A MIXED METHODS COMPARISON STUDY OF PLACEMENT STRATEGIES FOR COLLEGE MATHEMATICS COURSES

DISSERTATION
SUBMITTED TO
College of Education
ASHLAND UNIVERSITY

In Partial Fulfillment of the Requirements for
The Degree
Doctoral of Education in Educational Leadership
Victoria Ann Ingalls, B.S., M. Ed.

ASHLAND UNIVERSITY
ASHLAND, OHIO
2008
A Dissertation

entitled

A Mixed Methods Comparison Study of Placement Strategies

for College Mathematics Courses

by

Victoria Ann Ingalls

In Partial Fulfillment of the Requirements for

The Degree

Doctor of Education in Educational Leadership

[Signatures and dates]

Ashland University
December, 2008
A MIXED METHODS COMPARISON STUDY OF PLACEMENT STRATEGIES
FOR COLLEGE MATHEMATICS COURSES

By
Victoria Ann Ingalls
ASHLAND UNIVERSITY, 2008

Dr. Howard Walters, Chair and Dr. Ann Shelly, Co-Chair

The purpose of this study was to better understand the mathematics placement process currently used at Tiffin University as well as to compare the respective accuracy and success rates of four different placement methods historically utilized by the college. Interviews with the mathematics department chair brought forth the expert judgment in making decisions based on multiple measures. Quantitatively, the math subscore of the American College Test, Course Placement System data, online placement testing, and expert teacher judgments of 1508 students were analyzed statistically. In short, although the accuracy rates of the methods varied within three course levels, the accuracy rate of the expert teacher was most often higher than the other methods. There was no pattern to the success rates.
For the bike.
<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>PAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td></td>
</tr>
<tr>
<td>Identification of the Problem</td>
<td>1</td>
</tr>
<tr>
<td>Key Definitions</td>
<td>4</td>
</tr>
<tr>
<td>Research Questions and Hypothesis</td>
<td>4</td>
</tr>
<tr>
<td>Theoretical Significance of the Study</td>
<td>6</td>
</tr>
<tr>
<td>Practical Significance of the Study</td>
<td>7</td>
</tr>
<tr>
<td>Limitations</td>
<td>9</td>
</tr>
<tr>
<td>Delimitations</td>
<td>9</td>
</tr>
<tr>
<td>II.</td>
<td></td>
</tr>
<tr>
<td>Review of the ACT Literature</td>
<td>11</td>
</tr>
<tr>
<td>Review of the Course Placement System Literature</td>
<td>16</td>
</tr>
<tr>
<td>Review of the Teacher Judgment Literature</td>
<td>19</td>
</tr>
<tr>
<td>Review of the Placement Test Literature</td>
<td>26</td>
</tr>
</tbody>
</table>
III.  29

Research Questions.................................................. 29
Design................................................................. 29
Participants.......................................................... 30
Data Collection...................................................... 30
Data Analysis........................................................ 32

IV.  36

Results of Informed Teacher Judgment Process............ 36
Results of Focus Group Interviews............................ 63
Results of the Placement by Informed Teacher Judgment.... 64
Results of the Placement by ACT-M............................ 65
Results of the Placement by CPS............................... 68
Results of the Placement by Online Test....................... 69
Results of Comparisons........................................... 70

V.  74

Further Conclusions............................................... 82
For Future Study.................................................... 84
REFERENCES……………………………………………………………………………….. 86

APPENDICES

Appendix A: Letters of Permission………………………………… 97

Appendix B: Institutional Review Board…………………………… 100

Appendix C: Interview Protocol…………………………………….. 103
LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 1:</td>
<td>Informed Judgment Accuracy and Success</td>
<td>65</td>
</tr>
<tr>
<td>Table 2:</td>
<td>ACT-M Accuracy and Success</td>
<td>67</td>
</tr>
<tr>
<td>Table 3:</td>
<td>CPS Accuracy and Success</td>
<td>68</td>
</tr>
<tr>
<td>Table 4:</td>
<td>Online Test Accuracy and Success</td>
<td>70</td>
</tr>
<tr>
<td>Table 5:</td>
<td>Overall Accuracy and Success</td>
<td>72</td>
</tr>
</tbody>
</table>
CHAPTER I

Tiffin University (TU) is a small, private liberal arts college in rural northwest Ohio. Centrally located between Toledo, Columbus and Cleveland, it must compete with both large and small schools. The university is best known and nationally recognized for its undergraduate criminal justice and forensics majors, as well as its online graduate business program. The 2300 students who currently attend the university are recognized as the customer base, and the administration’s organizational effort is concentrated on those students.

As part of the prescribed curriculums for core knowledge and core skills, all students in the undergraduate programs must complete one of two academically equivalent mathematics courses. As is common to most other colleges and universities (Sawyer, 1996), TU also enrolls some students who are admitted without the necessary skills to succeed in the credit-awarded classes. There are remedial classes to accommodate such students. The remedial courses do not carry credit toward graduation, although the students are allowed to improve their math and English skills, while simultaneously beginning the other regular college curriculum.

Identification of the Problem

The inherent problem with multiple course offerings is the initial placement of any student into either the remedial or standard curriculum (Weber, 1986). “For a student to have the best opportunity to reach his potential under this system is it absolutely essential that he be initially placed at the proper point in his remedial work” (Jones, 1997,
Many educators presume that a student’s academic survival and success depends on adequate assessment of entry level skills and proper placement into courses and programs of study (Woods, 1985). The essential dilemma is the determination of an appropriate evaluation for incoming students in order to place them accurately in their college courses.

Universities throughout the country struggle with the decision of the most effective way to place the students. Some opt for course placement from a single measure such as American College Test (ACT) math sub-scores (ACT-M), which along with the Scholastic Aptitude Test (SAT), is the major entrance screening device in higher education (Sattler, 1998). High school grade point average (HSGPA), high school percentile rank, and entrance exams are other frequently used methodologies for first semester college course placement. The high school indicators were highly subjective to teacher grading practices and beliefs (Ang & Noble, 1993) although placement testing tends to differentiate among the less proficient students (Sattler) in a consistent setting. Many colleges and universities use placement testing because it is the cheapest, easiest, and least time-consuming method of determining a student’s basic skills (Jones, 1997); however, the validity of many of these tests is questionable (Schmitz & delMas, 1991).

Proper mathematics placement has both short and long-term impact. For instance, 56% of faculty members indicated that working with underprepared students was a source of stress (Lindholm, Szelenyi, Hurtado, & Korn, 2005). When students are improperly placed too low, they may be bored, feel penalized and frustrated, and drop the class. If placed too high, there is little chance of success, and if they do pass, they are not
likely to apply what they have learned. There is then complete frustration with the course and math in general (Ang & Noble, 1993; Jones, 1997; Myers, 2002; Sawyer, 1996). Akst and Hirsch (1991) stated that “the consequences of misplacement can be devastating for students” (p. 3). Placement in inappropriate coursework disables a student from achieving at an individual level, thereby reducing the chance of retention and success at the university. In reaction, schools may then feel the need to lower the academic standards for admission.

In contrast, students who are placed into classes which reflect their abilities will be more likely to succeed at the university (Cronin, 2000). In such circumstances, students’ confidence in their abilities may increase, resulting in improved self-esteem. Students who have been placed appropriately are more likely to remain at the institution, in turn helping to provide a growing university student population (A. Staunton, personal communication, April 17, 2008).

In order to achieve these short and long term benefits, TU must properly place the freshmen into their entry level courses. Thus, the purpose of the study was to determine the most effective method to place incoming freshmen into their first semester math courses. The four methodologies for comparison included placement by the single variable ACT-M, the ACT corporation’s prediction model based upon our curriculum, informed teacher judgment with non-mathematical multiple measures, and an institutionally-developed, curriculum-specific online placement test offered to all of the incoming freshmen.
Key Definitions

ACT-M- The math subscore of the American College Test Assessment.

CPS- Course Placement Service division of the research services available from the ACT Corporation.

Informed teacher judgment- Using prior knowledge and experience to make a professional judgment about student ability.

Accuracy rate- The percentage of students who were correctly placed into a course. This included the true positives, or students who took the course and were successful, as well as the true negatives, or students who did not meet the established criteria and did not take the course. That number was totaled then divided by the total number of valid student entries.

Success rate- The percentage of students who earned a C or better of all students placed into the course divided by the total number of valid student entries.

Research Questions and Hypothesis

In a dearth of campus-specific data on placement methodology, an investigation of the accuracy and success rates for four distinct math placement strategies seemed necessary. As course placements have been historically done using a series of informed teacher judgments, the first research question solicited the process of making students’ mathematical course placements using informed teacher judgment. Closely related, the students were asked about their perceptions of that strategy.
Following the qualitative research, the quantitative questions for the first placement strategy were (a) what is the overall accuracy rate of placing students using informed teacher judgment?, (b) what are the accuracy rates by course level of placing students using informed teacher judgment?, (c) what is the overall success rate of placing students using informed teacher judgment?, and (d) what are the success rates by course level of placing students using informed teacher judgment?

Each placement strategy reflected a parallel set of inquiries. That is, for the second method of comparison the research questions were (a) what is the overall accuracy rate of placing students using the ACT-M?, (b) what are the accuracy rates by course level of placing students using the ACT-M?, (c) what is the overall success rate of placing students using the ACT-M?, (d) what are the success rates by course level of placing students using the ACT-M?, and (e) what are the students’ opinions on using the ACT-M for placement?

The third set of questions included (a) what is the overall accuracy rate of placing students using a locally developed placement test?, (b) what are the accuracy rates by course level of placing students using a locally developed placement test?, (c) what is the overall success rate of placing students using a locally developed placement test?, (d) what are the success rates by course level of placing students using a locally developed placement test?, and (e) how do students perceive an online placement test?

Although each methodology posed a comparable set of questions, the Course Placement System (CPS) only made placements into the standard course. In other words, only the highest entry level course was available to provide accuracy and success rates.
Thus, the questions for the second methodology were limited to what is the overall accuracy rate of placing students using the CPS and what is the overall success rate of placing students using the CPS?

The final question set involved comparing the accuracy and success rates of each methodology. In other words, are there statistically significant differences by method in the accuracy and success rates? Referent to inferential statistics, I hypothesized that the proportions for accuracy would differ significantly by method. A similar hypothesis was formulated for successful placement for each type. Moreover, I theorized that the insertion of multiple measures of standardized data into an expert system would provide the most effective method for placement. That is, I presumed that judgment based on teacher experience and expertise would present higher accuracy and success rates than placement by ACT-M, CPS, or placement testing.

*Theoretical Significance of the Study*

The nature of the research questions justified a mixed methods approach, necessitating the use of both objectivist and existentialist ontologies. This study added to the body of literature in both its empirical analysis of the effectiveness of placement strategies and the personal experiences within the ethnographic case study. Moreover, my research grew from four major bodies of inquiry, and may thus add to the knowledge base of each. Moreover, the epistemology associated with each facet of the study provided the opportunity to address a gap in knowledge as well as to inform practice (Creswell, 2005) in placement options and processes. That is, the use of both conceptual
frameworks provided a richer context for analysis and synthesis relative to the single-universe perspective predominant in the body of literature.

In the former, the post-positivist perspective provided a conceptual framework to answer many of the research questions through empirical standardized testing. The nature of the data was fixed and measurable, providing epistemological proof of existence. The subjective qualitative portion of the research nested within the concrete objectivist approach. The qualitative research portion of the study utilized the direct, personal authentic experiences of the single voice with respect to the process of making placements based upon informed teacher judgment.

**Practical Significance of the Study**

Determining the need for change and best way to place incoming freshmen in their initial mathematics course supports the TU ideology of student as customer and could positively impact many aspects of the college. The university may benefit through this evaluation and recommendation process with increased morale and time resources in the admissions department and Registrar’s office, in addition to positive community relations. By using the most effective mathematics placement tool, the professors might have greater ease of instruction and classroom assessment. The students, the university’s customers, may feel more positive about their educational experiences and the amount of time it took to complete their undergraduate degrees.

Overall, identifying the most effective available method could create many good outcomes at Tiffin University. In summary, “There is a need to periodically evaluate a
placement scheme or system…. that is subject to malfunction over time due to changes in student characteristics and alterations in course content” (Frisbie, 1982, p. 133). Limiting the analysis to the four methods that are currently available to TU provided the opportunity to thoroughly examine each placement option and compare the accuracy rate of each.

Inasmuch as this study may influence the future practices of mathematics course placements for students in generations to come, the mixed methods approach to this research also attached itself to much larger issues of universities throughout the nation. Using ethnographic methods in addition to statistical testing allowed for a diverse body of data which in turn magnified issues within the general current college culture. In short, the larger issues of objectivity versus subjectivity in placement judgments and multiple sources versus any singular piece of data were exposed.

Within the context of this study, the qualitative human factor appeared to provide a richer context for judgment within its multiple measures of student achievement. That is, despite the inherent subjectivity, the expert judgments of the TU Mathematics chair had higher accuracy rates than the other methods. Her placement practices employed as many objective assessments of student achievement as were available per student; however, she ultimately, made a subjective judgment. A large percentage of her placements were correct, lending themselves to the success of the students she processed as individuals. Thus, another instance of practical significance would be that other comparable schools may align themselves to the context of this study and accept the results offered by TU to direct their own placement practices.
Limitations

Both limitations and delimitations existed in this placement method study. The limitations included restricted access to student records beyond the current enrollees, missing data, limited timeframes with which to access and conduct interviews with students and faculty, and one point of contact for the ethnographic portion of multiple-measure placement. Due to my status as junior faculty at TU underneath the tutelage of the department chair, a potential bias was introduced into the hypothesis, data collection and qualitative data analysis.

Additionally, the placement test was employed for only one cohort of freshmen due to its lack of accuracy and the inherent consequences for course misplacement. Unable to obtain IRB approval prior to the end of the fall semester, placement test surveys were only allotted to freshmen taking a math course second semester. Most importantly, the study cannot be generalized as the mathematic curriculum and CPS predictive equations are specific to TU. The student population academic and demographic characteristics may not be similarly represented in larger or more selective schools.

