Proposal for the Creation of A
Master of Science in Interdisciplinary Studies
For Middle School Mathematics

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Department of Mathematics
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Table of Contents

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Introduction

The University of Texas – Pan American, the leading institution of higher education in South Texas is forging a path to offer more advanced degrees in the Rio Grande Valley. Its responsibility to meet the demands for advanced education comes with the need to build upon and move forward the interdependent educational, infrastructure and research-based processes necessary to assure a remedy of the complex and difficult pedagogical issues, workforce needs and research goals -- and real life opportunities -- of the regions' (predominantly Hispanic) population. In joint effort with departments from the College of Science and Engineering, the College of Education, the College of Arts and Humanities, the College of Health Sciences and Human Services, the Department of Mathematics at the University of Texas-Pan American proudly submits this proposal for the creation of the Master of Science in Interdisciplinary Studies for Middle School Mathematics to address these challenges and opportunities.

The Master of Science in Interdisciplinary Studies (MSIS) for Middle School Mathematics builds on our recently implemented Bachelor of Science in Interdisciplinary Science (BSIS) for Middle School Mathematics undergraduate program (now in its third year). This MSIS for Middle School Mathematics degree has been developed as one approach to assist in the development and enhancement of the mathematics education instructional workforce. This workforce will be equipped, in an environment of research and practice, to meet the mathematics educational needs of middle school students. Both from a national and regional perspective, this program is also a response to the need to replace a large number of mathematics educators (including University faculty) who are expected to retire over the next decade. Thus, graduates of this program will be well-prepared to take on positions of leadership in mathematics education settings and to pursue doctoral work in mathematics education, eventually filling faculty positions at Universities.

In addition to helping to replenish the instructional mathematics educational workforce, this MSIS for Middle School Mathematics degree will also help to diversify the instructional mathematics education workforce and will also be a conduit for conducting ongoing research related to learning and teaching across the spectrum of mathematics education. This is a must because the K-12 student population is becoming increasingly diverse; yet, the K-12 instructional workforce has not diversified appreciably nor has its ability to provide appropriate instruction for diverse learners increased. These conditions of mathematics education contribute to many students (especially students from minority and disadvantaged populations) in our country not realizing their full human potential. Although past initiatives have been helpful in understanding the situation and many individual teachers in schools have made progress on eliminating the mathematics achievement gap, initiatives, such as this MSIS for Middle School Mathematics program are also needed to help deal with the problems in this region and across the nation.

Both the MSIS for Middle School Mathematics graduate program and the BSIS for Middle School Mathematics undergraduate program have been developed with alignment to one another and to national mathematics standards (NCTM, 1989, 1990). Recent studies have

identified a positive relationship between the use of teaching practices based on national standards and improved student learning (Cohen & Hill, 1998; Kahle, Meece, & Scantlebury, 2000; Klein, Hamilton, McCaffrey, Stecher, Robyn, & Burroughs, 1999). Further, the efficacy of combining professional development with standards-based curriculum is becoming evident (Weiss, Montgomery, Ridgway, & Bond, 1998). For some teachers in our region and from elsewhere, this MSIS for Middle School Mathematics program will be there only opportunity to get professional development in their field making it possible for them to get up-dated on standards-based curricula for mathematics. The need to couple this emerging knowledge base with new and effective ways of preparing mathematics professionals, as well as retain, effective teachers at the middle school levels (U.S. Department of Education, 2000) is supported by school districts who often pay for their teachers to enhance their educational background, especially in shortage areas such as mathematics. As a result, we are confident that the MSIS for Middle School Mathematics program will be as successful as our BSIS for Middle School Mathematics program currently is.

Mission Statement

The mission of the MSIS for Middle School Mathematics program is that it be a vehicle and agency to provide study and research opportunities that will help to:

- develop leaders in mathematics education by providing a wide array of opportunities to develop them as professionals who will certainly respond better to the particular needs of today's society, especially to the Hispanic population of students;

- improve the quality of mathematical content and pedagogical preparation of in-service mathematics teachers and their research ability in areas significant to this region that is predominantly Hispanic, and

- improve mathematics instruction in the middle schools of the Rio Grande Valley of South Texas, across the State of Texas, and beyond.

The MSIS for Middle School Mathematics degree program will provide its graduate students opportunities to enhance their content knowledge, develop teaching strategies that lead to improved student learning, implement high quality instructional materials, incorporate information technology, and develop skills in using various strategies for assessing learning of middle school mathematics students. For the intended audience of students, this program will provide study and research opportunities with the goal of improving learning, teaching, and assessment across the 4^{th} through 8^{th} grade level mathematics continuum.

It is anticipated that graduate students in the MSIS for Middle School Mathematics will be experienced classroom teachers who wish to renew their interest in and enthusiasm for their discipline, deepen their knowledge of the subjects they teach and build leadership skills. They will return to their classrooms and schools with an expanded disciplinary, pedagogical and leadership repertoire, able to analyze and continually refine practice of teaching and learning related to middle school mathematics. They will be catalysts for the reform of mathematics and education programs in their schools and will contribute to the development of challenging or advanced courses. As instructional leaders, master teachers and mentors, they will become resources for their peers and their profession. Through their involvement, they will work with their peers and key administrators on behalf of improved mathematics education in their school

and districts. Upon completion of the program graduates will be prepared to serve as a resource teacher, mathematics teacher in a departmentalized situation, coordinator, or in other leadership roles in an elementary, middle, or secondary school mathematics program. Graduates will also be ready to serve pursue doctoral work in mathematics education.

Rationale for the Middle School Grade Band

Factors influencing choice of grade band include the: (1) evidence of consistently poor academic achievement in mathematics and science and dramatic drop in TAAS results between 4^{th} and 8^{th} grade; (2) recent intensification of state standards and assessments -- defined as Texas Essential Knowledge and Skills (TEKS) and Texas Assessment of Knowledge and Skills (TAKS); (3) addition of 5^{th} grade science test (dependent on mathematical knowledge and skills) and requirements for mastery in Algebra 1 and Geometry and competency in chemistry, physics, and biology for graduation; (4) Texas Mathematics Initiative Workshops; (5) new certification level in Middle School Mathematics for Texas; (6) Texas Education Agency reports of fewest secondary mathematics certified teachers and high percentage of unprepared teachers in Region 1; and (7) the newly established rationale for middle school mathematics research focus by the National Council of Teachers of Mathematics.

Furthermore, learning experts suggest that between grades 4 to 8, it is critical that students -- especially those with limited or partial proficiency in English, as are many of the Hispanic students of South Texas -- acquire strong conceptual understanding and reasoning skills in mathematics. Their subsequent success and entry into higher education and mathematics careers depend upon how they comprehend and make sense of instruction and learning. Thus, the MSIS for Middle School Mathematics grade band (4^{th} to 8^{th}) will ensure that its students understand the nature of a strong conceptual learning base and skills as related to students' acquisition of necessary mathematical language proficiency. To achieve this, calls for additional attention to written expression, reading and concept development as students transition from elementary school instruction to more linguistically complex instruction. This approach will be supported by underlying research on language issues (e.g., use and understanding of symbols and terms, and mediated learning strategies) that facilitates and supports the transfer of learning between a student's first and second languages in order to enhance mathematics literacy. These approaches will be embedded throughout the first, second, and third areas of concentration of the MSIS for Middle School Mathematics program.

Needs Assessment Survey Data [Program Demand, Potential Students, Job Market Needs]

The historically uneven pattern of human and material resources that characterize South Texas' educational and social development – and underlie its problems of replenishing and enhancing the instructional workforce – are important determinants in shaping the goals of the MSIS for Middle School Mathematics program. Enduring reports of serious teacher shortages and inadequate instructional preparation, especially in levels of middle and high school mathematics, indicate that present and future generations of South Texas students are likely to continue to lag behind educationally.

