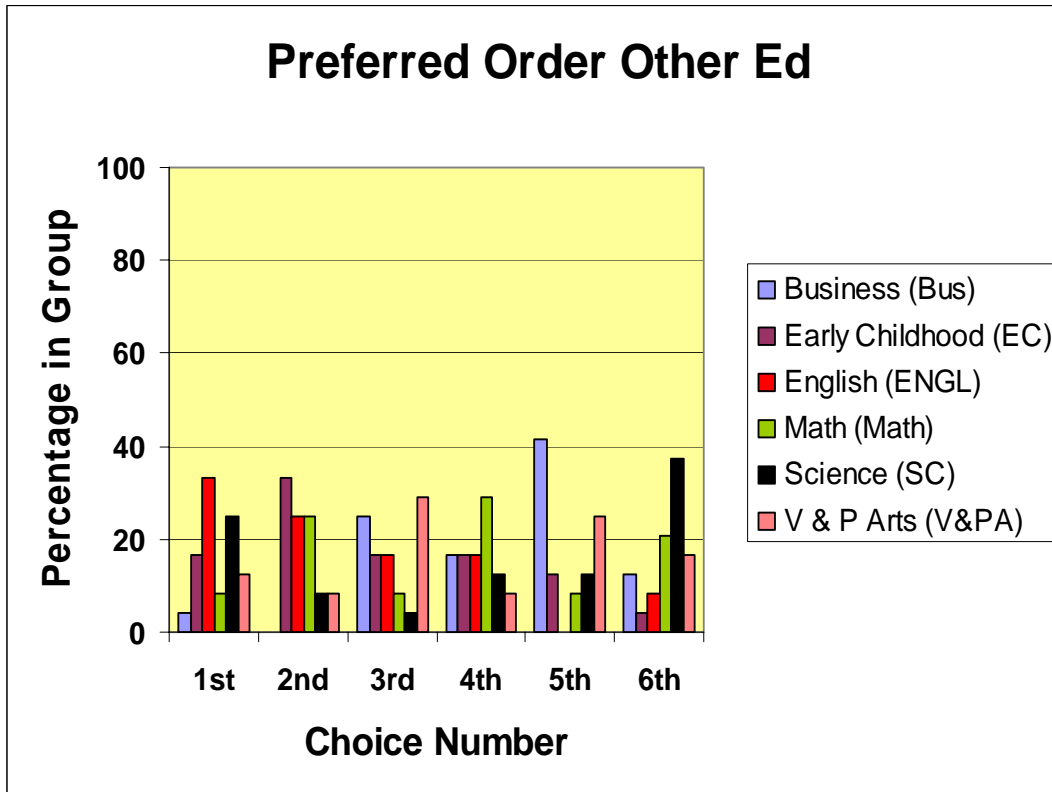


Figure 6. Preferred order for education options associated with a mix of teaching positions.

Summary and Conclusions

This paper has attempted to present the findings of a study regarding the E-COACH advising tool used with a group of students seeking post baccalaureate teacher certification. The E-COACH component ED DOCTOR was used to evaluate career mapping, learning style assessment, and teaching field preference for the group. The career mapping and learning style assessment provided clear and expected results. The teaching field preference provided both expected and unexpected results. In an address at the ASEE Annual Conference and Exposition, Dr. Shirley Jackson presented “Changes and Challenges in Engineering Education” (available at <http://www.asee.org/conferences/annual2003/speech.cfm>). In this presentation, Dr. Jackson delivered relevant points for this study and its results. First, Dr. Jackson reports “U.S. students rank near the bottom internationally in science and mathematics”.⁵ The question that arises for this study in conjunction with the statement follows: Is teacher lack of interest in the math and science fields impacting what happens in the classroom? Additionally, Dr. Jackson points out that “engineering enrollments, essentially, are flat”.⁵ Math and science are disciplines necessary for the study of engineering. If the areas of math and science are neglected in the classroom due to lack of teacher preference toward the fields, what impact will this have on learning?