Delimitations

As the study was practitioner-based and highly location specific, I limited the placement options to methods previously used at TU. Other delimitations included using only fall semester placement data, since that was when the majority of freshmen took their initial math courses. In order to be consistent with the CPS research and suggestions
for exclusion of withdrawals and incompletes, the students with such outcomes were consciously omitted from the results.
CHAPTER II

Review of ACT literature

Standardized testing became a way of life in America following World War I (Perrone, 1977). As of 1963, students’ achievement and aptitude were measured by standardized tests such as the SAT and ACT the transition from high school to college. Unlike the SAT, which was designed as a non-curriculum specific, standardized measure of knowledge for college admissions, the ACT was designed to measure the academic skills taught in typical college-preparatory curriculum in high school (Ang & Noble, 1993; Koenig, Frey, & Detterman, 2008; Sawyer, 1989) that are necessary for success in the first year of college (Allen & Sconing, 2005). Taken during either the junior or senior year of high school (Weber, 1986), the achievement battery encompasses four tests: English (ACT-E), ACT-M, Reading (ACT-R), and Science (ACT-S), with a composite score (ACT-C) ranging from 1 to 36. The producers of this test have regularly conducted national curricula studies to ensure that the content of the ACT is consistent with high school curricula across the country while different forms have been created with procedures that ensure the same content, difficulty, and variability (Koenig, Frey, & Detterman). With a reliability coefficient of .9 (ACT, 1987), the ACT has provided an objective measure of student academic achievement and readiness for college (Allen & Sconing).

Although the ACT measured academic achievement directly linked to college preparatory curriculum and readiness for college (Allen & Sconing, 2005), it was also
intended to predict test takers’ future grades in college (Popham, 2007). In a 1981 study by Popovics and Jonas (1991), grades appeared to be closely associated with general achievement and aptitude. That is, lower grades were associated with lower ACT scores while higher grades were associated with higher ACT scores. High scores on the four ACT subtests showed that a student was proficient in the subject areas and was ready for college level work (Allen & Sconing). The ACT seemed to predict the first semester college grades more accurately than the SAT at selective institutions (Aleamoni & Oboler, 1978; Lenning & Maxey, 1973) and at yearly intervals over a four year span at all types of institutions (Rowan, 1978). Other statistically significant correlational studies have also been conducted with the ACT, though they were highly specified to concurrent validity with the Descriptive Test of Language Skills (Snowman, Leitner, & Snyder, 1980), Pre-Professional Skills Test (Heard & Ayers, 1988), or the Armed Services Vocational Aptitude Battery (Koenig, Frey, & Detterman, 2008).

Many other studies also reflected the predictability of the ACT. The literature documented the ACT’s high levels of predictive validity across certain ethnic and socio-economic groups. Merritt (1972) measured the correlation of predictability for low socioeconomic ACT and college GPA as $r_{\text{male}} = .32$ ($p < .001$) and $r_{\text{female}} = .50$ ($p < .001$). Others contributed to the body of ACT research concluding that gender, financial aid status, attrition, or high school grade status produced no significant correlation with the ACT (Maxey & Ferguson, 1976; Popovics & Jonas, 1991).

Stumpf and Stanley (2002) found that ACT scores at the 25th and 75th percentiles were good predictors of the percentage of student grades from the same institution that
admitted them as freshmen. Specific correlation coefficients ranged from .47 to .75 math predictability, depending on the researcher and year (Allen & Sconing, 2005; Boyce & Paxson, 1965; Merritt, 1972). When the ACT was combined with other measures such as HSGPA, the predictability rose between 1% and 18.4% (Ang & Noble, 1993; Halpin, Halpin, & Schaer, 1981), with the major differences occurring between HSGPA levels of 3.0 and 4.0 (Noble & Sawyer, 2002). However, even after adjusting for the effects of other factors such as HSGPA, the positive relationship between ACT and success criteria remained (Allen & Sconing, 2005; Noble & Sawyer; Popovics & Jonas, 1991). The relationship between overall HSGPA and ACT-C virtually mirrored the correlation to high school math GPA and ACT-M (Noble & Sawyer).

With respect to the four subscores, the ACT-M has been used to predict students’ success in College Algebra, the ACT-R for social sciences, the ACT-S for Biology, and ACT-E for English and composition (Allen & Sconing, 2005). The subscores have also been used for course placement purposes, with the ACT-E and ACT-M most frequently occurring in the literature. In a study of 900 institutions of higher education, McNabb (1990) found that over one-fifth of public and private schools used only the ACT, with 38% indicating use of subscores to make math and English placements. He also determined that 43% of the schools used the ACT-E and 38% of the sample used the ACT-M for the respective course placements. The highest percentages were at four year colleges, especially at private religious schools, universities of traditional and liberal selectivity, schools with populations over 4000 students, and those found in the mountain plain states (McNabb). For standard level courses, the ACT subject area subscores were
the most effective for making initial student placement, although combining them with other measures further improved the accuracy (Ang & Noble, 1993; Noble & Sawyer, 2002).

In contrast, many studies have also demonstrated the limitations of the ACT as a valid predictor of first semester college grades (Aldeman, 1999; Phillips, 2006). For instance, Wattenbarger and McLeod (1989) found that of 605 first semester college students, half of the grades were negatively correlated to their ACT scores while those scores that did show a positive relationship were weak correlations. Thus, some conclude that the ACT may be less valid as a predictor of college academic success (Merritt, 1972). Researchers at Providence College stated that their data indicated that neither the SAT nor the ACT has been a successful predictor of the students with strong grades and records. With respect to student athletes, Bauman and Henschen (1986) found that the NCAA test score criterion would have disqualified 54% of Black males and 49% of Black females who attended and subsequently graduated from college. In contrast, only 9% of White males and 9% of White females would have been disqualified. For the collegiate athlete, it appeared that other factors such as HSGPA were better predictor of academic success than the ACT (Bauman & Henschen). This was true with non-athlete sample groups, as well (Halpin, Halpin, & Schaer, 1981; Weber, 1986)

Other researchers contest the validity of the ACT based on racial and socio-economic subgroups (Cronin, 2000). Popovics and Jonas (1991) found that the fraction of Blacks with low ACT scores was higher than the fraction of Black students with high ACT-C and that the fraction of White students with high ACT-C was greater than the
fraction of White students with lower ACT scores. Those researchers also asserted that significant predictors of ACT scores were race and GPA and that in regression equations, the largest coefficient in determining ACT was race. Similarly, Bauman and Henschen (1986) found that Caucasians predicted better than non-Caucasians, though the difference was not statistically significant. Other researchers have shown standardized tests generally favor the middle class (Gifford, 1989; Merritt, 1972; Popovics & Jonas, 1991). “The view that standardized testing creates a barrier to educational access is not new. They can serve to restrict or enhance educational access. They can serve to enhance or impede educational progress” (Koenig, Frey, & Detterman, 2008, p. 1). Pascarella, et al. (2006) corroborated the theory of test bias although reporting that the ACT may simply be too global of an index to provide much information about the quality and impact of students’ classroom experiences.

Many researchers assert that general aptitude tests may be considerably less valid for predicting success in specific courses (Bridgeman, 1982; Jones, 1997; Wattenbarger & McLeod, 1989; Weber, 1986). Other researchers agreed that using the ACT subscores to make course placements is an act that should be done with caution (Bridgeman; Snowman, Leitner, & Snyder, 1980; Stiggins, Schmeiser, & Ferguson, 1978). Rather, the ACT-C and subscores should be used to identify those needing further diagnostic testing and remediation (Allen & Sconing, 2005; Bridgeman). Although the labels varied from institution to institution, the basic idea was to reduce the chances of student failure by providing lower level instruction and thus prepare students for success in the standard course (Sawyer, 1989).
If the ACT-C or subscore was to be used to determine placement into remedial or standard courses, it should only represent a portion of student evaluation and course placement (Isbell, 1988; Matzen & Hoyt, 2004; Morante, 1989; Phillips, 2006; Truman, 1992; Wattenbarger & McLeod, 1989; Weber, 1986). The ACT Corporation held a similar opinion (ACT, 1994; Noble & Sawyer, 2002). Multiple measures, such as standardized test results, performance in select courses, and HSGPA, appeared to supplement placement tests for placement decisions (Morante, 1987; Wattenbarger & McLeod). “Seldom should test results be the sole criterion on which educational decisions are based; educational settings are too complicated to support such a practice. Other information should be combined with test results to enable educators to make sound decisions” (Patterson, Czajkowski, Hubbard, Johnson, Slater, & Kaufman, 1977, p. 343).

In summary, the ACT has been widely studied. The predictability of college success, predictability for specific courses, and predictability for specialized ethnic and gender groups were prominent themes throughout the literature. Though frequently criticized for its bias and lack of validity for use as a course placement tool, it remained a powerful force in colleges.

Review of Course Placement System Literature

In response to the growth in decision making with placement and the ACT, the company founded its CPS in 1988 (ACT, 1994). As part of the Prediction Research services division of ACT, the CPS has partnered with participating institutions to develop
prediction equations for course success based on campus-specific and aggregate information (Sawyer, 1989). The models were built on placement variable data such as ACT subscores, HSGPA, post-high school grades, coursework, or local placement test scores. Sawyer categorized the CPS logistic regression model estimates of conditional success as conceptually simpler, but computationally more complex. As is the case for logistic regression, those outcomes were dichotomous with a 0 for unsuccessful and 1 for successful.

Each CPS model was developed through a two-stage process. The first phase determined the logistic regression equation relative to the placement variable(s) and the probability of a successful outcome in the reference course as determined by an estimation group that had already completed the courses in question. In phase two, the regression results were applied to data of the active placement group. The CPS allowed the option of treating withdrawals (W) and incompletes (I) as unsuccessful course outcomes or excluding them from the data used to generate the course placement statistics. The deletion of the W’s and I’s was recommended if the students under those categories were similar to the remaining scores (ACT, 1994).

The CPS also provided the comparison of a baseline accuracy rate to actual accuracy rate. That meant comparing the rate of success in the standard course based on the lowest score of the placement variable among the placement group to the accuracy rate of success using a particular cut score. Rather than using one value, or cut score, the CPS model also allowed for decision zones. These placement value ranges comprised the initial set of course placement criteria and were tied to students’ probabilities of success.
in the standard course served as the basis for the CPS model (McNabb, 1990). Thus, students who scored above the region were placed into the standard course.

In studies conducted by the CPS, the correlations of math subscore and math course grades ranged from .13 to .59, with a median correlation of .39 (ACT, 1994). The author of the CPS report commented that “if a test is already being used to place students in a given course, no student will have less than the cut score, making the correlation appear artificially low” (p. 9). Additionally, McNabb (1990) conducted a study of 900 institutions in 1986 and found that 3% of the sample schools used the ACT assessment probability values provided by the Prediction Research Center (PRC), although none of them were highly selective institutions. That study also determined that as selectivity decreased, the number of schools using the predictive services increased. In other words, 1% of selective, 2-3% traditional depending on the subject, and 19-21% of open colleges made their placement decisions based on the CPS regression model. By region and classification, the highest percentages of schools using the service for mathematics were 10% of the mountain plains schools and 7% private religious schools. In light of constant evaluation due to changing demographics of freshmen classes, 7% and 8% of the institutions modified their respective prediction equations within the last five years for English and math placements. This represented 13% of selective institutions and 12% of liberal colleges for math equation changes. Fifteen percent that made changes to the predictive math models had populations over 10,000 students. Additionally, 19% of the 900 surveyed schools anticipated making a change to the cutoff ACT score within the next five years (McNabb).
The CPS also performed its own study. Researchers within the ACT Corporation found in a sample of 80 universities using the single variable of ACT-M that 33% of students were prepared for college algebra and were placed into that course with an accuracy rate of 71%. The intermediate algebra group was ready at the same rate, but was placed accurately in 69% of the student cases. Finally, the remedial group of elementary algebra was academically prepared for the course 65% of the time, and the predictive equation placed them into the correct course at a rate of 73% (ACT, 1994).

**Review of Teacher Judgment Literature**

Teachers have been identified as the primary source of information regarding students’ academic achievement (Eckert, Dunn, Codding, Begeny, & Kleinmann, 2006). In other words, teachers evaluated pupil comprehension, learning, thinking, knowledge, and task performance (Coladarci, 1986). The resulting decisions were influenced by teachers’ beliefs, philosophies of education, and varieties of information about the student (Dompnier, Pansu, & Bressoux, 2006; Eisenhart, Shrum, Harding, & Cuthbert, 1988). This information came from sources such as previous performance on standardized achievement tests, performance in other disciplines, the context of achievement within the environment, and teachers’ knowledge of student’s individual characteristics and school history (Dompnier, Pansu, & Bressoux).

The validity, or accuracy, of these judgments of student ability was often an issue in educational research (Egan & Archer, 1985; Hoge & Coladarci, 1989; Hoge & Cudmore, 1986). Most of the research established relationships between teacher
judgments and the concurrently collected criterion by means of correlation statistics (Egan & Archer, 1985; Hoge & Cudmore) with norm-referenced, standardized tests (Hoge & Coladarci). Many of these coefficients fell between .5 and .6. For instance, in measurements of teacher judgment against direct tests, the median correlation was .62 (Hoge & Coladarci). Sharpley and Edgar (1986) found significant correlation values between the Progressive Achievement Test (PAT) and teacher judgment. Teachers formally recognized as experts in composition within their school districts or some outside agency demonstrated that correlations between teacher judgment and the Smith writing test were found to be between .963 and .983 (Whalen, 1973). However, in a sample of 200 teachers not labeled as experts, over half of them disagreed with the expert judgments.

Within specific knowledge domains, other studies have found significant relationships between teacher judgment and other variables. When teachers were directed to rate each student’s proficiency disregarding attendance and attitude, student achievement tests were found to have substantial concurrent validity in reading, math, language arts, science, and social studies (Hoge & Coladarci, 1989; Pedulla, Airasian, & Madaus, 1980). According to the Hoge and Coladarci study, teachers were considerably more accurate in judging performance in math computation than in math concepts. Moreover, teachers’ knowledge of whether their students could solve different problems was significantly correlated with student achievement (Carpenter, Fenema, Peterson, & Carey, 1988). That is, a significant positive relationship existed between teacher awareness of student knowledge and students’ actual math problem solving achievement.
scores; most teachers could even identify what primary strategies each child used to solve the different kinds of problems (Carpenter, Fenema, Peterson, & Carey). High school teachers made the poorest predictions of student performance while middle school teachers were the most accurate in their predictions of student achievement in standardized mathematics tests (Nathan & Koedinger, 2000).