For example, The Texas's Teacher Recruitment and Retention Study (2001) found that 39% of seventh and eighth grade math teachers were not certified to teach those subjects; 88% of the teachers hold bachelor degrees, 9% master degrees, and 1% hold doctoral degree (compared to the state at 76%, 22%, and 2%). Additional information in this study showed

that local school districts have 7.8% teachers on permits rather than licenses (state 5.2%) and that there is a high turnover of teachers prevalent in partner schools. In recent years, the turnover rate has been approximately 16% (ranging from 9.9% to 21.8%) leading to a virtual turnover of teachers every 6 years. The largest districts in Region 1, those with more than 10,000 students, each have had double-digit teacher turnover rates within the last five years.

Furthermore, a survey commissioned by the National Science Foundation (2002) indicated that only 52.8% of teachers teaching mathematics (N =128) in grades 4^{th}-12^{th} are actually certified. However, despite the grievous educational problems that exist in these regions, the survey indicated that 66% of the mathematics and science teacher respondents are interested in pursuing a Masters degree in mathematics or science education, and 18% are interested in pursuing a Doctoral degree in either mathematics or science education. The data confirms what that there is an abundance of untapped mathematics education interest among this population.

School enrollment will increase by 31% by 2010.

Based on this data, there was an annual need two years ago for nearly 100 certified general elementary, and secondary math, science and technology teachers in 23 of the local school districts. Since then, demand has and will continue to increase. The McAllen-Edinburg-Mission standard metropolitan statistics area, whose population increased 48% in the last decade, is the third fastest growing metro area in the United States (Census Bureau, Feb/March 1998). In Hidalgo County alone, which serves 77% of the students in this proposal, the student population is projected to increase by 31% by 2010.

Clearly, these statistics call for measures that will help alleviate the plight of mathematics education in this region and the state. Only ignoring these conditions can blind one from demanding a program such as that being proposed. School district representatives, teachers, and recent graduates are among those asking if a program such as this is already available. For some school districts and teachers, this program will be a vehicle for them to pursue obtaining a Master Mathematics Teacher Certificate in order to assume the leadership role of becoming a mentor teacher to peer teachers. For others, this program will extend beyond the aforementioned goal because the job market for qualified mathematics educators to undertake leadership positions in school districts not just in this region, but across the State of Texas, and beyond, is extensive and attractive. Hence, the Department of Mathematics adds to its current graduate program with a teaching option geared for secondary teachers, this new program design for the MSIS for Middle School Mathematics. The Department faculty involved in writing this proposal are confident that this program will help bring about the needed changes to equip the instructional workforce who can meet the mathematics educational needs of middle school students.

National Perspective Relative to This Proposal

A growing body of research articulates both the needs of, and possible solutions to, the current state of mathematics education. **What Matters Most: Teaching for America's Future (National Commission on Teaching and America's Future** (1996) indicates that over 50,000 inadequately prepared teachers enter the teaching profession each year. This report indicates that in grades 7-12, approximately 33% of mathematics teachers have neither a major nor minor in their field; yet these under qualified teachers teach over 26% of mathematics students (Ingersoll, 1999). Moreover, of those teachers who enter with adequate backgrounds, 30% to 50% are likely to leave the profession within five years. Many of those

teachers teach science, technology, engineering, and mathematics. Numerous national reports call for expanding programs that prepare mathematics educators. Teacher preparation programs, particularly at the master's level, have been established nationwide to address these concerns. In the last decade, various graduate programs addressing these problems are doing so by integrating more disciplines such as the type submitted herewith.

The review of literature suggests that interdisciplinary areas are given more attention by higher education institutions in charge of the preparation of professionals. For instance, within the departments of mathematics, the following Universities: Arizona State University, Texas A & M University, Michigan State University, and Texas State University at San Marcos are offering interdisciplinary masters programs similar to the one being proposed herewith. At Arizona State University, the Department of Mathematics has established an interdisciplinary masters program in statistics. The Master Program of Natural Sciences is also a flexible interdisciplinary one. Students take one third of courses in a partner department and the remainder in the home department. Another partnership they have developed within the same institution is with the Mathematics Education Program in cooperation with the College of Education. The Mathematics Department at Texas A & M University offers one interdisciplinary masters program in Mathematics Teaching. Students have to take one third of the coursework outside the department. At Michigan State University a Master of Arts for a teachers degree is also offered. This program is designed for someone with a degree that would like to become certified to teach mathematics. Students must take at least 9 credit hours in mathematics education, no less than 15 credit hours from mathematics and statistics courses, and up to six credit hours from outside the department. Students must also pass the masters certifying examination; which is offered each spring semester. At Texas State University at San Marcos, in the Department of Mathematics three different masters programs are offered. Students even have the option to customize their curriculum plan in agreement with their advisor. These programs have non-traditional courses of study and the curriculum is more open. The Masters of Education program allows students to take a minor outside the science or math area.

The programs aforementioned are comparable to the MSIS for Middle School Mathematics program being proposed. There are common features across all programs (e.g. similar mathematics content, similar education course focus), but our program is unique in its choice of options for the third area of concentration. Our program provides additional options for course work in pure mathematics, applied mathematics, and secondary mathematics. Our program also gives particular attention to options dealing with language issues of diverse learners. The reasons for such is substantiated on pages 26-28. Furthermore, the fact that the nearest other institution of higher education offering a comparable degree (Texas State University in San Marcos) is located approximately 200 miles north of this region, makes it difficult for students to travel so far in quest of graduate level mathematics education. The University of Texas-Pan American, the leading institution of higher education can respond to the academic needs of this region and the job market demand for qualified mathematics educators by supporting the implementation of the MSIS for Middle School Mathematics.

Regional Perspective Relative to this Proposal

The Service Area. The primary service area for recruitment of graduate students of this **MSIS for Middle School Mathematics** program will be teachers in schools within

Region One
1.2 million people
88.5% Hispanic
36.5% living in poverty
45% of children in poverty
Ave. household income $21,000
33% have high school diploma

the Region One Education service area which is comprised of 7 counties in South Texas that run along the U. S.-Mexico border. The 2000 census population for this area is 1.2 million, larger than the state of Rhode Island. In land area, Region One is equal to the State of Maryland. This is a fast growing area in the United States, with population increasing 40% in the last decade. The area is majority minority, with 88.5% of the population Hispanic. Region One Education Service Center. The scope of responsibility for the Region One Education Service Center includes over 300,000 students and 25,000 education professionals on 512 campuses: 296 elementary, 80 middle school and 136 high schools. All the districts in Region One are "underserved". Of the students in the Region One school districts, 96% are Hispanic, 83% are economically disadvantaged, 38% are limited English proficient (LEP). The Region One high school dropout rate is higher than the state average: 8.8% vs 7.2%. The table that follows summarizes the scope of responsibility for Region One.

Counties Served	7
Economically Depressed Counties	7
Total Square Miles	9,662
Total Population (2000 Census)	1,188,949
School Districts Served	39
Charter Schools Served	11
Other Educational Institutions	1
Total Enrollment (ISD's)	303,275
Spanish Surname Enrollment	96%
Low-Income Students	83%
Education Professionals	24,298
LEA Elementary Campuses	296
LEA Middle School/Inter/Jr High Campuses	80
LEA High School Campuses	136
Total Campuses	512
Private Schools Being Served	15
Senior Colleges	3
Two Year Colleges	3
Graduate Schools	3
Technical Institutes	2

The MSIS for Middle School Mathematics program will be housed in the Department of Mathematics at the University of Texas-Pan American (UTPA). UTPA is a doctoral-granting Hispanic Serving Institution with approximately 17,000 students, 93% of whom are minority with 85% Hispanic. The UTPA College of Education graduates about 1,000 certified teachers each year, the largest production in Texas. UTPA is also a major producer of bilingual education teachers in the U. S. This program will attract teachers from various educational backgrounds, including those with elementary, middle school, or secondary mathematics teacher certification. In addition, this program will attract teachers whose background is education or areas of language (e.g., ESL, bilingual education, communication disorders, reading).