This study is not an attempt to answer these questions, but rather to present them for possible further study. Potentially, the results which show that math and science are usually least preferred by students seeking certification could be expanded for further study. Preference of students seeking traditional undergraduate certification should also be investigated. There has been research conducted on related issues such as math anxiety impact on teacher effectiveness, teacher beliefs and behaviors in the classroom, and teacher education developments and efficacy.^{6,7,8} Yet, as Dr. Jackson's remarks remind one, there are still problems which need solutions. This paper offers no solutions, but the results indicate that further study should be conducted to identify the impact (if any) that teacher lack of preference for the math and science field has in the classroom.

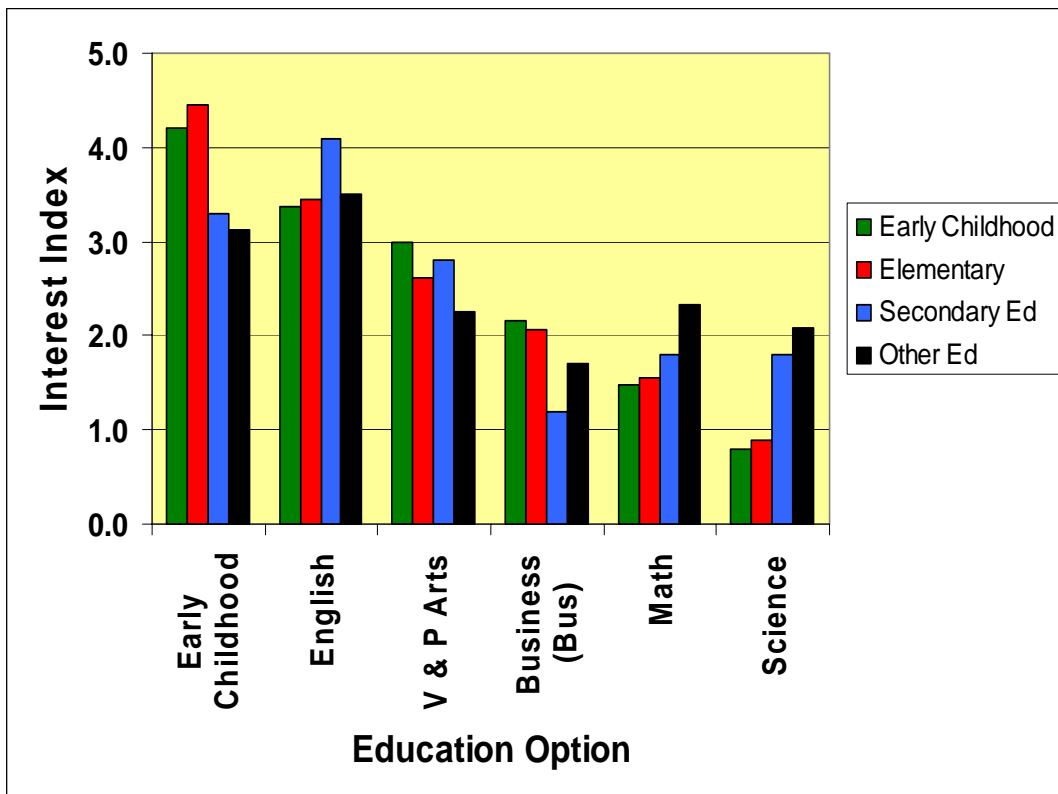


Figure 7. Preference index for education options by four teaching classifications.

It is desirable for the early childhood and elementary teachers to have a strong interest in children, child development, and human science. Based on the need for technical people in the workforce and the fact that student interest towards math and science has been flat in recent years, it appears that three education objectives would be appropriate for early childhood and elementary teachers:

1. Maintain the current interest toward early childhood and elementary education.
2. Add curriculum and experiences to create a more positive attitude toward math and science.

3. Continue to assess and adjust the education process until teachers have either a neutral or non-bias interest toward math and science or even to the point of having a secondary preference for math and science after early childhood.

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