With respect to ethnic and gender groups, teachers were again shown to make accurate and generally unbiased judgments. Dusek and Joseph (1983) emphasized the relationship of race and social classes on teacher expectancy. However, others disagreed with the direction of the relationship. Farkas, Sheehan, Grobe, and Shuan (1990) and McCombs and Gay (1988) each found differences in teacher judgment of ethnic groups. Delap (1994) indicated no racial bias. Similarly, the latter author found a slight gender effect, contradicting other research studies (Doherty & Connolly, 1985; Dompnier, Pansu, & Bressoux, 2006; Dusek & Joseph; Hoge & Butcher, 1984; Sharpley & Edgar, 1986). Interestingly, despite race and gender, factors such as socio-economic status (Madelaine & Wheldall; 2005; McCombs & Gay, 1988) and physical attractiveness were also shown to have strong links to biasing teacher judgments beyond pupil ability (Hoge & Butcher). In those studies, the higher socioeconomic groups and more attractive children were perceived to be brighter students.

Many of the above studies used either a ranking or rating of students. When ranking students’ performance on standardized tests, the teacher considered each student in relationship to his or her classmates and must use the full continuum of possible values. This was done despite the lack of true differences in proficiency within a class of
students (Hoge & Coladarci, 1989). In contrast, rating procedures asked the teachers to rate pupils with respect to one or more dimensions and were generally done more quickly than rankings (Hoge & Coladarci). Many researchers asserted that ratings were the more dominant form of teacher judgment and found substantial correlations between ratings and scores on standardized tests (Hoge & Butcher, 1984; Murphy, 1979; Pedulla, Airasian, & Madaus, 1980; Wright & Wiese, 1988). It should be noted, however, that teachers were reluctant to use the full range of values (Hoge & Coladarci) by tending to overuse the upper ranks (Egan & Archer, 1985). Thus, the teachers erred on the side of overestimation (Dompnier, Pansu, & Bressoux, 2006; Murphy, 1979) especially for math (Nathan & Koedingger, 2000), English achievement (Doherty & Connolly, 1985) and high achieving students (Hoge & Coladarci). However, the higher achieving students were categorized as easier to judge (Hoffman, 1960; Miller & Davis, 1992) while the lower the student’s proficiency, the more difficult and inaccurate the judgment (Coladarci, 1986).

Teacher-assigned class grades represented a traditional and almost universal means of documenting judgments of student achievement (Wright & Wiess, 1988). Often coupled with words such as confounded, subjective, and unreliable, grading practices as a reflection of teacher judgment have been highly criticized (Farkas, Sheehan, Grobe, & Shuan, 1990; Hoge & Butcher, 1984; Hoge & Coladarci, 1989; Murphy, 1979; Wright & Wiess). The philosophies, criteria, and standards vary greatly among teachers and schools (Hoge & Coladarci); many researchers related teachers’ abilities to make sound grading judgments to pedagogical beliefs and experiences (Carpenter, Fenema, Peterson,
Johansson and Kroksmark (2004) stated that “Experience as recognition is closely connected to intuition-in-action” (p. 365). These authors also stated that intuition is known and used throughout the world; teachers in their study described intuition as something unconscious, spontaneous, and physical. This “gut feeling” (Dansker, Wilcox, & Van Tubergen, 1980; Warner, 1975) led teachers to determine various educational situations, from what grade to assign to what works in the classroom when the lesson plan goes array (Johansson & Kroksmark). The judgments tended not to be made on a rational, systematic basis, but were often formed rapidly and intuitively from a limited set of cues. Eisenhart, Shrum, Harding, and Cuthbert (1988) concluded that judgments called for a “high degree of intuition mixed with practical knowledge” (p. 65). Teacher-based intuitions were often treated in a very casual way (Hoge & Coladarci, 1989). There was widespread assumption that teacher judgments were influenced by personal likes and dislikes and other non-cognitive factors (Egan & Archer, 1985; Hoge & Coladarci).

Research on teacher expertise found that expert knowledge was structured differently than the knowledge of novice teachers, with experts using higher order systems of categorization to efficiently access knowledge (Berliner, 1986) and analyze problems (Palmer, Stough, Burdenski, & Gonzales, 1987). Expert teachers also relied on self-regulatory and meta-cognitive capabilities unclaimed by the less experienced teachers (Berliner, 1986). In contrast to novice teachers, the expert teachers were faster
and more accurate in pattern recognition, more sensitive to task demands and social situations, and more opportunistic and flexible in their teaching (Berliner, 2004).

Additionally, the practiced teachers addressed problems with either crystallized or fluid expertise. In the former, the experts applied similar tasks to similar situational problems. The latter type allowed for knowledge and skills to transfer across domains and contexts into novel circumstances (Berliner, 2004). However, lengthy time-commitments were needed to attain the domain-specific, contextualized knowledge base necessary for expertise in pedagogy (Berliner, 2004; Palmer, Stough, Burdenski, & Gonzales, 1987). “Expert pedagogues, like experts in many other fields are likely to excel in their own domains and in particular contexts within that domain” (Berliner, 2004, p. 203).

Research in medicine and law where assessments of the situations were made quickly suggested that all professionals tended to make their decisions based on judicious hunches rather than objective information (Madelaine & Wheldall, 2005), but were generally considered rational and accurate (Egan & Archer, 1985). The core reliance on clinical judgment, or clinical wisdom, was defined by Goldberg (1968) as an important human activity typically carried out by a professional person aimed at the prediction of significant outcomes in the life of another individual. The process of making such judgments was identified as an idiosyncratic process that incorporated collecting, evaluating, and assimilating information with respect to the other individual (Hoffman, 1960). However, Goldberg asserted that clinical judgments were unreliable, only minimally related to the experience of the clinician, and were rather low in validity. In doing so he brought forth the clinical versus statistical prediction controversy, which
many research studies also mentioned: mathematical models of human prediction were more accurate than the clinical expert (Airasian, Kellaghan, Madaus, & Pedulla, 1977; Christal 1968; Dansker, Wilcox, & Van Tubergen, 1980; Dawes, 1971; Egan & Archer, 1985; Einhorn, 1970; Hoge & Butcher, 1984).

“Clinicians seldom believe that linear functions best describe the relationship between information and a characteristic being judged” (Hoffman, 1960, p. 122). It has been claimed that the clinician was superior to the mathematical model, or actuary, because he was able to take into account complex interactions (Einhorn, 1970). In short, experts organized the information in an elaborate schema (Dansker, Wilcox, & Van Tubergen, 1980), and had greater understanding of how and why they made certain decisions (Warner, 1975). Madelaine and Wheldall (2005) stated that the process of making judgments has not yet been adequately studied. This assertion has been echoed by Hoge and Cudmore (1986), and Hoffman (1960). That is, although the actuary model described the process through mathematics, the cognitive judgment process was still not discovered (Hoffman).

In short, an integral task of teaching was to make frequent judgments not part of any linear model. Some of those decisions were classroom based intuitions while others were larger research studies on the accuracy of predictive opinions. Teacher judgment, while comparable to expert opinion made in other professions, was often criticized for bias. Nonetheless, many researchers have studied the accuracy of teacher judgments and have found a high level of reliability.
Review of Placement Test Literature

The national pattern was to use the standardized achievement tests to determine placement (Weber, 1986) especially at community colleges. When the measures were institutionally developed, or in-house, local control allowed the test to more closely reflect the institution, departmental, and curriculum needs (McDonald, 1989). When the test was locally developed, a few guidelines were established within the literature. For example, the questions in the test should measure the prerequisites needed by the students in order to be successful in a course (Truman, 1992). That same author also stated that number of questions should be limited to 25 to 50 questions. Furthermore, to increase the quality of the test through a greater number and variety of test questions, it was important to include as many faculty members as possible in test question submission.

Faculty developed tests allowed for some positive outcomes. In-house tests were a direct measure of prerequisite skills of the local curriculum that were taken under uniform conditions, providing data that verified the effectiveness of each test question (Truman, 1992). This helped to maintain and raise educational standards by identifying and placing students in courses designed to teach them the necessary skills. By doing so, the underprepared student did not force the instructor to lower the difficulty level and quality of the course (Morante, 1989) which would shortchange students in pursuit of a successful career (Nonis, Hudson, Philhours, & Teng, 2005). By utilizing a placement test, the underprepared students were identified and given the needed assistance while placing the prepared students in a course that matched their ability and knowledge levels (Weber, 1986). Another advantage of assessment and placement were the economic
benefits available through student retention (Weber). Morante stated, “This type of policy will tend to attract students, not turn them away; it will also help in retaining students” (p. 3).

However, the in-house placement test brought some of its own problems, as well (McDonald, 1989). First, the faculty developed assessments did not carry any assistance from the standardized testing companies and were less defensible in the legal arena (Weber, 1986). Second, college staff members feared that the use of placement testing discouraged students from attending (Morante, 1989). Third, once implemented, placement testing and developmental education took extra time and funding. Finally, the departmental members had a greater temptation to ignore periodic reviews of the test that may have been appropriate relative to curriculum or textbook changes (McDonald).

Two other major concerns in placement testing were reliability and validity. Reliability, or the evaluation of whether a test consistently measured whatever it tested, tended to be low with faculty made tests (McDonald, 1989). These were expressed as correlation coefficients, ranging somewhere between .6 and .8, with a minimum split half expectation of .9 for test publication (McDonald; Truman, 1992).

Predictive validity, also expressed in correlations, was held as a key indicator of a placement test’s ability (Weber, 1986). In this type of statistical test, the relationship was between students’ final grades and their individual performances on a battery of placement items (Truman, 1992). Hassett and Smith (1983) stated that this coefficient was usually .35 to .50 (as cited in Truman). The evaluation of course placement testing should include both an analysis of placement-enrollment consequences and faculty and
student questionnaires (Weber, 1986). Furthermore, any resulting changes should be
determined by a committee of three to six department members, according to Truman.

In conclusion, much research has been done relative to placement options. While
the ACT and testing methodologies have been researched, other placement strategies
such as the CPS have not been studied. Although there was a literature concerning the
accuracy of teacher judgments, it was primarily related to the elementary school teacher.
To this point, there is a definite lack of published research concerning undergraduate
course placement by informed teacher judgment.

In light of the pertinent research, or lack thereof, it appeared warranted to
determine the most accurate and successful methodology specific to TU. Using a
qualitative framework to study the mathematics department chair, it seemed pertinent to
identify and examine the intellectual process of making multiple-measured clinical
judgments for student placements. The overarching quantitative questions also remained:
what are the accuracy and success rates for each placement method and which is the most
accurate?
CHAPTER III

Research Questions

As the purpose of the study was to determine the most accurate and successful way to place students, each method was analyzed with respect to those descriptives. A list of those research questions included (a) what is the process and perception of making students’ mathematical course placements using informed teacher judgment, (b) are the accuracy rates statistically significantly different by method, and (c) are the success rates statistically significantly different by method? The proportions of each method were compared.

Design

The study was conducted in three phases, with each portion slightly different from the others. The ethnographic portion of the study was done as observational research. The informed teacher judgments, ACT-M, CPS predictive models, and placement test were done with an ex-post facto, quasi-experimental design. Finally, for the comparison of the above-mentioned methodologies, the design switched to within group, repeated measures. In other words, after filtering out the missing entries in the population data set with respect to a placement technique, the mean accuracy rate and success rate were calculated. The original data set was then reset and the process was repeated for each of the four placement methods. As is common to quasi-experimental design, there was no control or experimental group. However, the accuracy rate and success rate data were
placed through statistical analysis as if they had been obtained authentically in each method.

Procedures

Participants

This study makes use of multiple sources of data and attempts to identify common outcomes related to placement. Following Institutional Review Board (IRB) approvals for focus groups and interviews, ten faculty members answered survey questions concerning placement opinions and suggestions. One of those members, the mathematics department chair was interviewed separately due to the nature of the research questions.

The second group included the TU population of 1508 seated students whose academic records were analyzed for ACT-M scores, drop and add notices, and entry level math course grades. The data mining procedure received prior approval from the TU registrar. The final group consisted of a purposeful sample of four sophomores and one junior who had been placed into their math classes based upon ACT-M scores.

Data Collection

Data Collection for informed teacher judgment. The mathematics department chair granted multiple interviews in her office during the 2008 spring semester, prior to the first 2009 freshmen orientation. These interviews were conducted using the Seidman
(2006) approach, where each of the three sessions lasted approximately 90 minutes and loosely followed a prescribed interview protocol. Moreover, using Creswell’s *Choosing among the Five Traditions* (1998) as a model, I also conducted an ethnographic study of informed teacher judgment with respect to student folder analysis. In this portion of the research, I became an apprentice in the analysis of student folders. Each folder contained an ACT record, high school transcript, and Ohio Graduation Test (OGT) results or another state’s exit measurement. The admissions office provided a list of each group scheduled in the five orientation sessions. All of the one-on-one interviews and ethnographic situations were audio taped with permission and transcribed verbatim when appropriate. Additionally, copies of the placement changes from ACT-M were retained with explanations of the reasons for each change.

*Data Collection for ACT-M.* The records of five graduating classes comprised the next data set. That is, the registrar and admissions offices granted access to the ACT-M scores of 1508 students. These data were aggregated into the statistical spreadsheet program SPSS for later analysis.

Students were also interviewed concerning placement via the ACT-M scores. Three focus groups convened and shared their thoughts and opinions about the validity of using the sub-scores to match the students’ ability level within the TU curriculum.
Data Collection for CPS model. The registrar kept a record of each current student at the university. In each file was a printout provided by the ACT Corporation. Each printout included the CPS predictive data including the percentage placed in a lower class and the probability of earning a C or better in the reference course. These data were added to the student placement database.

Data Collection for test evaluation. The scores of each student on each of the three tests were compiled through the online testing program, www.quia.com. This information exported to an EXCEL worksheet into SPSS. That testing company also produced the item analysis for each question on each of the three levels of testing.

Data Analysis

This study was done with a mixed methods approach. In other words, both quantitative and qualitative measures were employed in the data analysis portion of the study. The first research genre necessitated an inductive analysis of repetitive thematic phrases from the focus groups and individual interviews. Qualitative validity was established through recurring interview themes and documentary evidence such as high school transcripts and ACT results. This process of triangulation was done to provide corroborating evidence and further illuminate the major interview topics. The admissions department also provided a comprehensive sheet for each incoming student with major, GPA, and proposed class using previously established criteria for ACT-M cut scores. Within the realm of numbers, the data were analyzed descriptively, and then applied
inferentially with a Chi Square test when the nominal data of accuracy and success rates of all four placement methods were compared. The Cramer’s V test, a statistical measure of practical significance associated with the Chi square, was also performed in the instance of a statistically significant result from the Chi square.