Student Performance

The chart below reflects the course taking pattern for area students. As evidenced here, the majority of graduates (73%) leave high school with fewer than 4 math or science courses on their transcripts. Another indicator of the preparation (or lack) of students in the Region One Education school districts for advanced education, training and careers in mathematics is their participation in Advanced Placement (AP) courses. In recent years, participation in AP courses was less than 1% of high school students for Calculus BC and Statistics AP. Only 1.6% of high school students took Calculus AB; and 5%, Pre-Calculus.

Students graduating with:	Number	Percent of Total
• <3 math courses	3	n/a
• 3 - 3.5 math courses	4,481	73.4%
• 4 + math courses	1,619	26.5%

In addition, a preliminary study *The Algebra I Achievement Profile of Hispanics Students in the Rio Grande Valley* (Curts, Yanes & Pena, 2004) shows that "end-of-course" examination results 2003-2004 for Algebra I are still discouraging: Hidalgo County Hispanics students perform low according to state's panel recommendations. The very low passing percentage of Algebra I students is of great concern and indicates that students are not performing adequately in a course that is considered a foundation for further study in the sciences, mathematics, engineering, and technology. This lack of math preparation in the earlier grades explains the low percentage of students in Hidalgo County passing college admission tests like the ACT (9% meeting the test criterion compared to 27% statewide) and contributes to the under representation of Hispanics in advanced science and mathematics courses required for managerial and science careers. There is an urgent need to close the achievement gap of RGV Hispanic students in Algebra I.

A study by Reyes, Scribner, & Paredes-Scribner (1999) explains that in spite of all the evidence and factors that contribute to the low-performance of Hispanics, in the area of mathematics, academic achievement of Hispanic students is related directly to the quality and level of instruction they receive. Their study concentrated on high-performing Hispanic schools on the Texas-Mexico border where the student population was mostly Mexican American, from low socioeconomic backgrounds, and where a high percentage of the students were limited English proficient. Based on that study, the authors concluded that conditions of failure for Mexican American students need not exist. They discovered that high-performing schools serving Mexican Americans were very similar to other successful schools. Like effective schools in urban communities (Edmonds, 1979), these schools were typically characterized as communities of learners where students came first, teachers set high expectations for all their students, and instruction was interactive and student-centered rather than teacher-centered. Research elsewhere has shown that in high-performing schools, teachers empowered students to become excited about and responsible for their own learning (Blase & Blase, 1994). Additionally, the authors found that effective schools for Mexican American students shared a vision for all students. Above all, as Valencia (1997) also has reported, such schools ignored the barriers to learning often associated with "deficit thinking."

The mathematics achievement gap of Hispanics that Rio Grande Valley students experience, needs to be addressed and solved through research-based theory of learning and teaching. As presented in the above sections, many existing school practices are inconsistent with what is known about learning. But there are exemplary educational practices that have produced encouraging models when it comes down to educate minorities. The study by Reyes, Scribner, & Paredes-Scribner (1999), showed that in effective schools serving Mexican American students, teachers have high expectations for student achievement; teachers also emphasize the development and acquisition of literacy skills throughout the content areas to enhance language and cognitive development. The school climate is one that is conducive to learning, and one in which cultural diversity is celebrated. Regular feedback is provided to parents so monitoring student progress becomes a goal for teachers and parents.

When describing the most effective mathematics classrooms in Hispanic schools, Reyes, Scribner, & Paredes-Scribner (1999) reported those that incorporated student-centered instructional practices and resources from the students' cultural environment to make mathematics more relevant to the students' lives. Moreover, students were allowed to use Spanish as a tool for inquiry, communication, and thinking. If students experienced difficulty grasping a mathematical concept, the teacher instructed the student in Spanish and allowed the student to work with a more knowledgeable peer. Moreover, the most enthusiastic teachers used instructional strategies that required the students to formulate and test hypothesis, execute specific mathematical operations, communicate and defend their answers, and reflect on the procedures they used and results they generated. Students were encouraged to construct their own mathematical concepts and relationships. Throughout the instructional process, teachers and students offered alternative problem-solving strategies and assisted or questioned one another about their thinking as they attempted to solve mathematical problems. As students observed, practiced, and reflected, teachers or other students mediated their learning.

There is no doubt that the Reyes, Scribner and Paredes (1999) study demonstrated that constructivist and inquiry-based teaching are increasingly recognized as viable vehicles for school mathematics reform. The Texas state mathematics curriculum framework (focus on the quality of mathematics a student should know and be able to do, rather than on how the mathematics should be taught. All students must learn how to do rigorous and challenging mathematics, and this focus should underlie any effort in program development. Even though the National Council of Teachers of Mathematics *Principles and Standards for School Mathematics* (2000) advocates these pedagogical approaches, these pedagogies differ radically from traditional approaches, and most teachers must learn to rethink their teaching practices and the very goals of teaching mathematics. As the growing literature on teacher change and teacher education indicates, instructional change is not easy to accomplish. Rather, it requires carefully and new designed professional development programs at both the pre-service and the in-service level. This is another reason why this proposal for an MSIS in Middle School Mathematics builds upon the offerings of the recently implemented BSIS for Middle School Mathematics degree program.

Teacher Resources

The State of Texas mirrors the national trend in teacher shortage. Texas certifies approximately 22,000 teachers each year, but has about 63,000 vacancies, resulting in uncertified individuals teaching in our schools, or large classes. This low certification rate is exacerbated by the fact that 43% of all new teachers leave after three years, and 25% are over 50 years old and will be retired by 2010. Further, beginning teachers are twice as likely to be placed out of their field of certification. (Texas State University, Winter 2001). Texas has designated six subject matter shortage areas, three of which are math, science and technology applications (Texas Education Agency, September 21, 2000).

Also, student performance in South Texas is even worse because it is hampered by the lack of certified teachers. In Fall 2000, most of the openings for teachers were filled. However, 30% of teachers (higher that the state average) were not certified (with standard, probationary or a one-year certificate) to teach at the time of hire. Based on the fact that the McAllen-Edinburg-Mission standard metropolitan statistics area, whose population increased 48% in the last decade, and is the third fastest growing metro area in the United States (Census

Bureau, Feb/March 1998), the need for certified mathematics teachers will continue to increase. In Hidalgo County alone, the student population is projected to increase by 31% by 2010. Much is needed to help turn these circumstances around – the MSIS for Middle School Mathematics is just one intervention in the making. It is envisioned that **MSIS Middle School Mathematics Program** will positively impact prevailing conditions both directly and indirectly.

Requirements and Unique Features of the MSIS for Middle School Mathematics

The MSIS for Middle School Mathematics program promises to bring about positive changes by revitalizing mathematics education that embrace national reform standards. Well-focused, intensive and balanced mathematics education opportunities, with the appropriate support and instructional materials, will be offered to its graduates so they may have the tools (knowledge, skills, resources, and support systems) to expect greater achievement of their students and the means to have them experience challenging mathematics. Ultimately, the MSIS for Middle School Mathematics program will be a vehicle that can give each child in this community (via its graduates) ample reasons to value mathematics, to become confident in their ability to do mathematics, and to have opportunities for them to graduate from high school ready and able to pursue careers in mathematics fields, or in fields that require these disciplines.

