**Description of Assessment 2 Grade Point Averages in math courses required of all candidates**

## 1. Narrative

### 1a. Description of assessment.

Candidates' grade point averages of courses required of all candidates in the MAT program are being used for assessment 2. All of the candidates in our MAT program seek certification in Adolescence Education: Mathematics (grades 7 – 12).

It is important to note that until the Spring semester of 2013, when the new Program Coordinator assembled a 3-member MAT admissions committee (two members of the mathematics department and the Coordinator, herself), that an official protocol for admitting candidates to the MAT Program was established. This protocol includes establishing what undergraduate mathematics courses potential candidates have to take before being admitted to our program. The required prerequisite undergraduate courses are as follows: courses equivalent to our Calculus and Analytical Geometry 1, 2, and 3 (MA2310, MA2320, MA3330, respectively), Discrete Mathematics (MA3030), Linear Algebra (MA3160), and Introduction to Probability & Statistics (MA3210).

Twelve courses are *required* of all candidates in the MAT program: 6 graduate courses and the 6 prerequisite undergraduate courses identified by the MAT admissions committee. Since the 11 program completers reported here were admitted to the program before Spring of 2013, we do not have their individual grades for the 6 prerequisite undergraduate courses.

As stated in the School of Education Graduate Catalog (http://www.oldwestbury.edu/sites/default/files/documents/Graduate-Education-Catalog-2010-13.pdf), the SOE uses a 14 letter-grade system consisting of A, A-, B+, B, B-, C+, C, C-, F, CR (credit), NC (no credit), I (incomplete), W (withdrawal), and NR (not reported). All grades with the exception of CR, NC, I, W, and NR are calculated in candidates' respective GPAs. Grade points awarded for each grade can be found in section 2f. When a candidate repeats a course, if the new grade is higher, it replaces the old grade in the GPA computation. All grades, however, remain on the student's transcript. Grades for courses that were taken at another institution are accepted as transfer grades if and only if the college has found those courses to be equivalent to Old Westbury courses. Transfer grades are included in the GPA computation for this report.

Mathematics department policy dictates that grades of C- or lower earned in required courses do not satisfy degree requirements. For this reason, all program completers have earned at least a C in their required courses. For the candidates whose data is being used for this report, this means graduate courses only. In future reports this policy will include both the 6 graduate mathematics courses and the 6 prerequisite undergraduate mathematics courses.

### 1b. Alignment between the Assessment 2 and the NCTM CAEP 2012 Content Standards.

A course-by-course alignment between course alignment and the content standards was identified by a committee consisting of four faculty members: the mathematics department chair, two full-time mathematics professors, and the coordinator for the Adolescence Education: Mathematics Program, who is both a member of the School of Education and the mathematics department.  A table identifying the alignment can be found in Appendix A at the end of this document.

**1c.  Analysis of data findings.**

Grades were obtained from an examination of each candidate's transcript.  GPAs were computed separately using only those courses required of all candidates per SPA requirement.

Our first cohort of program completers graduated in Spring 2012.

**1d.  Interpretation of data.**

Course GPA and corresponding grade distribution are summarized in the tables found in section 2g.  Numerically speaking, the ranges of course GPAs show an increase from the 2011 – 2012 program completers (Group 1; 2.7 to 3.85) to the 2012 – 2013 program completers (Group 2; 3.42 to 4.0) and then a decrease for the 2013 – 2014 program completers (Group 3: 2.57 – 3.67).  With the exception of MA6100 (Probability and Statistics) for which the course GPA dropped (3.5 to 3.42 to 3.07), all required courses reflect the same increase then decrease pattern for the three groups of program completers.  The averages GPA of candidates in the three years of data being reported are all above 3.0.

The small numbers of program completers (i.e., 2, 6, and 3 respectively) make interpretation of the data difficult.

## 2. Assessment Documentation

### 2e. Assessment tool.

Grade point averages of mathematics courses required to earn an MAT degree. Grades are obtained from an examination of each candidate's transcript(s).