*Analysis of ACT-M placement data.* Records of registration including ACT-M scores and drop/add slips from the last four years were statistically analyzed. The accuracy rates were determined by the number of students who conformed to the TU ACT-M guidelines and earned a C in the appropriate course added to the number of non-conforming subscores that were not enrolled in the course in each level. The denominators of the accuracy rates were the total number of valid student entries at each level. The success rates were computed as the number of students who earned a C or better divided by the number of valid student entries. Next the Chi square and Cramer’s V were applied to the data to determine the goodness of fit and practical significance of the results. The qualitative focus group data of students’ opinions were categorized into major themes after obtaining permission to interview students from the IRBs at both Ashland University (AU) and TU.

*Analysis of informed teacher judgment placement data.* Immersion in the verbal data, continuous coding, and repeated sorting of key words triangulated the information obtained through observation and documentary evidence. This continuous shaping of categories validated potentially meaningful connections to the placement experience.
consistent across the orientation data, interviews, and actual placements. The accuracy of the initial math placement was also calculated. That is, the number of students correctly placed as evidenced by the students who remained in the prescribed class through the entire semester and achieved a C or better semester course grade was added to the number of students who Professor Fox decided should not be placed in that course and did not add the course. That number was divided by the number of valid student entries for each course level. The success rate was determined by the number of students who earned a C or better in the course divided by the number of valid student entries. Again, the Chi Square and Cramer’s V tests were conducted.

*Analysis of developed test placement data.* With respect to the teacher developed exams, the split-half reliability coefficients and test item analyses were computed and scrutinized for each of the three developed tests. Due to the nature of the implanted test results and student interviews, it became necessary to re-examine the dropped course means for each course level, the proportion of students who were misplaced according to previously established guidelines, and the ratio of students who were placed without any ACT-M data. The accuracy rate was determined by the number of students who earned a 70% or better on their highest level of the three tests and earned a course grade of C or better was added to the number of students who scored less than 70% and earned less than a C. That total was divided by the number of valid student entries. The success rate was determined by the number of students who earned a C or better in the course divided
by the number of valid student entries. Similar to the other methods, the Chi square and Cramer’s V were applied to the data.

*Analysis of CPS placement data.* Using the CPS definition of successful placement, the number of students who scored above the decision zone and were placed into the standard course was combined with the number of students who scored below the decision zone and were placed into the lower level courses. That total divided by the number of valid student entries provided the accuracy rate. Again, the rate of successful student outcomes was calculated as the number of students who earned a C or better divided by the number of valid student entries. Chi-square and Cramer’s V tests provided the necessary statistical comparisons.

*Analysis of comparison methods.* Using the standards set forth in each method, I defined the accuracy rate as the number of students belonging in each course level added to the number of students not belonging in each course level divided by the number of valid student entries. Moreover, the success rates were defined as the number of students completing each course with a C or better divided by the number of valid student entries for each course. The proportions of accuracy and success for those four methods were then compared with a Chi-square analysis via SPSS. This type of test was chosen as there were four different data groups measured at the nominal level of successful or unsuccessful outcome. Additionally, a Cramer’s V test was performed to determine the amount of practical significance of each statistically significant Chi-square test.
CHAPTER IV

Results of Informed Teacher Judgment Process

On a cold and gloomy March day, I trudged through the slushy sidewalks along a busy city street until I climbed the steps of a huge gothic structure. Though there was no label on the building, it was well known throughout the small college in Northwest Ohio as Main, the oldest classroom building on the small campus. Entering through the ten foot high double doors, I climbed more sets of carpeted stairs until I reached the office of the Mathematics Department Chair at Tiffin University. She had previously agreed to meet with me to explain her process of placing incoming freshmen into their initial math course at the university. During the course of the interviews and authentic experience of the placement process, five major themes and five sub-themes emerged.

Theme 1: Institutional History of Placement

She explained to me that she had been at the university for about twenty years and had served as the department chair since the inception of the position, about twelve years ago. During that time, TU maintained three tiers of entry level coursework. That is, a student could begin at Math 100, a remedial course for students who possess very poor arithmetic skills. The second option was for Math 173. In this second level, students learn or relearn basic Algebra skills that were necessary for success in the standard course. As remedial courses, the above-listed curricula did not count as hours or quality points toward the Baccalaureate degree. The students must demonstrate mastery at the standard
level, taking either Finite Math or College Algebra. Both of the latter courses served as a pre-requisite for Applied Statistics, a sophomore level class. She commented that other schools “just have one math class that everybody takes….It is a do or die situation,” but for TU, “there is no one class that everyone takes.”

She recalled that the university had “done a lot of different things” to place students into the beginning math courses at the institution. The first method that she spoke of was a seated placement test during orientation. “When I first got here they would take a test during orientation. It would get scored and then according to that score, that is where they would be placed. It was a seated test during orientation scored by scantron.” The specific process was as follows:

We had to do the testing in the morning. Then we all got in this room and we had to go through every single file and put down what math and what English. That took time. Then we had to write it on the files and get the folders to the advisors. So it was laborious and time wise it did not work. While I was doing it, before I even heard what they got on the test, I would always have in front of me another transcript I’d go, ‘I bet this one is going to be this’ That is where is hit me, why are we doing this test? I can place them without the test. It was somewhat accurate, but then other times I would say if they got that score, then they did well in high school. I’m not going to put them in that class.

That period of TU placement history ended shortly thereafter. Becky stated, “I think I only did the [group process] folders for 1 or 2 years, about 15 years ago. We stopped doing it during orientation because the administration wanted a faster way to do
it.” That is, “they wanted a method that placed the student before the student even got here for orientation…They just want a fast easy way.”

Wishing to make a quick and easy, yet effective, decision before orientation, the admissions staff switched to using the ACT subscores to make the student placements. Shortly thereafter, people were coming back and saying some of these students are placed wrong. Therefore, the Dean of the Graduate School who was a former math department faculty member conducted a study for the correlation between course placement and ACT: “She did a study with the correlation between ACT and success in the math classes. I think that she found that there is no correlation.” For Math Department Chair, Becky Fox, this was a turning point. She recalled that after the correlation study,

I think that it was at that point that I started looking at grades the students got and what their ACT scores were. Judy Gardner was working with it too. At that point she was in charge of that stuff. We could not find any correlation just looking at the scores. We had kids who did well in 174 and had a low ACT. We had kids with high ACTs and did crummy. There was just no rhyme or reason. I was trying to find an ACT score that would work, the range kind of thing. Trying to and never really could come up with anything that I was satisfied with. That was when admissions were doing it and I took it back over. I said, ‘just let me come back in and look at them.’ That was when I was still in the process of trying to figure out the ACT, what works and what doesn’t. I figured that if I just looked at what classes they took and then it just, it worked. I’ve been doing that for a long time.
The TU admissions department changed the process of student math placement. For a very brief time, the Course Prediction Service provided free from the ACT Corporation was used as a model. Becky stated, “We placed them that way for awhile under Cam… Cam was the one who came up with it” and then, “I would have looked at them when we did the ACT predictor. I think that I did it one time. I think that they used it and I double checked it…. I don’t look at it anymore.” However, the CPS method only places the more advanced students.

Last year, when TU piloted an online test for placement, the folder concept was not abandoned. “They were telling me that a lot of students weren’t even taking it and where do we place them?” She replied to the admissions department, “let me come in and I will place them all” to make it easier. “The ones who did take it were misplaced many times. It wasn’t jiving right….so I continued to look at folders even last year with the placement test.” With respect to the online test, she mentioned, “you did everything right. I think that it was perfect, but the students just didn’t do it.” When asked what improvements would need to be made if the idea was to work, Becky replied, “Maybe give better training for the admissions people and maybe make the letter stronger.” She also commented that she never saw the letter.

Was it its own thing or just a paragraph in the letter? You know how students are. They don’t read they just skim. I’m not sure but as far as I am concerned, everything was in place and ready to go. It should have worked….They had all kinds of excuses like ‘I didn’t have my calculator’, or ‘I didn’t take it seriously.’ There were all kinds of human factors. Had they taken it seriously and had a
calculator with them, it probably would have worked much better than it did, but we don’t have any control over students.

However, with respect to seated placement tests, she stated, “none of them worked. I am sick of writing them.” Thus, she continued her folder process.

Of all of the historic choices, Becky believed that her judgment was the most accurate for student placement. However, she commented that using her sole judgment was not a good idea. She elaborated “I personally am the one who decides everybody? That’s wrong. What if I get sick? What if I die? What are they going to do? That’s wrong. In my opinion that’s not good.” When questioned why she was still the only one to place students she explained, “There’s such a turnover in admissions that you have to constantly redo everything. If there was some stability there they could place them. I’ve talked to them enough about it.” She further stated that without the constant turnover, the admissions staff “could place them pretty good without me.”

Nonetheless, in order for all students to be placed correctly, Becky mentioned yet another model. She thoughtfully proclaimed, “To sit down with their folder in front of them, each student individually, you could probably get 100% placement. That would be the ideal.” Her own immediate response to the idyllic nature of student interviews for placement, “Wouldn’t that be a challenge?”

 THEME 2: Folder Placement

Prospective students provided documentary evidence of their high school careers to the TU admissions department. Those department members developed a summary
profile sheet and placed one into each student’s folder. The summary sheet included high school GPA, ACT composite and subscores and method of report (i.e., transcript or self-report), admission status, prospective major and concentration area, and SAT score if available. Behind each cover sheet lay a high school transcript with courses and class grades, cumulative GPA, and address of the high school. The last evidentiary piece was the actual ACT transcript provided by the ACT Corporation. If in existence, it provided a wealth of demographic data, chosen major, athletic status, and predicted course grades for the standard English and math courses.

The placement process began anew before each of four orientations. More specifically, Professor Fox would set up a convenient time to go to the Paradiso room, a conference room directly across the hall from the admissions office, where she would receive each batch of folders for the incoming group of students. These groups ranged from approximately 40 to 100 students per assembly from mid-April to mid-June. We met in the same place each time for approximately an hour for each session. Of the process in general, she claimed,

Really, I can really zip through them pretty fast. I would imagine about hour for each orientation. It gets faster. I think that the first two are the largest….It really does not take long to do it. It takes longer on the first one, but it depends on how many there are.

Once seated, she was given a stack of student folders and a tabular synopsis. She related that this phase of the process was new this year, though it did not affect her judgment, only the reporting of any changes. In other words, the admissions department provided
her with a review sheet of names and probable course placements based on the ACT subscores. If she made any changes after examining the complete set of folder data for each student, she was to mark the summary sheet appropriately to notify the admissions staff of any changes.

Her general process was a flexible analysis of the data. It started with ACT and GPA but extended to transcripts for other coursework as well. Of her process she whispered, “My process is weird. Sometimes it is just a gut feeling.” When pushed to verbalize her steps, she explained the following:

Prior to orientation we go through every file. The first thing that I look at is ACT. If that is 19 or above, it is automatically a 174/181. So I look at the degree that they are going into and that determines which one I write down. And if it’s not, if it is below that, then I look at the GPA. Not so much the GPA but more of the classes that they took in math and what grade they got. It gives me a better idea of their math background. Along with that, I also look at the high school and where it is. I look at it and some schools still have those really weird math titles like Integrated I and II. What in the heck are they? Now I look at proficiency test scores, too. I have to look more into that but I know when I see them. I know that one is a top student, that one is questionable.

The data analysis began with the ACT subscores. She always looks at their math ACT. “Twenty and above has always been Math 174 or 181. I don’t even look any further. Close it and we’re done. This year it is going to be 19 and above.” In prior years for students who achieved a 19 on the ACT-M she explained, “If it’s 19, I look.” She
stated, “if they have a low ACT I am not going to jump them up to 174 their first
semester. We want them to have some success.” Of the lower scores, she delineated that
the cut score for math 173 was 15 or 16. She explained that “16 through 18 will go to
173, maybe…. If they have a 15, but have had Algebra and did pretty decent in it, then I
will go 173.” Then she stressed, “If I don’t see Algebra 1 skills then I put them in the
lower course.” Thus, for anything below a 19, the next step is to “look at is their GPA,
high school transcripts and what math courses did they take? I look at all of the math
ones and what grades they got.”

She closely related GPA to the math history also. She reflected that there were
times when she has seen that “the GPA is a little lower but the ACT is 20. Usually it is
the private schools because they are very, very hard.” Moreover, “if they get an ACT of
20 they know the stuff. So even if they didn’t show that in the transcript, they still know
it.” She decided that in order to find success in Math 174 or 181, the student’s GPA will
generally be around two or above; “I figure that maybe that they can handle the upper
class, even with an ACT or 17 or 18. Maybe they had a bad day on the test.” She strongly
believed that “what they do over four years makes a little bit more difference than what
they do in one day on an ACT score.”

While the quickest method to place the advanced students was to use the standard
of 19 and above, the most important factor for the lower scores was Algebra background.
Throughout the course of our interviews and conversations at the pre-orientation sessions,
Becky often made comments such as, “I figure if they had Algebra and Algebra 2, I am
not too concerned about Geometry…..All you need to know are the Algebra 1 basics. If
an A, B, or C in Algebra 1, I usually go to 174.” Moreover, “It would be kind of iffy if
the Algebra 1 grade was a C and the Algebra 2 grade was a D. Then I’d go for 173.” She
was very wary of upper placements when “those math courses look questionable,” and
reflected, “If I don’t see Algebra 1 skills then I knock them down.” The following quote
provided a more elaborate thought process:

If they have below a 2.0, a 1.9 or a 1.8, that means they struggled. I am more
likely to go to a 173. Then I look at the course they took. So I look to see if they
had any Algebra 1. If they got an A, B, or C in it, I am more likely to go to 173. If
they did not do well in it, then I think 100. One hundred is they either had very
little math or what math they had they failed.

Another important factor in her judgments included the prior non-mathematical
coursework that built the cumulative GPA. “While you are skimming through the math,
you are looking at other subjects that they take. If they biology and chemistry and stuff,
they are a good student.” She often looked to see if a student took Biology or Chemistry.
She added, “I look at sciences.” Then Becky would ask herself, “What kind of courses
did they take? Did they take college prep courses?”