Purposefully, this will require equitable learning environments where graduate students are engaged as active participants in mathematics instruction. To create such environments, graduate students will be provided opportunities to learn how to engage their students in discourse that will help them construct their own understanding of mathematical concepts (NCTM, 1989; Loucks-Horsley, 1998). Furthermore, as stipulated by Reyes, Scribner and Paredes' study, some basic cognitive principles about *how people learn* can be applied for mathematics instruction and extrapolated to this region's classroom setting to effect positive change in learning conditions found in Hispanic learning communities. These principles are embraced by this program's design and are as follows:

a) Learning is a process of knowledge construction, not absorbing and recording pieces of separate information.
b) Learning depends on previous knowledge as the principal means of constructing new knowledge. Learners use what they already know to construct new understandings.
c) Learning is facilitated through the use of metacognitive strategies that identify, monitor, and regulate cognitive processes.
d) Learners motivation to learn and sense of self affects what is learned, how much is learned, and how much effort will be put into the learning process.
e) The practices and activities in which people engage while learning shape what is learned.
f) Learning is closely related to the situation or context in which it takes place. It is enhanced through socially supported interactions.

Overall, the components' coordinated and synergistic planned endeavors represent an essential and substantive approach to improving mathematics teaching and learning. What follows on TABLE I are key features of this proposed degree.

TABLE 1: Features of the MSIS for Middle School Mathematics Degree		
Recruitment, Retention, and Reward Model	**Professional Development Model**	**Research Model**
Candidates recruited into this program will: * by way of grants and/or school district support will be provided incentives (e.g., tuition paid courses, textbooks, mathematics kits, conference fee provisions) *will be provided with mentoring and access to technical assistance, and to high quality curriculum resources for classroom instruction and professional development. *recognized for their exemplary studies and commitment to mathematics education . *encouraged to become life-long learners with philosophical beliefs that support the creation of classroom environments that advocate teaching and learning of mathematics for all students, especially the creation of classroom environments where sensitivity towards socioeconomic, cultural, and racial differences are understood and dealt with appropriately.	**In-service mathematics teachers will have opportunities to:** * will be provided with ample selection of courses appropriate to meet the goals of the program, as well as eight options for the 3rd area of concentration; * reflect on the high quality mathematics that are taught through research-validated models (e.g., extended inquiry, problem-solving, exploring information technologies) * be exposed to processes for the utilization or creation of mathematical materials to help all students achieve high standards, to stimulate and manage classroom discourse so that all students and teachers are clear about what is being learned, and to analyze student learning, the mathematical tasks, and the environment in order to make ongoing instructional decisions. * learn innovative uses of information technology. * participate in activities that go beyond standard courses or generic in-service activities, that	**Candidates participating in this program will have opportunities to:** * master their disciplines, will become knowledgeable about current reforms, assessment issues, and effective uses of technology, and be expert at translating research findings into educational practice. * understand national and state standards and know how to connect the goals of mathematics education to classroom practices that lead to enhanced student achievement. *understand the research base for both student learning and professional development and will learn to incorporate research into instruction. Moreover, they will be able to relate their expertise to curricular and instructional issues in 4th to 8th grade mathematics education. * will have opportunities to conduct research and assessment studies in issues of mathematics learning and teaching; *apply knowledge in realistic settings and will be provided extensive mentoring to help them develop a broad network of contacts that will provide support after the program of study is complete. * will be encouraged to help raise the awareness of regional leaders,

*valued for their contributions in embracing high standards based on research-based findings and practices.	will be based on national standards, and that include effective pedagogy for adult learning.	superintendents and principals of the importance of inquiry and standards-based mathematics for the welfare of the community.

Structure of the MSIS for Middle School Mathematics

Table II below consists of information regarding the structure of the MSIS for Middle School Mathematics Program. This program has three areas of concentration with a cumulative count of 36 hours of graduate credit. The maximum graduate credit hours in education equal 12.

Table II: Structure of the MSIS for Middle School Mathematics Program
Courses – Unless otherwise indicated, the courses are not new. All courses that are not new have been implemented within the last three years.
1st Area of Concentration: 18 hours of Middle School Mathematics
MMAT 6321 Set Theoretic and Logic Foundations (New Course)
MMAT 6322 Advanced Geometric Structures (New Course)
MMAT 6323 Foundations of Real Analysis (New Course)
MMAT 6324 Advanced Algebraic Structures (New Course)
MMAT 6338 Research Readings and Applied Statistical Methods (New Course)
MMAT 6339 Design and Field-based Research (New Course)
2nd Area of Concentration: 9 hours of Education
EDCI 6304 Measurement and Evaluation
EDCI 6305 Educational Curriculum
EDCI 6309 Learning Theories for Mathematics Instruction (New Course)
3rd Area of Concentration: 9 hours in 1 of 8 Options
Option 1: Mathematics Education
SMAT 6306 Mathematics Education Development (New Course)
SMAT 6308 Teaching of Algebraic Concepts
SMAT 6310 Topics in Mathematics Teaching
SMAT 6312 Teaching of Geometric Concepts
Option 2: Pure mathematics
MATH 6331 Algebra I
MATH 6332 Algebra II
MATH 6352 Analysis I
MATH 6353 Analysis II
MATH 6370 Topology

Option 3: Applied mathematics MATH 6360 Ordinary Differential Equations MATH 6362 Fourier Analysis MATH 6364 Statistical Methods MATH 6365 Probability and Statistics MATH 6387 Mathematical Modeling MATH 6388 Discrete Mathematics
Option 4: Physics Education PHYS 5404 Physics by Inquiry I PHYS 5405 Physics by Inquiry II PHYS 6301 Topics in Physics for Teachers PHYS 6302 Environmental Physics for Teachers PHYS 6400 Astronomy by Sight
Option 5: Communication Disorders COMD 6310 Research in Communication Disorders COMD 6320 Speech-language and Hearing Science COMD 6325 Childhood Language Disorders and Clinical Intervention COMD 6355 Normal and Abnormal Language Development of Culturally Diverse Populations COMD 6370 Seminar in Speech-language Pathology
Option 6: English as a Second Language ENG 6328 Introduction to English as a Second Language ENG 6329 Problems in English as a Second Language ENG 6350 Introduction to Descriptive Linguistics for Teachers ENG 6352 Practicum in English as a Second Language ENG 6353 ESL Testing
Option 7: Reading and Language READ 5351 Teaching Reading to the Secondary Student 3 hours from Option 5, and 3 hours from Option 6
Option 8: Bilingual Education and Language EDBE Bilingualism/Multiculturalism: Critical Issues and Practices 3 hours from Option 5, and 3 hours from Option 6

Description of Courses in Support of the Proposed MSIS for Middle School Mathematics Degree

<u>Part A</u>.

18 Graduate Course Hours Required -- Courses Available for the 1st Area of Concentration in Middle School Mathematics. [All courses listed in Part A are new courses developed specifically for this degree.]

MMAT 6321 Set Theoretic and Logic Foundations

This course reviews and expands the study of mathematics as a system with set-theoretic and axiomatic foundations. Use of sets, axioms, and logical foundations to examine reasoning within systems of numbers will be studied. Topics include: Construction of numbers and number systems (rational numbers from the integers), relations, functions, unary and binary

operations, permutations, groups, fields, and logic. Prerequisites: Background equivalent to a BSIS in Middle School Mathematics minor

MMAT 6322 Advanced Geometric Structures

This course examines advanced topics in Euclidean geometry, Euclidean constructions, and transformations, with connections and contrasts to finite geometry, non-Euclidean geometries, projective geometries, and affine geometries. Prerequisite: Background equivalent to a BSIS in Middle School Mathematics minor

MMAT 6323 Foundations of Real Analysis

This course emphasizes applications of real analysis relevant to middle school mathematics. Topics include: sequences, series, limits, integrals, derivatives, and deriving the real numbers from the rational numbers. Prerequisite: MMAT 6321 Set Theoretical Foundations for Middle School Mathematics

MMAT 6324 Advanced Algebraic Structures

This course emphasizes applications of advanced algebraic structures relevant to middle school mathematics. Topics include: polynomials, matrices, transformational geometry, vectors, constructible numbers, and algebraic extensions. Prerequisite: MMAT 6321 Set Theoretical Foundations for Middle School Mathematics

MMAT 6338 Research Readings and Applied Statistical Methods

This course will include the examination, review, and application of inferential statistical methods used in select prototype middle school mathematics research and assessment studies. Implications derived from reading and examining research studies in middle school mathematics will be covered. Students are expected to conduct a review of literature and develop a proposal for research study. Prerequisites: Admittance into Department of Mathematics Graduate Program, EDCI 6309, MMAT 6321, and at least one from MMAT 6322, MMAT 6323, and MMAT 6324.