Courses taken by candidates as part of the MAT program:

- MA6100 – Probability & Statistics
- MA6150 – Geometry
- MA6200 – Algebra
- MA6250 – Analysis
- MA6400 – Topics in Adv. Mathematics and Technology
- MA7500 – Topics in Mathematics and Mathematics Education

Courses equivalent to the following undergraduate mathematics courses taken before being admitted to the MAT program:

- MA2310 – Calculus & Analytic Geometry 1
- MA2320 – Calculus & Analytic Geometry 2
- MA3030 – Discrete Mathematics
- MA3160 – Linear Algebra
- MA3210 – Introduction to Probability & Statistics
- MA3330 – Calculus & Analytic Geometry 3

### f. Scoring guide.

Each semester grade is determined by the corresponding professor as described by the course syllabus. Grade point awards are determined by the college and are as follows:

| | | | |
|---|---|---|---|
| | B+ = 3.5 | C+ = 2.5 | |
| A = 4.0 | B = 3.0 | C = 2 | F = 0 |
| A- = 3.7 | B- = 2.7 | C- = 1.7 | |

**2g. Candidate data derived from Assessment 2.**

Table 1. Mean scores by course over 3 years

**Grades * in Required in Mathematics and/or Mathematics Education Courses**
**Adolescence Education: Mathematics 7-12**
**MAT Program Completers**

*A = 4.0, A- = 3.7, B+ = 3.5, B = 3.0, B- = 2.7, C+ = 2.5, C = 2.0, C- = 1.7, F = 0

| **Course Number and Name** | **2011-2012** | | | **2012-2013** | | | **2013-2014** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Mean Course Grade* and (Range)** | **Number of Completers** | **% of Completers Meeting Minimum Expectation** | **Mean Course Grade* and (Range)** | **Number of Completers** | **% of Completers Meeting Minimum Expectation** | **Mean Course Grade* and (Range)** | **Number of Completers** | **% of Completers Meeting Minimum Expectation** |
| MA6100 Probability & Statistics | 3.5 (3.5 – 3.5) | [redacted] | 100 | 3.42 (3.0 – 4.0) | [redacted] | 100 | 3.07 (2.7 – 3.5) | [redacted] | 100 |
| MA6150 Geometry | 3.85 (3.7 – 4.0) | [redacted] | 100 | 3.95 (3.7 – 4.0) | [redacted] | 100 | 3.67 (3.0 – 4.0) | [redacted] | 100 |
| MA6200 Algebra | 2.7 (2.7 – 2.7) | [redacted] | 100 | 3.73 (3.0 – 4.0) | [redacted] | 100 | 2.57 (2.0 – 3.0) | [redacted] | 100 |
| MA6250 Analysis | 2.85 (2.7 – 3.0) | [redacted] | 100 | 3.61 (3.0 – 4.0) | [redacted] | 100 | 3.57 (3.0 – 4.0) | [redacted] | 100 |
| MA6400 Topics in Adv. Math and Technology | 3.0 (3.0 – 3.0) | [redacted] | 100 | 3.75 (3.0 – 4.0) | [redacted] | 100 | 3.5 (3.0 – 4.0) | [redacted] | 100 |
| MA7500 Topics in Mathematics and Mathematics Education | 2.75 (2.5 – 3.0) | [redacted] | 100 | 4.0 (4.0 – 4.0) | [redacted] | 100 | 3.23 (2.0 – 4.0) | [redacted] | 100 |

Table 2. Mean GPA by academic year

| Mean GPA * in Required in Mathematics and/or Mathematics Education Courses<br>Adolescence Education: Mathematics 7-12<br>MAT Program Completers<br>*A = 4.0, A- = 3.7, B+ = 3.3, B = 3.0, B- = 2.7, C+ = 2.3, C = 2.0, C- = 1.7, F = 0 | | | |
|---|---|---|---|
| **Academic Year** | **Mean GPA* and (Range)** | **Number of Completers** | **% of Completers Meeting Minimum Expectation** |
| 2011 - 2012 | 3.11 (3.02 – 3.20) | [redacted] | 100 |
| 2012 – 2013 | 3.80 (3.5 – 4.0) | [redacted] | 100 |
| 2013 – 2014 | 3.27 (3.02 – 3.7) | [redacted] | 100 |

# Appendix A

## Course Alignments

| NCTM Standard Elements Addressed by Course(s) | Course Number and Name | Course Components Addressing Cited Standard Elements |
|---|---|---|
| **1a)** Demonstrate and apply knowledge of major mathematics concepts, algorithms, procedures, applications in varied contexts, and connections within and among mathematical domains (Number, Algebra, Geometry, Trigonometry, Statistics, Probability, Calculus, and Discrete Mathematics) as outlined in the *NCTM NCATE Mathematics Content for Secondary*. | MA2310 – Calculus and Analytical Geometry1<br>MA2320 – Calculus and Analytical Geometry 2<br>MA3160 – Linear Algebra<br>MA3030 – Discrete Math<br>MA3330 – Calculus and Analytical Geometry 3<br>MA3210 – Introduction to Probability & Statistics<br>MA6100 – Probability & Statistics<br>MA6150 – Geometry<br>MA6200 – Algebra<br>MA6250 – Analysis<br>MA6400 – Topics in Adv. Mathematics and Technology<br>MA7500 – Topics in Mathematics and Mathematics Education | **Refer to NCTM CAEP Mathematics Content for Secondary Alignment Table attached to the program report.** |