Another set of important judgment elements referred to the type of coursework
and if the school provided extra help. In cursory glances through many transcripts she
quickly identified if a student had an IEP or some alternative to a traditional high school
education. In her judgment, these issues impacted the validity of the math grades and the
cumulative GPA.
I look to see if they have a learning disability of some type. Then I don’t value the grade as much. Learning disability and As and Bs but I don’t equate them as As and Bs because they were usually one on one. They did not really do they work. They usually land in 173. The problem is sometimes the IEPs get tutoring through the whole thing and they get all As. So their GPA is high but they are going to have a low ACT, because they can’t get tutored through the ACT. There are now accommodations.

As for the students on IEPs with higher ACT scores, she declared, “they do fine in 174. It makes me wonder why they have an IEP.” The students of concern were the ones of the “opposite scenario when they have no business coming here. You can see it in their transcript.”

She held the same general caution toward urban school systems. She stated, “Certain schools in certain areas inflate: inner cities, mostly, not the suburbs.” Becky also cautioned, “Certain sections south and southwest are a little iffy sometimes. It is just once aspect, it is just a teeny weenie aspect….I very seldom look at the city.” If a student was border-line between two classes and from one of those aforementioned areas, she said that “I might be tempted to go down.” Originally, “people in the admissions office let me know. You really have to watch what school they are in.” She summarized the grade inflation with “they may say As and Bs but they really are Ds and Fs. They are very much inflated.” She provided a general example

If the ACT was 17 and GPA was greater than three …you look at the classes and see that he got As and Bs in everything. Then you look and you see that he is
from an inner city. He really did not get those As and Bs. Usually you do not see the opposite when there is a high ACT and low grades. Not very often.

Professor Fox made her judgments on multiple measures in support of her strong opinion that “what they do over four years makes a little bit more difference than what they do in one day on an ACT score.” Some folders lacked a complete overview of high school data. In those instances where “I have folders that have no ACT, SAT, no transcript. I go 173. Because I have nothing to base it on I go 173 because I know that I can move them up.” She judged that the ones that are “not going to hand this stuff in are usually the lower students. The bright students make sure that everything is there.” Thus, “If I have nothing to base it on, I go 173. Sometimes this happens at the earlier orientations and they just didn’t have time to get the other stuff in.”

Sub-theme 1: Math 100 avoidance. While in favor of a multiple-leveled curriculum, Professor Fox does not like the lowest course as an offering; she shied away from placing students there unless absolutely necessary. “I’m not going to put them in 100 unless they are really, really bad. They must come from an inner city school.” To her, “if they had some algebra, I would probably go 173 with that.” She stated, “I would really like to get rid of the Math 100. I don’t think that we should really be offering it.” However, she added, “I do think that there should be some remedial work by course or by program, like Hawkes, if they don’t get a certain ACT score then they have to do some sort of remedial work” In explanation, she said the following:
I shy away from putting anybody into 100. That would be the last resort. I would question if they have any math ability. If I put them in 100, it puts them 2 classes behind graduation and I don’t want to do that to anybody for money. I would not want someone doing that to my kids, so I really hesitate. They count toward hours like are you a freshmen, sophomore, or junior; but not graduation.

Becky further reflected, “I tend to push them higher, I think” and then, “With 173, we can always move them down to 100 if they don’t get it. What they need are the equations and she doesn’t get to that until later in the semester.” Frequently her comments mentioned the financial concerns for the students who would be placed in this course level: “Money wise is one of my concerns,” “I don’t want to do that to anybody for money,” “they leave for… money or majors,” and “if they go home and take a course at a community college, they are going to spend $200-300”. However, while speaking to this point, she contrasted her previous financial belief system “If I get them in to 174 and then they do OK, I rather do that than put them into 173.” Nonetheless, while examining her motives, she had an epiphany.

Do you see a lot of 173s? When I think about the students that I have in 173, though, even though they probably should not have been there, they get As and Bs. Sometimes they don’t get the As. But I think that it increases their…they come to believe that they can do math. It is a good thing for 173 to get them ready for 174. I know that I have had students say this is the first time that I have ever gotten an A on the test. I don’t hear that in 174. I only hear that in 173. It is a big confidence builder, 173. Maybe they have to take an extra course in the summer
of something, but I think that it is well worth it. They get through the 174. It makes them feel better overall, not just for another math. I think that they think that I am finally in a place where I can learn. I think that that may be a big deal. I usually think, well maybe they can do 174, but maybe I am doing them a disservice by pushing them into 174 rather than letting them have a nice first semester freshmen year. I’ve never thought about that idea. It might branch out into other subjects other than math.

They might actually say I can do college because I am getting an A in math and math is a tough subject. Not so much that it will give them more time to do other subjects, but more than it is a confidence builder for college work. It makes sense. Maybe some of these borderlines, maybe we should just leave them in 173. The ones who were definitely misplaced, they are spotted the first day. If they should be in the higher one, they identify themselves immediately. There are ones who are competent to go to 174; they already have the good attitudes. They are good students and could move up. But you catch those ones who aren’t real confident, probably could have done 174, but need the confidence builder. You’ll get that student who comes up to you and is very adamant that they want to move up. They are going to work hard because they want to do it. Maybe we are not doing them a big service on that one. If they go home and take a course at a community college, they are going to spend $200-300? That’s not a big deal if you look at the overall tuition here at TU. Going and spending the two to three hundred to be in 173 and get a confidence builder. Maybe that will spur them on
to do better in their other subjects. Rather than putting them in a 173 and having them bomb, cut out the first semester and now they are out $16,000. That might, 173 might be more than just getting their Algebra skills.

Sub-theme 2: Goal fit needs. Professor Fox asserted that the goal of placement was “to match them with the right math class and ability.” That is, “The goal of placement is one course above proficiency level.” She made her course recommendations based on that goal and the idea of “putting them in a class thinking that they will do well in the class.” In her opinion, the current TU process was meeting that goal:

The majority of the students, I’m not talking about the very top ones who could make it no matter what, the majority of the students seem to be placed in a class where they have some background but it is new material. They need to … it is new material. They are not in a class where they have already done this stuff or it is way over their head and they can’t even comprehend. The grades seem to show. We are not flunking a lot of students. We are also not giving a lot of As. We have a good mixture. That says to me that we’ve made a good match.

Each year she re-evaluates the process. She stated, “Every year I re-look to see where are we wrong? Where can we improve? Where do we need to update, especially with the new majors coming in.” However, she does not believe that students leave Tiffin because of math: “If we placed them wrong, they wouldn’t leave. They don’t leave for those reasons. I’ve never heard of a student leaving because the math was too simple or too hard. I never heard that.” Yet, in spite of this, she stated
We have had students who have said that this is the first time that I have actually understood math. So we do get, because of our backgrounds, we do get students excited. We get students to succeed in math who have never succeeded in math before. In a way, yes, that may have a certain effect on retention. I think if they have a good experience their freshmen year, and if math can be one of those good experiences, they are more likely to stay four years than they are not to. In that aspect, they find success because of the way we teach and the way our courses are.

Thus, personalizing the placement and the ensuing curriculum helped meet the university and math department goal. She added, “We don’t do things because other colleges do. I feel the same way with our math curriculum. It shouldn’t have to match anybody else’s. We fit for our students and our needs.”

**Sub-theme 3: ACT only in future & reasons why.** As TU was a growing and thriving university, Becky commented that her process, though effective could only go so far. In short, she questioned, “If we get bigger and bigger, how are we going to do it? You’ve got to find a method that works for everybody.” She added, “I think the ACT is good enough. It’s never going to be 100%, but it would work. It would be adequate and it’s fast. I think that students take the ACT more seriously that they do a placement test.” She acknowledged that the ACT had limitations, but still expected it to work better than other methods for math placement:
Yes, I think that we are talking about a low percentage of kids that are misplaced with the ACT. I don’t know what other options there are. We could give them another test, but if they bomb the ACT because they don’t like tests, they are going to bomb the placement test because they don’t like tests.

Based on her experiences in the rich history of TUs placement processes, the students take the ACT more seriously than other placement possibilities. She asserted, “They think that they are going to get more money for college. The parents are pushing them and the teachers are pushing them and they are going to work harder.” However, she quietly added, “I don’t know what the answer is; I don’t think any college knows. I think that in most colleges, ACT, boom you’re there.”

Theme 3: Deviation from predictive judgment

There were instances when the process and procedure did not work as expected. The major changes to students’ placements occurred when students self-identified themselves as being in the wrong class or the professors acknowledged gaps in student ability levels, processed through the drop and add slips. Moreover, the advisors also played a potential role in student course changes. Each point was addressed in the sub-themes below.

Sub-theme 1: Movement in first week of classes. Despite every effort to place the students appropriately, some were still misplaced. With respect to that rare scenario, she told her students on the first day, “if you don’t think that you are placed correctly, come and see me, and I’ll review their records and say, yeah maybe you should have gone up.
Or you can go up but you can’t come down.” In short, her comment was “I hope that once they’re in that class, then we can evaluate that first week to determine if they should be there.” She was adamant that a “move up has to be done the first couple of weeks or I don’t do it…I try to get it in the first week but sometimes I don’t catch it until after the first test. Then it goes down.” She emphatically stated

I do not move them up unless it is in the first two weeks. If it is past that point I don’t even tell them. After that, yes, they are going to be behind, and that’s going to pull them down. So, easily move down. I even move them down halfway through the semester. But not move up.

Even so, some students adamantly fought their placements. To them Professor Fox avowed, “If you decide to go up to 174 or 181 please note that you cannot move down. Once you have decided to go up, you stay up.” In other words, “if they insist on going up, I let them go up but I say to them once you are up you will not go down. We will not let you go down once they go up.” She made many other related comments throughout our interviews including “You wanted it, you got it” and “But you wanted up, you stay up, you work it.” She insisted that the university math department did “not want them going back and forth, back and forth.” Her experiences were that the students think that the initial coursework is too easy. Then, according to Professor Fox, “they go up to 174 and then bomb the first test. And they think maybe I should have been in 173.” She related, “I have had a couple who lied through their teeth saying that they did really well and they didn’t. They don’t think that I’m going to look up transcripts….I usually never see them again.” There were also times when she sent an email message stating, “I
looked at your transcript and this would not work for you. Or, I looked at your transcript and you should have no trouble moving up.” Moreover, just as there were times that the students attempted to con her out of a particular placement, she felt strongly that the advisors should not be conned as well. That is, “We don’t want advisors talking to the students and the student saying, ‘Oh, but I took this, this, and this, and I shouldn’t be in 173. We don’t want them switching.” She was slightly concerned that the advisors who have been around for many years “know that they will be behind if they take 100 or 173” and may change the placement recommendation.

Sub-theme 2: Drop and add. While Becky remained consistent in her ideals of transferring classes very early in the semester, she elaborated on the actual switching procedure. She explained the process as “pretty easy. If they are placed wrong, in the first few weeks all they have to do is pick up a drop-add slip from the registrar, and then I fill it out, say OK.” However, the timing was a crucial aspect as shown in the following quote:

For them to drop and add a course, it really has to be done in the first two weeks. Withdrawing from a course you can do right up until the withdraw date, but you can’t add a class at that time. I think [the add date] is up to the registrar or the individual instructor. The dropping and adding strictly in math is not a problem. Picking up another class, that’s a problem. Very, very seldom do I ever allow an advisee to do that unless it is in the first couple days of the semester.
She guessed that “on the average I would say 2 to 3 out of 30 students” were doing any dropping or adding, then added, “that’s not bad. I don’t think that we’ll ever get it down to 0. That would be Ok with me. 100% would be great but I don’t think that it would be very logical or realistic.” Most students who decide to make a change do so “not that they weren’t placed correctly but they got sick or something like that. I don’t see very many that have been placed wrong and I do it. I tell them that they should go up or down.” For Professor Fox’s students, “They drop and add because I suggest that they go down and up.” Professor Fox elaborated with the following comments:

If they are in a 174 and really should have been in the 173, I talk to them and make it sound like this is the way to get a good basic foundation so you succeed. I’m not telling you that you are dumb or anything, I’m telling you that you need a little bit better background so that when you come back to 174 or 181 you can do A, B, C work and not struggle so much. So they usually are pretty good with that.

I don’t find any negatives. It’s not like telling a child in grade school that they have to be retained a year. It is not going to have that same kind of effect.

Students are usually pretty happy, even in the moving up. I’ve done the opposite, too: you really need to go up to 174; you are wasting your time here.

Although not all students are granted their wants, most unsigned forms remained so because “I have talked to them and talked them out of it …. I have never actually denied a drop add slip….I don’t think it’s our right to do that.” Becky implied that students have the right to change. In other words, “If he does not like me, get somebody else.” As a representative of the greater body of faculty she declared
If someone picks up my course, I assume that they have the responsibility to catch up. I do not bend over backwards for them; they are on their own unless they come to me for help. I think that that is pretty much the way that other faculty feel. If someone picks up their class, they are responsible for the material. Usually they catch up pretty fast; you are talking about the first couple of weeks. Things are slow. I don’t speed up until that time period has passed.

Such accommodations were unplanned; the timing simply worked out that way.

She stated, “It just happens to work that. The first weeks we do not get a whole lot accomplished,” leading her to her conclusion that “I don’t see a problem with the current drop/add process.”

Theme 4: Gut Feeling

Although Professor Fox loosely followed the processes described in the previous pages, in some instances she relied on her own professional intuition. She assessed, “There is probably a lot of contradictory stuff when you go through this. Sometimes it is just a gut feeling.” She frequently made comments about this. For instance, she stated “Your gut says so,” “It’s just a gut feeling. I just look at it and I know,” and “So you go with the gut feeling.”

According to Becky, most of the placements were simple: “The majority is very fast and easy. Once I see that 19 or 20 ACT, boom.” For the students without the high ACT-M, she reverts back to the transcript. In this part she admitted, “You get a general feel with the classes that they take. Are they scholarly or did they just float through to get
the high school diploma. You get a general feeling for that.” Of course, not all students provided the requisite information. In those cases when she receives a folder with information that was “just all over the place and you just can’t get a fix on them. You’ll get one or two of those so you go with the gut feeling.”

Once the semester begins, there were times when she had to make changes to what she had originally thought.

When I see students that I am questioning about, I give quizzes and they are flunking or they come and talk to me and say I really don’t think that I belong in here, then I go back to their transcripts and re-look at everything and then I make a decision. I have switched several that way.

There were also times when another’s gut feeling was accommodated and validated. She affirmed that when “Adjuncts who are not sure, they send me a name and I go over and look it up. I’ll say yeah, I think he can go up, or you’re right, he needs to go down.”