MMAT 6339 Design and Field-based Research

This course on research design will have students design and conduct a field-based research project about a middle school mathematics education topic. Prerequisites: MMAT 6338 and admittance into Department of Mathematics Graduate Program, EDCI 6309, and at least two courses from MMAT 6321, MMAT 6322, MMAT 6323, and MMAT 6324.

Part B.

9 Graduate Course Hours Required -- Courses Available for the 2nd Area of Concentration in Education. [The first two EDCI courses listed in Part A are courses already available through the Department of EDCI. The third course EDCI 6309 is a new course developed specifically to support this degree.]

EDCI 6304 Measurement and Evaluation

Students will explore the design, construction and administration of tests with an emphasis on achieving test validity. Student performance on teacher-made, textbook-supplied or standardized tests will be analyzed to determine relevance and appropriateness for informed curricular and instructional decisions. Mandated measures of student performance will be investigated with particular regard to their impact on educational practice in schools. A focus on students' content specific discipline will be emphasized.

EDCI 6305 Educational Curriculum

An overview of theories, principles, practices and issues in curricular planning for modern educational experiences in schools will be covered. Emphasis will be placed upon application of educational psychology in the selection and teaching of curriculum and the achievement of successful classroom management to improve educational practice in schools. A focus on students' content specific discipline will be emphasized.

EDCI 6309 Learning Theories for Mathematics Instruction

This course will examine instructional learning theories about how people learn and use mathematics and the ability to apply these theories for effective mathematics teaching. This course will focus on understanding processes involved in mathematical thinking, the impact of learning theory on mathematics instruction, expert-novice models of mathematical behavior, and ways to enhance mathematics learning in the classroom. Clinical experiences based on theoretical principles and methodology of mathematics will occur.

Part C.

Eight Options are available for the 3rd Area of Concentration for this proposed degree. Students must take a total of 9 hours. The Eight Options are as follows:

Option 1: Mathematics Education
Option 2: Pure Mathematics
Option 3: Applied Mathematics
Option 4: Physics Education
Option 5: Communication Disorders
Option 6: English as a Second Language
Option 7: Reading and Language
Option 8: Bilingual Education and Language

Option 1: Mathematics Education [Any 9 hours from the following list of courses:]

SMAT 6306 Mathematics Education Development

This course explores the philosophical and historical foundation of mathematics and its impact in the evolution of modern mathematics education consistent with national principles and standards. Insights into the teaching and learning of selected topics dealing with numbers, measurement, operations, algebra, geometry, probability, and statistics, mathematical

embodiments, representations, and applications will be emphasized. Students are expected to research areas of interest related to practical teaching and learning classroom situations

SMAT 6308 Teaching of Algebraic Concepts

This course examines issues, trends, and research related to the teaching/learning of secondary school algebra. Topics include historical items with major influence in algebra and a study of relationships between abstract and school algebra. Prerequisite: MATH 4351 or equivalent

SMAT 6310 Topics in Mathematics Teaching

This course examines issues, trends and research related to the teaching/learning of secondary school mathematics. Specific topics vary, but could include: technology in the classroom, mathematical problem solving and the use of applications in the teaching of mathematics. Prerequisite: Graduate standing in mathematics.

SMAT 6312 Teaching of Geometric Concepts

This course examines issues, trends and research related to the teaching/learning of secondary of secondary school geometry. Topics include the historical significance of geometry, the relationship between modern geometry and the geometry taught in schools, and the van Hiele equivalent, model of geometric understanding. Prerequisite: MATH 3304 or consent of instructor.

Option 2: Pure Mathematics [Any 9 hours from the following list of courses:]

MATH 6331 ALGEBRA I

This course is an extension of the undergraduate course in abstract algebra. Topics include polynomial rings over a field and finite extensions. prerequisite: MATH 4351 or consent of instructor.

MATH 6332 ALGEBRA II

The purpose of this course is to provide essential background in groups, rings and fields, train the student to recognize algebraic structures in various settings, and apply the tools and techniques made available by algebraic structures. Topics include groups, structure of groups, rings, modules, Galois theory, structure of fields, commutative rings and modules. Prerequisite: MATH 6331 or consent of instructor.

MATH 6352 ANALYSIS I

The purpose of this course is to provide the necessary background for all branches of modern mathematics involving analysis and to train the student in the use of axiomatic methods. Topics include metric spaces, sequences, limits, continuity, function spaces, series, differentiation, and Riemann integral. Prerequisite: MATH 4357 or consent of instructor.

MATH 6353 ANALYSIS II

The purpose of this course is to present advanced topics in analysis. Topics may be chosen from (but not restricted to) normed linear spaces, Hilbert spaces, elementary spectral theory, complex analysis, measure and integration theory. Prerequisite: MATH 6352.

MATH 6370 TOPOLOGY

This course is a foundation for the study of analysis, geometry and algebraic topology. Topics include set theory and logic, topological spaces and continuous functions, connectedness, compactness, count ability and separation axioms. Prerequisite: MATH 4360 or consent of instructor.

Option 3: Applied Mathematics [Any 9 hours from the following list of courses:]

MATH 6360 ORDINARY DIFFERENTIAL EQUATIONS

This course examines existence and uniqueness theorems, methods for calculating solutions to systems of ordinary differential equations, the study of algebraic and qualitative properties of solutions, iterative methods of numerical solutions of ordinary differential equations and an introduction to the finite element methods. Prerequisite: MATH 3349 or consent of instructor.

MATH 6362 FOURIER ANALYSIS

This course includes trigonometric series and Fourier Series, Dirichlet Integral, convergence and summability of Fourier Series, uniform convergence and Gibbs Phenomena, L2 space, properties of Fourier Coefficients, Fourier Transform and applications, Laplace Trasform and applications, distributions, Fourier Series of distributions, Fourier Transforms of generalized functions, orthogonal systems. Prerequisite: MATH 6353 or consent of instructor.

MATH 6364 STATISTICAL METHODS

This is a course in the concepts, methods and usage of statistical data analysis. Topics include test of hypotheses and confidence intervals; linear and multiple regression analysis; concepts of experimental design, randomized blocks and factorial analysis; a brief introduction to non-parametric methods; and the use of statistical software. Prerequisite: Consent of instructor.

MATH 6365 PROBABILITY AND STATISTICS

Topics in this course include set theory and concept of probability, conditional probability, random variables, discrete and continuous probability distributions, distribution and expectations of random variables, moment generating functions, transformation of random variables, order statistics, central limit theorem and limiting distributions. Prerequisite:
MATH 2401 or equivalent, or consent of instructor.

MATH 6387 MATHEMATICAL MODELING

This course presents the theory and application of mathematical modeling. Topics will be selected from dynamic models, stable and unstable motion, stability of linear and nonlinear

systems, Liapunov functions, feedback, growth and decay, the logistic model, population models, cycles, bifurcation, catastrophe, biological and biochemical models, chaos, strange attractors, deterministic and random behavior. Prerequisite: Consent of instructor.