| | | |
|---|---|---|
| **2a)** Use problem solving to develop conceptual understanding, make sense of a wide variety of problems and persevere in solving them, apply and adapt a variety of strategies in solving problems confronted within the field of mathematics and other contexts, and formulate and test conjectures in order to frame generalizations. | MA3030 – Discrete Math | Candidates are introduced to proof techniques (e.g., direct proof, proof by induction, proof by contrapositive, and proof by contradiction). Candidates are asked to apply these proof methods in the context of a number of contexts (e.g., number theory, sets) and as part of proposing and proving generalizations. Candidates are asked to solve problems related to real-world phenomena such as the use of graphs and trees in the study of scheduling problems and in transportation. |
| | MA3160 – Linear Algebra | Candidates are given multiple opportunities to solve problems and develop new problem solving strategies as they study two- and three-dimensional spaces in new contexts (e.g., matrices, systems of equation, determinants, vectors, and linear transformations). In this study they learn new learn representations (e.g., vectors as ordered pairs and vectors as matrices), and new procedures to solve problems. |
| | MA 6100 – Probability and Statistics | Candidates are asked to solve problems that are set in real-world and other contexts that require them to determine, for example, which distribution is required, and justify their choice of distribution. |
| | MA 6150 – Geometry | Use of software such as GeoGebra to may sometimes help a student test conjectures and formulate a proof<br><br>Candidates solve a wide variety of problems (i.e., homework exercises) in Euclidean geometry and this helps in understanding the concepts and techniques and theorems |
| | MA 6200 – Algebra | As part of this course, candidates “discover” properties of the number systems. They model these properties in numbers by creating abstract structures (rings and groups) that generalize properties. Candidates go on to prove that given abstract structures satisfy (or fail to satisfy) the list of properties (thus verifying that it is a group or ring). |

| | | |
|---|---|---|
| | MA 6250 – Analysis | In Calculus and Analytical Geometry 1 & 2 candidates learned a non-rigorous version of limits. In this course they learn what limits are rigorously and what the Real Numbers are rigorously. Candidates study the axioms that define the number systems. |
| | MA 6400 – Topics in Advanced Mathematics and Technology | Candidates solve problems (abstract and real world) for which the use of technological tools (e.g., Mathematica, Maple) play an important role in helping candidates to develop understandings of complex ideas. Using the tools candidates formulate and test conjectures on their way to solving problems. |
| **2b)** Reason abstractly, reflectively, and quantitatively with attention to units, constructing viable arguments and proofs, and critiquing the reasoning of others; represent and model generalizations using mathematics; recognize structure and express regularity in patterns of mathematical reasoning; use multiple representations to model and describe mathematics; and utilize appropriate mathematical vocabulary and symbols to communicate mathematical ideas to others. | MA3160 – Linear Algebra | Candidates study two- and three-dimensional spaces in new contexts (e.g., matrices, systems of equation, determinants, vectors, and linear transformations) and new mathematical objects. They learn the axiomatic definition of vector spaces, and thereby abstract certain properties of $R^n$; candidates develop their mathematical vocabulary to include terms such as subspace, basis, linearly independent; and candidates develop their understanding of these concepts when they determine whether a specified set of vectors forms a subspace, or basis, or is linearly independent, etc.<br>Using the new mathematical objects (e.g., matrices, vectors), candidates are given many opportunities to reason abstractly and quantitatively about 2- and 3-space. |
| | MA 6100 – Probability and Statistics | As part of their study of mathematical laws of random phenomena, expectation and variance, probability distributions, candidates examine fundamental properties of Probability and asked to prove them. |
| | MA 6150 – Geometry | Candidates learn multiple approaches to geometry - e.g. through an axiomatic way, or through a transformation-based way (Erlangen program).<br><br>Candidates construct proofs of geometrical propositions and in doing so learn to reason abstractly, represent and model generalizations using mathematics. |