Theme 5: Specific Placement examples

The premise for the ethnography was to make the student placements. Using most of the previously listed themes, Becky allowed me to tape her verbalizations of her thought processes and respective judgments. The following represent a random sample of those judgments:

An ACT of 17. They put him 174. Why did they do that? From [name of school], That is really tough, but all of the scores were Ds. He got a D minus in Algebra 1,
Geometry he started out as a C but wound up with a D minus. A 1.6 GPA. No, he shouldn’t be there. If it’s wrong, we’ll just move him up.

I have one in 173 right here. An A in Algebra 2, took French. She does have some weird classes. Algebra 1 A, She has straight As, she has a 4.0. This doesn’t make sense. She has an 18, that’s not that bad.

I have a toughie for you. This one has a B in Algebra 1, a C in Algebra 2 and a 16 on the ACT. They have him in 173. My gut would say move him to 174. If we are looking at that Algebra 1 and Algebra 2 concept being the stronger idea, then I wouldn’t put him in 173. What would you do? Yeah, I’d move him up. Did he take other chemistries and stuff? No. What school? [name of school]. That used to be a good school, now its inner city. There is no sign of overachievement, only a B in Biology. What was the ACT? The composite was 18, math was a 16. My gut feeling is that if it is in [name of school], that is an inner city. If it would be Columbian, I would say move up. But [name of school] I have heard has gone downhill. I think that they just pass them. Keep him in 173, 16 is low, too.

This one is weird. The description says structured. There is no ACT, just a 2.5 GPA. This is too weird. I don’t trust it, do you? He had been at an urban school. He was given one on one help, right? Does he really know it? If I double the SAT and get 1000, that makes a 21 ACT. He was placed in 174/181. I am going to write this name down and check this out. He had to do the OGT. I am going to check this guy out.
If you look at this one, he got lots of Cs and Ds, but As in band. That was definitely a 173, ACT of 16.

I wonder if that pre-calc is really a Pre-Calc. He had Pre-Calc at Calvert. Is that any good? His ACT was 17. My gut is saying 174.

I thought we told them that an ACT of 18 goes to 173. I don’t understand…I have to agree that this person needs 174. She did well. She had an 18, but Algebra 80s, Algebra 2 86; that’s not bad. She As and Bs. Geometry 77. Everything else is 80s and 90s. 3.2. I don’t know. All college prep classes: Biology, Spanish, Chemistry, Anatomy. What is she going into? Forensic Science. I’ll go 174.

It seems like we are looking at the ACT and we are putting them into 173. That is kind of the goal. I would like to get rid of 100. If it weren’t for the adult students, I would cancel it right now.

Leave this one alone. Algebra 2 is a D plus, leave him in 100.

He is 100 because he has nothing. 15 ACT and that is what he self reported. He has a conditional status.

Is going to 174 or 181. She had lots of math, As and Bs in all of them. Algebra1 and Algebra2 and had some statistics. From Texas. The SAT was 880 which put her into the upper 18 ACT. She is also an honors invite.

He got a 21 from [name of school]….ooh, F in Algebra 2. I don’t know. It seems to me like he had a really hard teacher. C plus in Algebra1, 21 ACT, you are talking about people who have 19s and go into 174 and do fine. Geometry C.
A B C student. He is taking Algebra 2 again. Keep him in 174/181. He did get a C plus in Algebra 1 and a C in Geometry. He is retaking Algebra 2, so he has had a lot of Algebra. There is probably a lot of contradictory stuff when you go through this. Sometimes it is just a gut feeling.

He is retaking Algebra 2. He has had Algebra pounded into him for years. He should have retained at least some of it. Stay in 174, yeah.

These two are definite. All I looked was the official ACT, math of 23. It immediately goes to 174. If they are in business, they go right into 174 so I am crossing off 181. That way when this folder goes to the advisor, they should not let them take 181. A lot of people go into 181. So I am crossing off 181 and putting them into 174.

I look at the school, [name of school], good school. I look down and try to figure out why he did not take any math. Algebra C plus. This is low, but I can’t figure out why they only took one Algebra, I would think 173. Geometry, Art, Physical Education, Photography. Only one math. She had Geometry, I wouldn’t put her in 100, and I’d go 173. Now let me check that I changed her.

This one has an ACT of 17; Geometry got a B, Algebra 2 B, [name of school]. I don’t think that I want to bump up. So many times they got the grade because they did the homework. They did well on the other parts. A 20 on the English so there was no problem with the test, just not strong in math.
This one has a 450, this does not make sense. They took all upper level classes. Oh, verbal plus math. You have to add the two together. Why would they do that? Oh, 960, that makes a 19 ACT. That makes more sense.

Here is an ACT of 18, Algebra D, D in Pre-calc. That doesn’t mean much. A D in Algebra, that tells that something is wrong. Took Geometry and got a C, D, C; and a C minus and As. Yeah, I’m going to stay in 173.

Ds in everything, but a 20 ACT. Newton Falls…electricity… The ACT is 17, but put down as 20. I’d better change that. He got Ds in all of his math courses. He must have gotten really lucky I think more of 173. I’m going to change that.

This one is a 20, I’m just going to look at the grades to make sure As and Bs. Yep, 174

An 18. Algebra 1 D, Geometry D, Algebra 2 D. They just kept plugging on. My guess is he’s taking Pre-Calc now. [name of school]; I have no idea. Grove Port, Ohio, Columbus area. That is a pretty good school system. It is not 100, but definitely a 173.

We got a 28, [name of school]. She is going into business. She got straight A’s. Her science background is fantastic.

She was placed in 100, I moved her to 173 because she did have some algebra background and it was a C. She was from a fairly good school. I looked for any indication that she was a vocational student, IEP, or anything that she would have gotten help or tutoring. I did not see any. She passed all of her OGTs.
Algebra 1 A, Geometry B, Algebra 2 A. Not all As, but she is a good student. She was in 173 from the 17. It doesn’t hurt. She is in management. Dance, vocal music, science, pre-calc got an A. That should be a 174 because of the higher classes. This one should be no question.

Here is one that they put in 173. His ACT is an 18. Algebra 1 got Bs, Accounting As, Geometry Bs, Biology, and Zoology B. He is a good student. From [name of school]. I would move him up to 174. He looks like a good student.

This one right here: 3.5, 173, ACT 17, but you look at his grades and he was consistently As and Bs all the way through. Psychology, Spanish, Chemistry. I would bump him up. Put him in 174/181.

Integrated math B, Integrated math 2 C, Integrated math 3 B, Pre-Calc B. Why can’t they just name them Algebra? What do I do? 3.0 He has lot of math. I would move him up. That settles it. There is a change that you need to write in….He had math every year and got Bs and Cs.

This one is interesting because everything is self reported ACT. There is no ACT math. ACT math 15, they put him into math 100. OK, let me look. He is a regular admit, hmmm, I am just looking at this ACT paper from ACT web services. Now I am looking at the transcript. He is from [name of school]. Algebra 1 B, C. World Religion, Biology, Geometry C, English, Accounting, Algebra 2 C plus. OK he has taken a lot of math; he has taken Algebra, Geometry, and Algebra 2 and is taken Trig and other topics now. I am looking back to see
what other courses he took, difficulty level. Was he breezing through his courses? Science, fine arts, health, American studies, religion. I am looking to see if he took college prep courses, but it doesn’t look like it. I guess 173 since he did have some algebra and they weren’t technical math 1, 2, and 3. But I don’t think that he has a strong enough background to do well in 174. I would not put him into 100 because he did have some algebra. In Algebra 2 and got a C, but I am not placing a lot of weight on that. So I look back to see what kinds of other courses that he took. If they were college bound courses then I wouldn’t second guess it, just thinking that maybe he didn’t do well on the ACT. And even in English placement they put down that he has to take a placement test, so he didn’t even do well in English. I will stay in 173.

This one is from [name of school]. Got a 16 ACT. Math is not her thing because she did pretty well on the other ones. Let’s see what she took…Algebra 1 C minus, Geometry C minus, Algebra 2 D plus. Science 9, French, choir, WR work, rhythm and dance. WR work: that makes me think that she might have been a half day school and half day work. What do you think? Cooperative office work study. She must have done half day academics and half day work field. I am tempted to put her down into the 100. She got Cs in Algebra and Geometry. D in Algebra 2, so I would stay with 173 here.

This one is just good: 23, yes!

We have not hing he re. Here w e ha ve S AT. Where i s m y cheat s heet? What do we do? A 760 is like a 16. I guess that will be a 173.
Results of Focus Group Interviews

Focus group interviews with the students found that the students felt that the ACT-M was appropriate for placement. The students’ major problems with the process centered on communication. For instance, one female sophomore stated that the university classified her as on the borderline between two classes with a sub-score of 26. She was forced to take a version of a placement test without prior notice or a calculator; she mentioned that she would have studied and come prepared to perform well had she known about it in advance. She did not do well and was placed in the lower class, but had to drop that class and add the more difficult level to her schedule where she did earn an A. Another student was scheduled to be in the lowest level course, but was notified three days before classes began that her schedule was changed: she was to report to Math 173.

None of the sample students felt that it would be a bad thing to have to drop down a level, should that be necessary. However, going up a level created problems for some of their classmates. Three out of five felt that professors did not care about students’ progress if the students joined the class later in the semester. They reported that the faculty members told the late-coming students to go to the learning center for help rather that see the professor individually.

When questioned, all of the students were amenable to a seated placement test. In contrast, five out of five students felt that an online test would be a problem. One student said that if the university did not care to bring her in and have a sincere test, then she should not feel obligated to take it seriously. Another student mentioned that she did not feel that either a seated or online test would be necessary as her ACT-M placed her into
the correct course. The grade that she received in her entry-level math course reflected
where she thought she should be. These focus group members also raised concerns about
cheating with books or having another student take the test for them.

Results of Placement by Informed Teacher Judgment

Professor Fox made her judgments based on multiple measures as included in the
students’ informational folders. Her accuracy rates were also determined by the true
positives and true negatives. Those categories were determined by the students who did
not drop or add after her placement. In other words, if a student was placed into a certain
class and stayed in it to earn a semester course grade, they were categorized as a true
positive. Similarly, a student was not placed into a certain course level who did not shift
from that level in the semester represented the true negatives. As in the other
methodologies, the sum of the true positives and true negatives was divided by the total
number of valid student entries within the method.

Encompassing 842 valid student entries, placement by informed teacher judgment
held an overall accuracy rate of .79. Breaking this into course levels, the Math 100 results
showed an accuracy rate of .79 for its 61 students. For the 237 students in Math 173, the
accuracy rate was .84. The level 2 courses of Math 174 and Math 181 had an accuracy
rate of .86 for its 544 students.

Additionally, the number of students who earned a C or better was divided by the
total number of students with valid entries in each level determined the success rates. The
The overall rate was .86. This broke into rates of .78, .86, and .87 for the three respective levels.

Table 1

_Informed Judgment Accuracy and Success_

<table>
<thead>
<tr>
<th>INFORMED JUDGMENT</th>
<th>accuracy</th>
<th>success</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>100 Count</td>
<td>13</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>0.21</td>
<td>0.79</td>
</tr>
<tr>
<td>173 Count</td>
<td>38</td>
<td>199</td>
</tr>
<tr>
<td></td>
<td>0.16</td>
<td>0.84</td>
</tr>
<tr>
<td>174/181 Count</td>
<td>79</td>
<td>465</td>
</tr>
<tr>
<td></td>
<td>0.15</td>
<td>0.86</td>
</tr>
<tr>
<td>Overall Count</td>
<td>181</td>
<td>661</td>
</tr>
<tr>
<td></td>
<td>0.21</td>
<td>0.79</td>
</tr>
</tbody>
</table>

**Results of ACT-M placement**

In order to answer the research questions, the data were compiled into EXCEL for a series of descriptive statistics. The accuracy rates were determined by the ACT-M guidelines, as established in previous years by the math and admissions departments. Any ACT-M of 15 and below was placed into Math 100, the level 0 class. Scores between 16 and 18 were sent into Math 173, the level 1 class. Finally, any score above 19 went into the level 2 courses of either Math 174 or Math 181. Excluding missing data, if a student
matched the criteria of score ranges and appropriate course level, they were labeled as a yes. Students whose placements did match the categorical ranges were labeled as no.

The ACT-M showed an overall accuracy rate of .72. This set was further broken down by class level, where Math 100 was represented by level 0, Math 173 by level 1, and Math 174 and Math 181 by level 2. For the 647 data entries, 39 were at level 0, 192 at level 1, and 416 at level 2. The accuracy rate by course levels were .33, .69, and .76, for the respective level 0, level 1 and level 2 courses.

Unlike accuracies which took into account true positive and true negative matches, the success rate was determined solely by a semester grade of C or better. Again, these students were labeled with a yes for success. Students who earned a D or F were given the label of no. The success rates were figured as the proportion of students earning a C or better by course level, divided by the total number of valid student entries. The success rates for the course levels were as follows: .79, .88, and .91. These rates accumulated for an overall success rate for the ACT-M of .89.
Table 2

*ACT-M Accuracy and Success*

<table>
<thead>
<tr>
<th>ACT-M</th>
<th>no</th>
<th>yes</th>
<th>no</th>
<th>yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>26</td>
<td>13</td>
<td>8</td>
<td>30</td>
</tr>
<tr>
<td>Count</td>
<td>0.67</td>
<td>0.33</td>
<td>0.21</td>
<td>0.79</td>
</tr>
<tr>
<td>173</td>
<td>59</td>
<td>133</td>
<td>23</td>
<td>169</td>
</tr>
<tr>
<td>Count</td>
<td>0.31</td>
<td>0.69</td>
<td>0.12</td>
<td>0.88</td>
</tr>
<tr>
<td>174/181</td>
<td>99</td>
<td>317</td>
<td>39</td>
<td>376</td>
</tr>
<tr>
<td>Count</td>
<td>0.24</td>
<td>0.76</td>
<td>0.09</td>
<td>0.91</td>
</tr>
<tr>
<td>Overall</td>
<td>184</td>
<td>463</td>
<td>72</td>
<td>575</td>
</tr>
<tr>
<td>Count</td>
<td>0.28</td>
<td>0.72</td>
<td>0.11</td>
<td>0.89</td>
</tr>
</tbody>
</table>

Analyses of the 1220 students who had been freshmen between 2003 and 2006 showed that for the 442 students who had ACT-M data listed, 105 were misplaced. Of those students, only about 2% who were misplaced had to drop or add a class. Only 4 people were misplaced and did not receive credit while three were misplaced, then dropped and added a class, but still did not earn course credit. Each of these latter groups of students represented less than 1% of the population. Moreover, in the sample of students representing the freshmen population for the 2005-2006 school year, thirty students did not list an ACT-M. Approximately 17% did not receive credit for their entry-level math class and 14% had to drop or add a math class in their first semester at TU.
Results of Placement by CPS

The analysis of the data set by CPS determined different numbers. By definition of the CPS, only the standard course was included in the predictions. Thus, the level 2 course was the only one which provided data. The .70 level was used as the cutoff for predicted success in the class as it matches with the mathematical equivalent of a C, according to the grading scale used within the math department at TU.