MATH 6388 DISCRETE MATHEMATICS

This course is an introduction to modern finite mathematics. Topics include methods of enumeration, graphs, partially ordered sets, and an introduction to Polya's theory of enumeration. Prerequisite: MATH 4351 or consent of instructor

Option 4: Physics Education [Any 9 hours from the following list of courses:]

PHYS 5404 PHYSICS BY INQUIRY I

This course is a set of laboratory-based modules that are designed to offer prospective and practicing teachers (K-12) the opportunity to acquire skills in teaching science through a process of "learning by discovery." The models are also suitable for liberal arts students and for under-prepared students who aspire to science-related careers. This course emphasizes the process of science rather than the presentation and explanation of facts. This course will deal with mechanics, thermodynamics and wave motion.

PHYS 5405 PHYSICS BY INQUIRY II

Physics by Inquiry II is a set of laboratory-based modules that are specifically designed to prepare prospective and practicing teachers (K-12) to teach science as a process of "learning by discovery." The modules are also suitable for liberal arts students and for under-prepared students who aspire to science-related careers. Physics by Inquiry II emphasizes the process of science than the presentation and explanation of facts. This course will deal with electricity, magnetism and modern physics.

PHYS 6301 TOPICS IN PHYSICS FOR TEACHERS

A course that incorporates many different topics in physics. Guest lectures, student participation and basic concept presentation will be utilized to teach each topic. Prerequisites: PHYS 5404 or PHYS 5405 or PHYS 6400 or consent of instructor.

PHYS 6302 ENVIRONMENTAL PHYSICS FOR TEACHERS

An enhanced understanding of environmental concepts and principles regarding pollution, air, water and waste management. The course will also address local issues and resources to help teachers provide students with opportunity for real world critical thinking and problem solving. The course will include in-depth industry site visits and guided field trips to environmentally sensitive areas. Both renewable and non-renewable energy resources with the concept of energy conservation, waste management, and disposal methods will be emphasized.

PHYS 6400 ASTONOMY BY SIGHT

Astronomy by Sight is a set of laboratory-based modules that are specifically designed to prepare prospective and practicing teachers (K-12) to teach science as a process of "learning by

discovery." The modules are also suitable for liberal arts students and for under-prepared students who aspire to science-related careers. Astronomy by Sight emphasizes the process of science rather than the presentation and explanations of facts. This course will deal with the sun, moon and stars, which will help predict and explain daily/monthly changes in the appearance of the sky. It will also deal with the earth, solar system and possibility of extraterrestrial life.

Option 5: Communication Disorders [Any 9 hours from the following list of courses:]

COMD 6310 RESEARCH IN COMMUNICATION DISORDERS

A study of the major methods of research in communication disorders. Basic statistical concepts will be introduced. Students will critique research projects that have been completed and published. Students will select a topic for research, write a clear statement of the problem, write a comprehensive review of the literature and outline the method proposed for addressing the problem. Prerequisite: Graduate standing ASHA: Related area

COMD 6320 SPEECH-LANGUAGE AND HEARING SCIENCE

A Study of embryology and neurology and their relation to the speech and language processes; physics of sound; psychology of communication; linguistics; and dialectology. Modern studies and research in the sciences related to speech and language will be addressed. Prerequisites: COMD 6310 and graduate standing. ASHA: Basic human communication processes.

COMD 6325 CHILDHOOD LANGUAGE DISORDERS AND CLINICAL INTERVENTION

Following a brief review of characteristics of special populations having abnormal language an in-depth study of the methods for language intervention will be presented. Family-based assessment and intervention will be addressed. Prerequisites COMD 6310 and graduate standing. ASHA: Language disorders.

COMD 6355 NORMAL AND ABNORMAL LANGUAGE DEVELOPMENT OF CULTURALLY DIVERSE POPULATIONS

An in-depth analysis of normal and abnormal speech and language acquisition for bilingual and monolingual children. A review of cultural factors that affect the delivery of speech-language pathology services to culturally and linguistically diverse populations. Particular emphasis is placed on differentiating communication disorders vs. differences. ASHA: Language disorders.

COMD 6370 SEMINAR IN SPEECH-LANGUAGE PATHOLOGY

The study of principles, methods and procedures for speech-language theory, assessment and/or intervention. Subject matter varies from semester to semester, so that specific communication problems may be studied in-depth. The course may be repeated for credit when specific matter changes. With approval, this elective may be substituted for a required course providing the requirement has a familiar focus and providing that ASHA's minimum requirements are not comprised. Maximum credit: 6 hours. Prerequisites: COMD 6310,

graduate standing and permission of instructor. ASHA: Speech/Language disorders (depending on content)

Option 6: English as A Second Language [Any 9 hours from the following list of courses:]

ENG 6328 INTRODUCTION TO ENGLISH AS A SECOND LANGUAGE

A study of ESL theory and techniques and their application to specific language performance skills. Special emphasis on the linguistic, sociolinguistic and psycholinguistic bases for selecting appropriate ESL methods and techniques. Prerequisite: ENG 3319 or ENG 6350 or consent of instructor.

ENG 6329 PROBLEMS IN ENGLISH AS A SECOND LANGUAGE

Studies in special problem areas of language and practice which prospective teachers or ESL students will encounter in the classroom. May be repeated once for credit when the topic values. Prerequisite: ENG 6328 or consent of instructor.

ENG 6350 INTRODUCTION TO DESCRIPTIVE LINGUISTICS FOR TEACHERS

An introduction to the methods of linguistic science with emphasis on problem solving techniques and the application to specific problems; includes a research project exploring the application of linguistics to specific situations. Credit Restriction: Not open to students with credit in ENG 3319.

ENG 6352 PRACTICUM IN ENGLISH AS A SECOND LANGUAGE

Supervised experience in teaching/working with learners of ESL in (a) ENG 1406, (b) a tutorial or (c) a laboratory. Actual experience will be based on theoretical principles and methodology of modern language teaching. Sample lesson plans will be developed and tried under the supervision of trained ESL personnel in a University context in order to meet the needs of ESL learners. Prerequisite: ENG 6329 or consent of instructor.

ENG 6353 ESL TESTING

Evaluation of second language learners of English following the principles and guidelines for diagnostic, placement, proficiency and classroom testing in ESL. Areas covered include principles and procedures for selecting, preparing, administering and interpreting results of tests of ESL learning. Prerequisites: ENG 6328 and ENG 6329, or consent of instructor.

Option 7: Reading and Language [Any 9 hours from the following list of courses:]

READ 5351 Teaching Reading to the Secondary Student

The relation of reading ability to academic achievement, procedures for teaching reading skills needed in content area reading and reading difficulties encountered by secondary students are included in this course. The student will use diagnostic tools and techniques to determine

reading needs of secondary students and will develop reading-learning activities to meet those needs.

Plus 3 hours from Option 5 and 3 hours from Option 6

Option 8: Bilingual Education and Language [Any 9 hours from the following list of courses:]

EDBE 6322 Bilingualism/Multiculturalism: Critical Issues and Practices

A course designed to provide understanding of the historical, theoretical and socio-political factors that impact bilingualism/multiculturalism in the public school system. The course will emphasize contemporary research findings that affect bilingual educational issues and practices.

Plus 3 hours from Option 5 and 3 hours from Option 6

Rationale for Including Each of the 8 Options for the Third Area of Concentration

Option 1: Mathematics Education

The courses in this option support objectives for mathematics teaching, primarily for secondary education. This option is primarily targeted at students who want to have broader knowledge of mathematics education teaching and learning issues through 12^{th} grade, who want to update and upgrade their mathematics content and pedagogical skills, and who want to take on a leadership role in secondary schools, and who desire preparation for advanced graduate study in mathematics education.

Option 2: Pure Mathematics

This option is primarily designed for those who wish to extend their mathematics content knowledge and skills beyond that expected for middle school mathematics specialists in pure mathematics. These students will be in a position to pursue a master's degree in mathematics, and will also be able to take on leadership positions at either middle or secondary schools.