| | | |
|---|---|---|
| | | Candidates are asked to share their proofs in class and provide feedback to their classmates. |
| | MA 6200 – Algebra | Candidates continue their study of abstract algebraic structures (e.g., groups, rings, Integral domains, and fields) at a more in-depth level. Working in these algebraic structures, candidates demonstrate their ability to reason abstractly and reflectively in a rigorous and formalized format by constructing rigorous proofs. Communication of their arguments/proofs is required to be written in correct logic and presented clearly and precisely. Candidates are often asked to share and provide feedback to their fellow classmates as proofs are shared and discussed in class. |
| | MA 6250 – Analysis | Candidates are introduced to rigorous real analysis in this course. Candidates are required to reason about abstract ideas and formulate proofs of properties/theorems and communicate their proofs precisely and clearly in writing. Candidates are encouraged to share and discuss their proofs in class. |
| **2c)** Formulate, represent, analyze, and interpret mathematical models derived from real-world contexts or mathematical problems. | MA2310 – Calculus and Analytical Geometry1 | Candidates are asked to use model real-world situations using functions (e.g., polynomial, trigonometric, exponential, and logarithmic) and use to the derivative to optimize the given situation. Candidates are also given functions and use the derivative to locate maximum/minimum points, zeroes, determine intervals of increase/decrease and intervals of positive/negative concavity. |
| | MA2320 – Calculus and Analytical Geometry 2 | Candidates are asked to use integrals to model real-world situations using functions (e.g., polynomial, trigonometric, exponential, and logarithmic) and to compute areas of regions and volumes of solids. Candidates use integration techniques to solve problems set in real-world contexts (e.g., finance, resource consumption, density). |
| | MA3330 – Calculus and Analytical Geometry 3 | As candidates in MA3330 learn the techniques of multivariable calculus, ideas are applied to physical phenomena such as trajectories through space and basic problems |

| | | |
|---|---|---|
| | | in physics. Candidates apply later techniques in vector fields to model problems in fluid flow and force fields. |
| | MA 6100 – Probability and Statistics | Applying probability models to real world situations is an emphasis of the course. Some models include, wait times (Poisson Distribution), life expectancy (Exponential Distribution), survey results (Binomial Distribution and Normal Distribution). |
| | MA 6150 – Geometry | Candidates study projective geometry, which is a mathematical model derived from the study of perspective in art, and Euclidean geometry, which is also derived from real word context. As part of this study they asked to solve problems in these geometries as part of proving propositions/properties. |
| | MA 6400 – Topics in Advanced Mathematics and Technology | The topics vary from semester to semester where there are two elements. One is a technological tool such as Maple or SAS. Candidates are asked to solve real-world/realistic problems who complexities require the use of technological tools to assist them in analysis, interpreting and/or representation. |
| **2d)** Organize mathematical thinking and use the language of mathematics to express ideas precisely, both orally and in writing to multiple audiences. | MA 6100 - Probability and Statistics | Candidates are required to solve problems and to formulate and write proofs of properties/theorems in the fields of probability and statistics. Candidates are required to express their ideas using the language of mathematics in their proofs and in class discussions of mathematical ideas being examined in the each lesson. |
| | MA 6150 – Geometry | Candidates are required to solve problems and to formulate and write proofs of properties/theorems in the different geometries they study in this course (e.g., projective, hyperbolic, Euclidean). Candidates are required to express their ideas using the language of mathematics in their proofs and in class discussions of mathematical ideas being examined in the each lesson. |
| | MA 6200 – Algebra | Candidates are required to solve problems and to formulate and write proofs of properties/theorems in the algebra. Candidates are required to express their ideas |

| | | |
|---|---|---|
| | | using the language of mathematics in their proofs and in class discussions of mathematical ideas being examined in the each lesson. |
| | MA 6250 – Analysis | Candidates are required to solve problems and to formulate and write proofs of properties/theorems in real analysis. Candidates are required to express their ideas using the language of mathematics in their proofs and in class discussions of mathematical ideas being examined in the each lesson. |
| | MA 6400 – Topics in Advanced Mathematics and Technology | Candidates are each required to do a project in this course in which he or she demonstrates a mathematical solution to a real-world problem using technology. Candidates' solutions to their problem are submitted in writing and shared with the class in a presentation. |
| | MA 7500 – Topics in Mathematics and Mathematics Education | Candidates are each required to do a project in this course on a topic taken from secondary mathematics. Candidates' write a paper on this topic and share their project with the class.. |
| **2e)** Demonstrate the interconnectedness of mathematical ideas and how they build on one another and recognize and apply mathematical connections among mathematical ideas and across various content areas and real-world contexts. | MA3030 – Discrete Math | Candidates are asked to draw upon their knowledge of school mathematics in conjunctions with understandings of ideas learned in their college courses (e.g., number theory, set theory, and calculus) to learn methods of proof and proving. |
| | MA3330 – Calculus and Analytical Geometry 3 | Candidates combine their existing knowledge in 2- and 3-diemsnional geometry and trigonometry with the notions of single-variable calculus to develop dot- and cross-products, as well as techniques in multiple integration and differentiation, cumulating with the combined analytic and geometric approach to vector fields and the fundamental theorems of multivariable calculus (Green's theorem and the divergence theorem). |
| | MA 6100 - Probability and Statistics | Candidates are given multiple opportunities to make connections between ideas of Probability and Statistics and other areas of mathematics in their proofs of properties they encounter in this course. They use their understandings of series from Analysis, for |