Again excluding missing data, the accuracy rate was determined by the true positives added to the true negatives and divided by the number of valid student entries. The true positives included only the students who possessed a CPS prediction of .70 and earned a C or better. The true negatives represented the students who were predicted by the CPS to be unsuccessful in the standard, level 2 course, and were not placed there. The total accuracy for the 67 students with CPS predictions was .63. Finally, a success rate of .63 included the students who earned a C or better and possessed a valid entry, thereby matching the criteria for the true positives of this method.

Table 3

<table>
<thead>
<tr>
<th>CPS</th>
<th>accuracy</th>
<th>success</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>Count</td>
<td></td>
<td></td>
</tr>
<tr>
<td>174/181</td>
<td>25</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>0.37</td>
<td>0.63</td>
</tr>
<tr>
<td>Overall</td>
<td>25</td>
<td>42</td>
</tr>
<tr>
<td>Count</td>
<td>0.37</td>
<td>0.63</td>
</tr>
</tbody>
</table>
Results of Placement by Online Test

The admissions department directed the 308 incoming freshmen to take the exams at www.quia.com prior to their respective orientation sessions. In order to judge the merits of the completed project, a summative evaluation of the test was done in the fall semester following the tests’ implementation. For the 203 students who took the series of tests, the split-half reliability estimates of each test were computed, again with SPSS software. They were as follows: .72, .71, and .68 for the three respective test levels. In order to further validate the results, the math department chairperson looked at each freshman’s application folder to ensure that the ACT-M, high school transcripts, and placement test results produced similar placement recommendations. The computerized results on quia.com showed that only 66% of the freshmen took the series of tests. Of those students, only approximately 45% of them placed into an appropriate course with the placement test, according to the comparison high school data. Moreover, only 153 registered for and completed a math class in the fall semester.

The placement test varied in its ability to correctly distinguish between student ability levels. The overall accuracy was .52. When broken down by level, lower two course levels found .25 and .76 of their respective students in the correct class. The online placement test accurately placed about .42 of the Math 174 and 181 students. Meanwhile, the overall success rate was determined by the grade of C or better. The overall success rate was .48 while the respective success rates for each level were .25, .93, and .94.
### Table 4

**Online Test Accuracy and Success**

<table>
<thead>
<tr>
<th>ONLINE TEST</th>
<th>100 Count</th>
<th></th>
<th>173 Count</th>
<th></th>
<th>174/181 Count</th>
<th></th>
<th>Overall Count</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>accuracy</td>
<td>success</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>73</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>0.75</td>
<td>0.25</td>
<td>0.75</td>
<td>0.25</td>
<td>0.07</td>
<td>0.93</td>
<td>0.58</td>
<td>0.42</td>
</tr>
<tr>
<td></td>
<td>0.24</td>
<td>0.76</td>
<td>12</td>
<td>37</td>
<td>58</td>
<td>42</td>
<td>0.58</td>
<td>0.42</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.24</td>
<td>0.76</td>
<td></td>
<td></td>
<td>0.07</td>
<td>0.93</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.24</td>
<td>0.76</td>
<td></td>
<td></td>
<td>0.07</td>
<td>0.93</td>
</tr>
</tbody>
</table>

#### Results of Comparisons

In order to answer the overarching research questions of which methods had the highest accuracy and success rates, an inferential test was necessary. The hypotheses were that the accuracy rates were different and that the success rates were different by method. My personal guess was that the informed teacher judgment system would produce both the highest accuracy and success rates. Nonetheless, the comparisons entailed tests using a Chi-square.

The total number of valid entries encompassed five years of incoming freshmen student data, from 2003 to 2007. There were 1508 unique student cases entered into the SPSS program. Some students were included in more than one analysis group, giving a
grand total of 1714 valid analyses by method. Moreover, the cross tabulation of method and overall accuracy brought statistically significant results, with the informed teacher judgment demonstrating a higher accuracy rate than the other three methodologies. That is, with a $\chi^2 = 50.42$ (3, $N = 1709$), $p < .001$, Professor Fox’s process of using multiple measures produced an accuracy rate of .79, the ACT-M had .72 correct placement, the CPS correctly placed students .63 of the time, while the placement test was correct in only .52 of the valid entries. The Cramer’s $V$ value for the Ch-square test was .172, $p < .001$.

The specification of course level accuracy rates also found statistically significant results. For Math 100, the $\chi^2 = 22.40$ (2, $N = 104$), $p < .001$. The informed teacher judgment had .79, the ACT-M had .33 accuracy, and the online test had .25 correct placement. At the second level which had $\chi^2 = 13.10$ (2, $N = 478$), $p < .001$, the informed teacher judgment had .84 correct placement, the ACT-M placed .69 of the students correctly, and the online placement test accurately placed .76 of the students. No CPS data applied to either of those course levels. In the highest course level, the $\chi^2 = 96.66$ (3, $N = 1127$), $p < .001$. The methods produced accuracy rates of .86 for informed teacher judgment, .76 for the ACT-M, .63 for the CPS, and .42 for the online placement test. The effect sizes for the respective courses were determined by the following Cramer’s $V$ values: .46, .17, and .30, each significant at the $p < .001$ level.

The success by method gathered statistically significant results, as well. The overall cross tabulation was $\chi^2 = 170.97$ (3, $N = 1709$), $p < .001$ with the informed teacher judgment finding success in .86 of the cases, the ACT-M gathering .89, the CPS had .63,
and the placement testing had .48 success rates. The Cramer’s V value for overall success was .32 with an associated probability of less than .001.

When broken into course levels, the respective course level chi-square values for success and method were 6.03 (p<.05), 2.22, and 41.24 (p<.001). The Math 173 was not statistically significant. For the lowest course level, the success rates by method were .78 for informed teacher judgment, .79 for the ACT-M, and .25 for the online test with a Cramer’s V of .24 (p<.05). Success rates of .86, .88, and .94 represented the respective placement strategies in the middle level. Specific rates for the level 2 courses included .87 for teacher judgment, .91 for the ACT-M, .63 for the CPS, and .94 for the online test. The Cramer’s V for that inferential test was .20, p < .001.

Table 5

<table>
<thead>
<tr>
<th></th>
<th>accuracy</th>
<th></th>
<th>success</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>INFORMED JUDGMENT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Count</td>
<td>181</td>
<td>661</td>
<td>116</td>
<td>726</td>
</tr>
<tr>
<td></td>
<td>0.21</td>
<td>0.79</td>
<td>0.14</td>
<td>0.86</td>
</tr>
<tr>
<td>ACT-M</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Count</td>
<td>184</td>
<td>463</td>
<td>72</td>
<td>575</td>
</tr>
<tr>
<td></td>
<td>0.28</td>
<td>0.72</td>
<td>0.11</td>
<td>0.89</td>
</tr>
<tr>
<td>CPS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Count</td>
<td>25</td>
<td>42</td>
<td>25</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>0.37</td>
<td>0.63</td>
<td>0.37</td>
<td>0.63</td>
</tr>
<tr>
<td>ONLINE TEST</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Count</td>
<td>73</td>
<td>80</td>
<td>79</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>0.48</td>
<td>0.52</td>
<td>0.52</td>
<td>0.48</td>
</tr>
</tbody>
</table>

Additional descriptive information about the sample included a mean ACT-M of 20.07 and a standard deviation of 3.70. Earning an average C+ by TU grading standards,
the mean numerically categorized grade was 2.83 with a standard deviation of 1.34. The freshmen dropped and added math classes at a rate of 5% over the course of the four years, with a breakdown of 6%, 4%, 5%, and 2% for each of the respective classes.

Furthermore, the Chi-square results $\chi^2(1219, N = 1220) = 28.51$, $p < .001$ performed prior to the 2007 freshmen showed a statistically significant difference in the proportion of credit given within the three different course levels. The lowest math course level, MAT 100, had a passage rate of .88. The MAT 173 students passed .82 of the time and the two classes considered mathematically comparable at the highest level for incoming freshmen had passage rates of .93 and .94, respectively. The Cramer’s V value for this population group was .15 and random samples within the SPSS spreadsheet provided similar outcomes.

Although the comparative success and accuracy rates were quantitative and objective, the placement practices of an expert teacher were balanced between process and intuition. Interestingly, the subjective placements of the expert teacher found greater accuracy than the traditional objective assessments. The comparison of the results thereby brought forth a much larger issue: which type of placement judgment is better for the accurate placement of mathematics students? The results within this chapter demonstrated the personal judgments of the expert teacher trumping the commonly accepted numerically driven decision making model.
CHAPTER V

When Professor Fox first began the folder process, she was looking at all of the independent variables contained in the research questions: the ACT-M, the placement test results, and the CPS data, and the high school transcripts. In short, the TU placement process has encompassed many different strategies. Each of the methods has been used throughout Professor Fox’s tenure at the university. However, it has been her informed judgment with all of those multiple measures that has endured. Based on the quantitative analysis, her method was the most accurate though not necessarily the most successful. Her thematic narrative provided a wealth of information concerning the historical perspective as well as the current expert-system process. Though ironically contradicting herself many times, her process was generally a series of yes and no answers to hierarchically structured questions, as was suggested in the literature by Einhorn (1970). That researcher defined this type of judgment process as lexicographic; the attributes were ordered by importance and the decision made based on each ordered variable before proceeding onto the next ordered variable. Moreover, lexicographic models were not dealt with mathematically. The answers assessed the strengths and weaknesses of each student, as was suggested by Royer and Schumlir (1976), before making the appropriate placement using her expert judgment.

In other words, she valued the ACT-M as her first and most important piece of data. She held the opinion that the higher scores were much easier to place using the
ACT, confirming the work of both Allen and Sconing (2005) and Stumpf and Stanley (2002). If the student’s math subscore fell below the cut score of 19, she more heavily weighted the mathematical portion of the transcript. She believed that “what they do over four years makes a little bit more difference than what they do in one day on an ACT score.” Similar to the recommendations of Hoffman (1960), Professor Fox used the pattern of scores and grades on the transcript as an explanation of each student’s ability. Whenever possible, she attempted to keep the students out of the lowest remedial class.

She used her maternal lens during the folder analysis to do what was both academically correct and fiscally responsible for the students. As was also evident in her thematic narrative, she would be happy to cut the Math 100 out completely, but would do so only if it was right for the TU student body. She would not succumb to the pressure of doing what everyone else did; it would not be right. “We don’t do things because other colleges do. I feel the same way with our math curriculum. It should not have to match anybody else’s. We fit for our students and our needs.” When TU grows to a point when she cannot make her judgments, she was also open to new ideas that would be appropriate for the new situation such as using only the ACT-M for placement.

It could safely be said that she was open minded to options that were best for the student. That is, when the students need to move classes because they were misplaced, she happily recommended the change within the first few weeks. It was her opinion that the drop and add process worked well for both students and faculty. It did not matter whether the person who sought the change was herself, the student, or another faculty member who had the student in class. Becky was humble enough to recognize that a
change needed to be made. Her gut feelings worked most of the time, as was evidenced by the .79 accuracy rate. Nonetheless, she recognized the flaws within her own judgments and made the necessary changes to students’ class schedules.

Although the major purposes of the study were to determine the process of making subjective judgments and find the placement method with the greatest accuracy, this study answered Coladarci’s (1986) call for more empirical research on the accuracy of teacher judgments. While using the ACT-M to make her initial cut for Math 174 and 181, she also pulled in other facets of the students’ high school careers such as HSGPA and college preparatory experience. The use of these types of data agreed with previous studies’ assertions that HSGPA and level of High school courses offered significant information on academic preparedness (Allen & Sconing, 2005; Noble & Sawyer, 2002).

Professor Fox’s use of student information was one of placement not prediction, aligning with some (Noble & Sawyer, 2002) and contrasting other studies (Allen & Sconing, 2005). Her expertise also allowed for recognition of the limitations of HSGPA due to grade inflation and one on one tutoring, especially in the case of vocational students or those on an Individualized Education Plan (IEP). This judgment confirmed prior studies on the unreliability of grades (Allen & Sconing, 2005; Myers, 2002; Woodruff & Ziomek, 2004). Additionally, her use of both the transcripts’ mathematical and non-mathematical entries implied what was generally referred to as the halo effect. This was often an item in the correlational studies of teacher judgment and standardized tests when the teacher increased the judgment decision for one domain based on performances in other classes (Dompnier, Pansu, & Bressoux, 2006).
In contrast to my apprentice judgments during the ethnographic study, Professor Fox established her expertise with her experience in making placements, transcripts that put up proverbial flags, and intuition about general ability and motivation. The literature differentiates with the terms of novice and expert, with the latter using higher order systems of categorization and meta-cognitive process (Berliner, 1986). This case study supported the conclusions of many who have written on teacher expertise and decided that there were important differences in how the expert teacher thought about and used examples of student knowledge (Berliner, 1986; Palmer, Stough, Burdenski, & Gonzales, 1987; Peterson, Carpenter, & Fennema, 1989). It was this expertise that allowed her to make clinical-type of judgments unrelated to social or experiential factors. That is, Professor Fox made pre-instructional judgments based on available documentation, as defined by Coladarci (1986). She placed students based solely on documentary cognitive evidence, in contrast to a variety of studies which asserted using other factors (Dansker, Wilcox, & Van Tubergen, 1980; Farkas, Grobe, Sheehan, & Shuan, 1990; Madelaine & Wheldall, 2005). She mentioned that the ideal would be to perform individual student interviews where more could be intuitively gained, but added that the idea was not realistic or feasible. Her thought process toward this end was almost identical to the suppositions of Wattenbarger and McCleod (1989).