Option 3: Applied Mathematics

This option is primarily designed for those who wish to extend their mathematics content knowledge and skills beyond that expected for middle school mathematics specialists in applied mathematics. These students will be in a position to pursue a master's degree in mathematics, and will also be able to take on leadership positions at either middle or secondary schools.

Option 4: Physics Education

Given that Physics Education is a field where middle school mathematics is applied, selecting "Option 4: Physics Education" for the MSIS Middle School Mathematics program is appropriate for graduate students who want to extend their background to include basic

information regarding science education, acquisition models, and cognitive and affective needs of learners all of which impact understanding and enhance physics pedagogy and content knowledge. In addition, students will engage in selecting teaching methods/ techniques for physics education, and will examine state required standards.

The courses such as PHYS 5404-Physics by Inquiry I, PHYS 5405-Physics by Inquiry II, PHYS 6400-Astronomy by Sight, PHYS 6301-Topics in physics for teachers, and PHYS 6302-Environmental physics for teachers are designed to offer prospective and participating teachers and the students the opportunity to acquire skills in teaching science through a process of "Learning by Discovery" --a very powerful method used in learning physics. These courses are geared to improve attitudes of those learning and teaching physics, as well as confidence in learning and teaching physics. Emphasis will be placed on the processes of science rather than on the presentation and explanation of facts. Usual assignments are coordinated by the instructor and students enrolled in the particular course via a process paradigm.

Option 5: Communication Disorders

Selecting "Option 6: Communication Disorders" as an area of concentration for middle school mathematics teachers provides teachers with language acquisition and language research with particular attention to the middle school child, ages 12 through 14 years. Language issues have been identified by the National Council of Teachers of Mathematics Achievement Gap Task Force as important to understanding the mathematics achievement gap of children. Hence, graduate students in the MSIS Middle School Mathematics graduate program will be provided the content and research knowledge about communication disorders existing among middle school children.

Research findings stipulate that during the ages of 12 and 14, students should typically exhibit competencies in the rudiments of language (vocabulary, syntax, and grammar, both orally and in writing), and the emergence of instructional - conversational discourse (classroom conversations, narrative skills important for reading, and expository discourse important for understanding of textbooks and written assignments) (Catts & Kamhi, 1999; Lue, 2001; Nelson, 1993; Wiig, personal communication). Mathematics discourse is *language*, and therefore, concerns mathematics teachers, speech-language pathologists, and other professionals concerned with learning outcomes.

To ascertain that students are provided opportunities to gain these language rudiments and instructional-conversational discourse skills, the courses recommended for Option 6: Communication Disorders will include mathematics discourse activities that will guide:

- ✓ self-talk during guided or independent activities to work through processes.
- ✓ self-detection of comprehension failures and errors during class demonstrations, independent math work, or proofreading, and
- ✓ ability to identify essential details for problem solving—whether in formulas, or story problems.

Exposure to these graduate courses may impact teachers in several ways, with two significant areas being those of: (1) improved methods for communicating in the classroom, and (2) sensitivity to the communicative abilities of the middle school child for the purposes of delivering effective instruction.

Option 6: English as a Second Language

Language issues have been identified by the National Council of Teachers of Mathematics Achievement Gap Task Force as important to understanding the mathematics achievement gap of children. Consequently, another option for graduate students in the MSIS Middle School Mathematics graduate program is "Option 6: English as a Second Language". This option as third area of concentration for middle school mathematics teachers provides students with basic information regarding language, learning, acquisition models, language learning strategies, cognitive and affective needs of learners all of which impact understanding and using language as a means to gain knowledge (including that of mathematics and sciences), plus basic information on the nature of language itself, an analytic field of study which many people find to be very similar to mathematics. In addition, preparing curriculum, selecting teaching methods/techniques, and preparing formative and summative criterion-based tests appropriate to differing English language proficiency levels are available as elective credit within the five courses outlined.

Students will select 3 courses (9 hours of graduate credit) from those recommended for Option 6: English as a Second Language that include:

- ✓ English 6328 which introduces the language learning and acquisition concepts,
- ✓ English 6329 which uses language learning and acquisition concepts to base either classroom methods, materials, and teaching techniques or basic curriculum design for appropriate juxtaposition of language and conceptual learning,
- ✓ English 6350 which introduces the systematic nature of English (as one example of language itself) and its analytical system,
- ✓ English 6352 which exposes students to a variety of different language teaching paradigms via case studies, student conducted action researches, reflective teaching journals, and critique of peers' teaching demonstration videos, and
- ✓ English 6353 which explores testing for English language learners and the parameters of both norm referenced, but primarily criterion referenced testing.

Due to the nature of the field of ESL/EFL, each student defines her or his own needs based upon the students with whom s/he is working and/or plans to work in order to complete assignments such as curriculum design, test designs, teaching demonstrations, etc. Usual assignments are coordinated by the instructor and students enrolled in the particular course via a process paradigm.

Option 7: Reading and Language

The question of how to foster the kind of thinking that takes students beyond "performing" to sense-making and inquiry lies at the heart of the challenge facing mathematics teachers today. Therefore, this option "Reading and Language" finds a central place in mathematics education to help engage students actively in meaningful learning. The example of "reading to learn mathematics" is a transactional perspective on reading that treats reading as a far more active, generative, and social process than traditional approaches. Among the purposes for reading in mathematics education programs is to help students make sense of mathematical concepts or procedures, seeing connections between mathematics and real life, developing broader views

of mathematics, developing strategies for sharing information, and valuing students' own ideas and those of others. As a result, the MSIS for Middle School Mathematics offers Option 7 as a means for students to become informed of both reading and language issues pertinent to the teaching and learning of mathematics.

Option 8: Bilingual Education and Language

During the last decade, the number of children who speak other languages and who had difficulty speaking English in U.S. schools increased 27 percent, from 1.9 million to 2.4 million (U.S. Department of Education, National Center for Educational Statistics 1994). To succeed in mathematics, these students have to participate actively in mathematics classes in spite of having limited English skills (Santiago and Spanos 1993). Educators' experience shows that their English proficiency in day-to-day interactions and their ability to translate the mathematics lexicon from the fist language (L1) into the second one (L2) is not sufficient to meet the requirements of the mathematics classroom (Chamot and O'Malley 1993; Cuevas 1991). What these students need is to be assisted in acquiring the language of mathematics with mediated learning strategies that help them transition from their first language to English. Hence, this option will include courses that discuss the problems faced by students in bilingual environments, and students with limited English proficiency (LEP students) when they are learning to communicate mathematically in L2. To help teachers understand those problems, this program will help students understand the conditions in which LEP students develop communicative competence in mathematics. It will also suggest a model that links communicative competences with L1, L2, and the prior mathematical knowledge and behaviors required to learn mathematics.

Projections Regarding the Growth of the MSIS for Middle School Mathematics Program

The Committee analyzed potential course offerings for the first six years of the MSIS for Middle School Mathematics. It assumed that the first year of the program's course offerings would be Fall 2005 (see TABLE III). The Committee estimated the # of students, and # of SCH. The number of sections would be at most one for each of the courses.

The following projections are expected assuming that the enrollment of MSIS for Middle School courses begins with an enrollment of 15 students (in a cohort) during AY 2005, and an increase of 5 students for each cohort entering the program every other year thereafter Under these assumptions, a conservative estimate of graduates (headcount) after six years is 60 students if there is no attrition. Assuming some attrition, still it is anticipated that at least 50 students would graduate from this program within six years.

First, assuming a headcount of 60 students after six years, as per TABLE IV, 1080 SCH would be generated under the 1st area of concentration, and there would be an increase of 615 SCH in courses in the 2nd area of concentration. An additional 615 SCH will also be generated, collectively, in courses within the 3rd area of concentration.