| | | |
|---|---|---|
| | | example, in their proofs of properties of the Poisson Distribution or properties of the geometric distribution. The binomial formula, which candidates typically see as an algebraic topic is examined from the standpoint of probability. |
| | MA 6150 – Geometry | Candidates are given multiple opportunities to make connections among the geometries they study in this course. For example, they examine inversive geometry is connected to complex numbers, and how that can be used to model hyperbolic geometry<br>Starting from basic axioms of geometry, candidates see how mathematical ideas build on one another. Candidates demonstrate the interconnectedness as they prove propositions that are new (to them). |
| | MA 6200 – Algebra | Candidates are given multiple opportunities to make connections between ideas of Algebra and other areas of mathematics in their proofs of properties they encounter in this course. For example, they examine the space of functions or polynomials, a topic from Analysis, and show the space to be a group or a ring. |
| | MA 6250 – Analysis | Candidates are given multiple opportunities to make connections between ideas of Analysis and other areas of mathematics in their proofs of properties they encounter in this course. The real numbers, for example, are defined and proven to be a field, a mathematical idea they study in Algebra. |
| | MA 6400 – Topics in Advanced Mathematics and Technology | Candidates are each required to do a project in this course in which he or she demonstrates a mathematical solution to a real-world problem using technology. As part of solving their selected problems, candidates have to make decisions about what field of mathematics and corresponding ideas/methods to use in their solution. |
| | MA 7500 – Topics in Mathematics and Mathematics Education) | As part of this course, candidates study historical development of mathematics. Using history as a lens, candidates examine interconnectedness of the many fields. |
| | MA 6200 – Algebra | Candidates are required to write proofs in this course. Candidates use the mathematical |

| | | |
|---|---|---|
| | | practices of problem solving and reasoning as they formulate their proofs, and the connecting and representing in their writing as they communicate their arguments. |
| | MA 6250 – Analysis | Candidates are required to write proofs in this course. Candidates use the mathematical practices of problem solving and reasoning as they formulate their proofs, and the connecting and representing in their writing as they communicate their arguments. |
| | MA 6400 – Topics in Advanced Mathematics and Technology | Candidates are each required to do a project for which the use of technological tools plays a major role in helping them solve a real-world problem. Candidates use the mathematical practices of problem solving and reasoning as they formulate use tools to formulate their respective solutions, and the practices of connecting and representing in their writing as they communicate their solutions. |
| **2f)** Model how the development of mathematical understanding within and among mathematical domains intersects with the mathematical practices of problem solving, reasoning, communicating, connecting, and representing. | MA3030 – Discrete Math | Candidates are asked to draw upon their knowledge of school mathematics in conjunctions with understandings of ideas learned in their college courses (e.g., number theory, set theory, and calculus) to learn methods of proof and proving. |
| | MA 6400 – Topics in Advanced Mathematics and Technology | Candidates are each required to do a project in this course in which he or she demonstrates a mathematical solution to a real-world problem using technology. As part of solving their selected problems, candidates have to make decisions about what field of mathematics and corresponding ideas/methods to use in their solution. Solving the problem candidates choose require mathematical reasoning, making connections to mathematics. Candidates present their project to the class. In preparing for the presentation candidates make decisions about how to communicate and represent their thinking and their solution process(es). |
| | MA 7500 – Topics in Mathematics and Mathematics Education | Candidates are each required to do a project in this course on a topic taken from secondary mathematics. Candidates' write a paper on this topic and share their project |

| | | |
|---|---|---|
| | | with the class. In preparing for the presentation candidates make decisions about how to communicate and represent their thinking and their solution process(es). |