Moreover, the overarching question of the greatest methodological accuracy was answered quantitatively in her favor. With a Pearson Chi-square value of approximately 50.42 and probability of less than .01, the results showed statistically significant differences within the four placement methods. The analysis found that the accuracy rate
using informed teacher judgment was far above the others. That is, Professor Fox’s multiple measures produced an accuracy rate of approximately .79, in contrast to the other methods whose accuracy rates did not rise above .72. Thus, the informed teacher judgment method provided the most accurate way of placing students into their initial math courses at Tiffin University. Moreover, the Cramer’s-V value was .17, p < .001, showing a moderate effect size (Rea & Parker, 1992). This amount of accuracy and practical significance should guide the university to continue in this particular practice, for the sake of future freshmen at TU.

Putting all of the different methods together in analysis by course level, the comparisons look quite different. The informed teacher judgment had an accuracy rate of .79 for the Math 100, and trumped the others in the next two course levels as well. For Math 173, the teacher judgment had .84 accuracy while the ACT-M followed at .70. The online test correctly placed .76 of its students at this level. Finally, the Math 174 and 181 students correctly placed into the class .76 via ACT-M, the Professor Fox’s method gathered .86, and the CPS had .63 accuracy while the online test lagged behind at .42. In each of these course level analyses, the results of the comparisons by method were significant at the .001 level. This series of comparisons demonstrated that despite clear recommendations for placement using overall ratings, students appear to benefit most from the multiple measured placements incorporated by professor Fox.

Consideration should also be given to the differences by level within each measure. The multiple-measured process of informed teacher judgment hovered around .80 accuracy regardless of course level. Both the ACT-M and online test accurately
placed students into level 2 courses, with .76 and .42 respective accuracy rates. It thus appears that using more than one form of measurement in the decision process showed greater levels of consistency than did any other method. This was consistent with previous studies (Morante, 1987; Wattenbarger & McLeod, 1989; Patterson, Czajowski, Hubbard, Johnson, Slater, & Kaufman, 1977).

The success rate analyses generated more noise than signal. The success rates differed significantly by overall method and for levels 0 and 2. Both of those tests produced significant Cramer’s V values with small effect sizes. None of the other tests for differences in success rate were statistically significant. Therefore, although student success was an important factor, the accuracies were what differentiated the methods. It was therefore more prudent to make future placement decisions based on the methodological accuracy rates.

Just as the methods can be compared for accuracy and success rates, they were also intertwined in a practical sense. For example, the placement test was piloted for only one year, but was not mutually exclusive of the other strategies. Contrasting the work of Stiggins, Schmeiser, & Ferguson (1978), the TU online placement tests were not a major source of student placement information. Although the admissions team members provided a set of test directions to each student entering the university in the fall of 2007, only 66% of the incoming freshmen took the test. Thus, Professor Fox was called back in to look at folders. While examining the records for each of the 308 students in that freshmen class, she found that the placement results of those who took the online test were “not jiving” with the students’ ACT-M scores. She thereby moved students to the
class that she thought to best represent the students’ abilities prior to classes beginning in the fall. Although this action saved many students from misplacement, it may also have invalidated the success rate results.

Despite reliabilities .72, .71, and .68 consistent with the expectations of faculty made tests (Truman, 1992), the other results were quite disappointing. In a convenience sample of 65 students, only 46% of them attended the class corresponding to the test score. In other words, they were not where they should have been as designated by their placement test results. The same sample of 65 freshmen from my classes demonstrated their ability to succeed in the upper classes, despite online placement into the lower class level. Inadvertently applying Sawyer’s (2007) theory that “the proportion of examinees for whom good outcomes can result can be used as an indicator of the usefulness of a test score” (p.257), the math department agreed that the series of tests did not work. Unable to control for the confounding factors of students not following directions or taking the test seriously, the placement test was cancelled.

The qualitative data also demonstrated the trend away from the placement test. Most of the students involved in the focus groups indicated that they had been placed correctly. However, their comments demonstrated little consistency in the application of TU’s established ACT-M standards. In truth, Professor Fox had used informed judgment to place each of the represented freshmen classes since she had been “doing folders forever.” That is, while the placements did not correspond with the TU ACT-M guidelines in 44 out of the 442 cases, it did not appear to matter. Those students passed the course 98% of the time. In contrast, when students gained admission via the SAT or
for other reasons did not provide an ACT-M, the admissions team had to guess at where
to place them. These placements resulted in students who did not pass and dropped the
class 17% and 14% of the time, respectively.

Historically, the ACT-M has been used for placement in some form throughout
the tenure of the department chair. While the methods were separated and artificially
applied to the data in the current study, the authentic results always included some
measure of the ACT-M. The ACT-M was an important facet of folder analysis and
placement, similar to Snowman, Leitner, Snyder and Lockhart’s (1980) regression model.
The CPS also made its placement predictions based on a regression equation heavily
reliant on the ACT-M. Although it stands to reason that the placement test could stand
alone, the ACT-M was brought back into play when the test results did not seem to match
the student’s folder profiles. The use of the ACT as a major factor in student placement
corroborated Cronin’s (2000) claims, although it also negated the assertions of
Wattenbarger and McCleod (1989) concerning the use of commercially available tests
such as the ACT and SAT for placement decisions.

Moreover, Becky made the prediction that if the university continues to grow as it
has been doing during the last few years, the process of multiple measures and informed
judgment for each incoming freshmen may not be feasible in the near future. She
suggested possibly switching to using the ACT as the sole measure for placement. Both
Egan and Archer (1985) and Halpin, Halpin, and Schaer (1981) presented similar
arguments, asserting that the tests cost thousands of dollars, but were not being used to
their full potential.
Further Conclusions

In summary, the problem of the problem (Achilles, Reynolds, & Achilles, 1997) was neither solved by a placement test nor by a minor tweaking of prior practices. The issue was not a lack of consistent application of the standards, but rather an understanding of the placement process. In other words, while it originally appeared that the ACT-M was not being fully utilized and a change was warranted by way of a placement test, a thorough data analysis demonstrated the reality of the situation. As was demonstrated by the quantitative data, informed teacher judgments that relied upon the complete set of data for each student were more effective than other historical methods for placing students. The ethnography provided that apprentice-like educational experience requisite for understanding and embracing the process.

Continuing and expanding such trainings will benefit the students, mathematics and business faculty, and admissions and registration staff. The students, the university’s customers, will continue to be placed appropriately with a much more individualized approach to placement. Although it will not be an online test that places them, the math department faculty will more thoroughly and effectively check transcripts and ACT-M scores to ensure a good fit between student ability and course level. Following such attention to ability and appropriate placement, the students may feel more confident in the math skills, which may in turn also increase their self-esteem. They will also benefit by potentially decreasing the amount of time and cost to complete their undergraduate degrees, intensifying long-term positive feelings toward the university.
By using more systematic and meticulous placement process, the professors might also benefit via ease of instruction and classroom assessment. That is, they may not need to provide supplemental instructions and assessments to misplaced students. There is also the possibility of deeper connections and more established relationships between student and faculty when students attend a class for the entire semester. This aligns with the university’s current slogan of “Real connections. Real results.”

The placement test series might find its niche in pre and post testing for all three levels of classes. This should also benefit the math department with entry and exit course information, albeit not in the original intended venue. The work was thus worth the effort.

Finally, the admission office need only accept the recommendations of the math faculty for proper course selection. No math knowledge is needed, thereby saving those staff members’ time and energy. The registrar reaps similar benefits when course changes and drops are significantly reduced. The entire university may benefit through this evaluation with increased morale, time resources, and positive community relations. Therefore, although the placement test did not revolutionize TU’s placement practices, the overall impact of the study will have many positive affects in years to come.

For members of the latter group such as me, the research on mathematics placement processes and accuracy rates provided a wealth of valuable information. The qualitative interviews and student documentary evidence allowed for professional development opportunities within the ethnographic case study Professor Fox’s deliberation of her personal placement processes trained me to do the same. Though time
will reveal the accuracy of my judgments for their predictive ability, that same factor of
time is one of the major contributors that also moved Becky from novice status. In other
words, analyzing folders for 15 years, coupled with content knowledge and other teacher
experiences, allows her the expert status defined by Berliner (1986). It would be my hope
that as a direct result of this research study that others in the TU math department might
become experts as well.

In conclusion, although mathematics placement is controversial in and of itself,
this research tapped into a much larger argument: objective versus subjective judgments.
My results demonstrated that the subjective judgments of an expert teacher based on
multiple objective measures were significantly more accurate than the self-standing
standardized score. Based on this evidence, I would assert that the respective placement
decisions by Berliner's (1986) notion of the expert teacher were more effective than any
solitary high school artifact. I would further assert a recommendation for continuing this
process as it currently exists for the greater good of the university community, most
especially students and mathematics professors.

For Future Study

Considering both the findings of this study and the limitations thereof, many
future research studies may emerge. For instance, one domain of potential research
includes the development of a predictive regression model for TU including the multiple
measures of the department chair. The placement test might also be applied to a specific
group of online students to examine the differences in scores and placement accuracy.
One might also examine using the placement test as a standard course exit requirement to validate any concurrent validity with the ACT-M. The idea of establishing SAT guidelines was another idea for future study. TU could also potentially benefit from descriptive follow up studies concerning whether the academic advisors follow the assignment recommendations by the math department. Finally, as suggested by Frisbie (1982), it may be prudent to do follow up studies on the students who do not take the recommendations of the placement advisor in this institution and beyond.
REFERENCES


Halpin, G., Halpin, G., & Schaer, B.B., (1981). Relative effectiveness of the California Achievement Tests in comparison with the ACT Assessment, College Board Scholastic Aptitude Test, and high school grade point average in predicting


APPENDIX A

LETTERS OF PERMISSION
To Whom It May Concern,

Vickie Ingalls has been given my permission to review student ACT records as part of her research needed for the completion of her Ph.D.

Alice Nichols
Registrar

Alice Nichols
Registrar

anichols@tiffin.edu
TIFFIN UNIVERSITY
155 Miami Street
Tiffin, OH 44883
419-448-3416
From: Rebecca J. Fox
To: Vicki Ingalls
Date: Monday, October 12, 2008
Subject: Permission

To Whom It May Concern:

Vicki Ingalls has been given my permission to use my real name as it appears in the document.

Rebecca J. Fox
Associate Professor of Mathematics
bfox@tiffin.edu
Tiffin University
155 Miami Street
Tiffin, OH 44883
419-448-3355
APPENDIX B

INSTITUTIONAL REVIEW BOARD
TIFFIN UNIVERSITY
INSTITUTIONAL REVIEW BOARD (IRB)

***

Notice to Investigator of
Initial Review of Application

Investigator’s Name(s)  Victoria Ingalls
Project Title  Mathematics Placement Test Research

***

Federal and University regulation require that all research involving human subjects be reviewed in advance by the full Institutional Review Board, except for specific categories of research which may be approved through an expedited review (Level I and Level II). Results of the initial screening of your project application are indicated below. If there are any questions, please contact Dr. Erin P. Dean, IRB Director at (419) 448-3390 located in Seneca House. Upon formal approval, a copy of the signature page of your application will be sent to you or your professor, if you are a student.

---

LEVEL III Review:

Your project will be considered by the IRB at its meeting on (Date) , starting at (Time) in the board room. Following the meeting you will be notified of the Board’s actions by the IRB Director.

☐ Your attendance at this meeting is optional.

☐ You are strongly urged to attend this meeting in order to answer any questions about your project. If you are a student, your faculty advisor is also invited to attend.

LEVEL II - Project will be examined by a second reviewer.

That reviewer is __________________________ Telephone __________________________.

☐ You may begin your project when notified by the IRB Director.

☑ LEVEL I - Approved

☑ You may begin your project immediately.

☐ ADDITIONAL INFORMATION IS NEEDED BEFORE APPROVAL CAN BE GRANTED. (See comments)

COMMENTS:

[Signature]  Dean, Ph.D  9/11/07
Reviewer  Date
TIFFIN UNIVERSITY
INSTITUTIONAL REVIEW BOARD (IRB)

***

Notice to Investigator of Initial Review of Application

Investigator’s Name(s) Victoria Ingalls

Log # 03270801

Project Title Mathematics Placement Test Research

***

Federal and University regulation require that all research involving human subjects be reviewed in advance by the full Institutional Review Board, except for specific categories of research which may be approved through an expedited review (Level I and Level II). Results of the initial screening of your project application are indicated below. If there are any questions, please contact Dr. Erin P. Dean, IRB Director at (419) 448-3390 located in Seneca House. Upon formal approval, a copy of the signature page of your application will be sent to you or your professor, if you are a student.

LEVEL III:

Your project will be considered by the IRB at its meeting on (Date) ________, starting at (Time) ________ in the board room. Following the meeting you will be notified of the Board’s actions by the IRB Director.

☐ Your attendance at this meeting is optional.

☐ You are strongly urged to attend this meeting in order to answer any questions about your project. If you are a student, your faculty advisor is also invited to attend.

LEVEL II—Project will be examined by a second reviewer.

That reviewer is __________________________ Telephone __________________________.

You may begin your project when notified by the IRB Director.

LEVEL I—You may begin your project immediately.

ADDITIONAL INFORMATION IS NEEDED BEFORE APPROVAL CAN BE GRANTED. (See comments)

COMMENTS:

[Signature] 3/28/08

IRB Director Date
APPENDIX C
INTERVIEW PROTOCOL
Questions to be asked of participant

How long have you been here at TU? What course have you taught?

What are your favorite classes? Why?

How long have you been department chair?

What are your responsibilities?

Tell me about the current placement process.

What different methods have been used at TU for math placement?

Which has worked best in your opinion and why?

Are ACT scores effective for proper math course placement of incoming freshmen?

Why do you feel this way?

How many students on average do you have drop/add per class in the fall semester?

Do you have any suggestions to lower the number of students needing to drop/add math classes?

What are your feelings toward a math placement test?
What logistical concerns also need to be evaluated before the implementation of such a test?

Express your opinion of online assessment of mathematical ability.

What is your involvement in the placement process?

What is the time commitment?

How do you feel about the time required to do that?

Do you get or want help from the rest of your department?

How accurate do you think that you are?

Talk about the drop add process and its effect on students.

What is the impact on the faculty?

What possible changes might you suggest to the current process?

Have there been any mandates from the administration?

Have you ever compared our process to other colleges?

Which ones and why?

What is the goal of placement?
Are we meeting that goal?

Does the placement process align with the course that we offer?

How?

How does this effect retention in your opinion?

How did we make the decisions last summer?

Has that ever been done before?

Tell me how you make the choices that you make when looking at their folders.