Next, assuming a headcount of 50 students after six years, 900 SCH would be generated under the 1st area of concentration, and there would be an increase of 512 SCH in courses in the 2nd area of concentration. An additional 615 SCH will also be generated, collectively in courses within the 3rd area of concentration.

These numbers could increase noticeably if incentives for teachers to return to school for graduate studies become available by more sources other than school districts. Still, 50-60 additional graduates in middle school mathematics can significantly change the plight of mathematics conditions in schools.

TABLE IV: Projections in # of Students, # of SCH					
Cohort 1:Entering Fall 2005					
Year 1: AY 2005 - 2006					
	# of New Students to UTPA	**1st Area of Concentration**	**# of SCH**	**2nd Area of Concentration**	**# of SCH Increase as a Result of New MSIS**
Fall 2005	15	MMAT 6321	45	EDCI 6305	30
Spring 2006	0	MMAT 6322	45	EDCI 6309	30
Summer 2006	0	MMAT 6323	45	EDCI 6304	30
(10 Weeks)	0	MMAT 6324	45		
Year 2: AY 2006 - 1007					
Fall 2006	0	MMAT 6338	45	EDCI 6305	15
Spring 2007	0	MMAT 6339	45	EDCI 6309	15
Summer I 2007	0	None		EDCI 6304	15
Total (1st Cohort)			**270**		**135**
Cohort 2:Entering Fall 2007					
Year 3: AY 2007 - 2008					
	# of New Students to UTPA	**1st Area of Concentration**	**# of SCH**	**2nd Area of Concentration**	**# of SCH Increase as a Result of New MSIS**
Fall 2007	20	MMAT 6321	60	EDCI 6305	30
Spring 2008	0	MMAT 6322	60	EDCI 6309	30
Summer 2008	0	MMAT 6323	60	EDCI 6304	30
(10 Weeks)	0	MMAT 6324	60		30
Year 4: AY 2008 - 2009					
Fall 2006	0	MMAT 6338	60	EDCI 6305	30
Spring 2006	0	MMAT 6339	60	EDCI 6309	30
Summer I 2006	0	None		EDCI 6304	30
Totals (2nd Cohort)			**360**		**210**

Year 5: AY 2009 - 2010					
	# of New Students to UTPA	**1st Area of Concentration**	**# of SCH**	**2nd Area of Concentration**	**# of SCH Increase as a Result of New MSIS**
Fall 2009	25	MMAT 6321	75	EDCI 6305	45
Spring 2010	0	MMAT 6322	75	EDCI 6309	45
Summer 2010 (10 Weeks)	0	MMAT 6323	75	EDCI 6304	45
	0	MMAT 6324	75		45
Year 6: AY 2010-2011					
Fall 2010	0	MMAT 6338	75	EDCI 6305	30
Spring 2011	0	MMAT 6339	75	EDCI 6309	30
Summer I 2011	0	None		EDCI 6304	30
Totals (2nd Cohort)			**450**		**270**
Total Number of Students after 6 years	60		1080		615

Relationship of the MSIS for Middle School Mathematics Program to Existing Authorized Programs

This MSIS for Middle School Mathematics will be an addition to the current inventory of Interdisciplinary Master's Degrees at UTPA. As per UTPA's 2002-2004 Graduate Catalog, on page 45 there are two types of Interdisciplinary Master's Degrees at UTPA; namely, the Master of Arts in Interdisciplinary Studies and the Master of Science in Interdisciplinary Studies. To date, there is one other MSIS degree at UTPA – the Master of Science in Interdisciplinary Studies in Physics Education. The proposed program will positively affect the MSIS in Physics Education because one of the options under the 3rd area of concentration will require 9 graduate hours of the 18 hours required in its 1st area of concentration. It is anticipated that approximately 15% of the graduate students pursuing the MSIS for Middle School Mathematics are likely to choose Option 4 in Physics Education, adding moderately to the program's enrollment, but not enough to overtax it with more students than can be handled.

Any enrollment in the MSIS for Middle School Mathematics will positively impact the graduate program represented in its 2nd Area of Concentration: Education and all eight of the programs represented by the options offered via the 3rd Area of Concentration; namely, Secondary Mathematics Education, Pure Mathematics, Applied Mathematics, Physics Education, Communication Disorders, English as a Second Language, Reading and Language, and Bilingual Education and Language. Since it is anticipated that this new program will begin with 15 students, there will be a moderate increase in class size in courses offered in each of the areas represented in the 2nd and 3rd area concentrations or options. There appears to be no need to be concerned that additional new faculty will be needed for additional sections in these other areas.

RESOURCES NEEDED

Program Coordinator

The Committee strongly recommends it will be necessary to provide ¼ FTE per semester and summer session for a faculty member to coordinate the **MSIS for Middle School Mathematics Program**. Starting a program is a time-consuming enterprise that needs one person whose specific focus is to build the program by implementing effective recruitment strategies, to advise the program's graduate students, and to work with faculty from various departments to plan the offering of courses that will support its various areas of concentration. The Program Coordinator should be qualified to teach courses in the first area of concentration, but s/he is not required to do so every semester. The MSIS for Middle School Program Coordinator will:

- Coordinate and administrate the scheduling of courses
- Work with faculty from different departments on course program and development
- Advise students
- Coordinate and administrate offerings of Teaching Assistantships, Research Assistantships, and/or Internships offered by the program
- Implement recruitment strategies

Equipment and Supplies with Regard to Proposal

Equipment and instructional materials in the Department of Mathematics needed for supporting instruction of the MSIS for Middle School Mathematics includes computer labs and instructional materials such as special calculators and hands-on-manipulatives. Currently, the number of computer labs available for use is sufficient to meet the needs of the program. Further, the current supply of instructional materials is sufficient to meet the needs of the program. However, regular surveying of program needs will be made to make whatever accommodations are needed. There will be no need for any alterations or renovations of existing facilities for use as a result of this new program.

Library Staff's Assessment of Library Resources

UTPA's library staff was asked to provide an inventory of library resources available for the proposed program. The response was that the UTPA library currently holds 5750 mathematics books, and has access to 72 journals (15 on-line). As per this assessment, there is no need to be concerned about the lack of library resources to support this proposed program.

Budget Recommendations

The Committee recommends the following budget for the MSIS for Middle School Mathematics Program. This information is on TABLE V.

TABLE V: Budget for Year 1 to Year 6

Request is for each of the 6 years unless otherwise stated

25% FTE for Program Coordinator [Reassignment – Source (Dept. of Mathematics Budget)]

5 Teaching Assistantships Stipends [Addition – Source (Dept. of Mathematics Budget)]

[Years 1-2] 10 Tuition Scholarships for Students
[Addition – Source (Dept. of Mathematics Budget)]

[Years 3-4] 15 Tuition Scholarships for Students
[Addition – Source (Dept. of Mathematics Budget)]

[Years 5-6] 20 Tuition Scholarships for Students
[Addition – Source (Dept. of Mathematics Budget)]

4 Work-study Students or Direct Wage Students @ Semester & Summer to help Program Coordinator and Faculty [Addition – Source (Dept. of Mathematics Budget]

Operating Budget& Travel [Addition- Source (Dept. of Mathematics Budget)]
- Office supplies for Program Coordinator
- Travel funds for Recruitment Purposes
- Travel funds for Faculty & Teaching Assistant's Research and Conferences
- Publications/Printing for Handbook and Pamphlets for Recruitment Purposes

Conclusion

After about two years of planning, the MSIS for Middle School Mathematics Developmental Planning Committee proudly submits this proposal for the creation of the Master of Science in Interdisciplinary Studies for Middle School Mathematics. The Committee looks ahead to the many positive results this program can produce knowing well that its success depends on having students enroll and succeed through this program. The Committee seeks the support of the UTPA Administration in committing funds for this program, and in assisting the Department of Mathematics with recruitment efforts that will help bring more students to a program greatly needed by this community.

** References cited in this issue can be made available upon request*