

MATH 2256 - Introduction to Linear Algebra

Reporting Period

2016-2017

Course Description

Introduces low-dimensional linear algebra through eigenvalues and eigenvectors. Applications to linear systems, least-square problems, and the calculus, including elementary differential equations.

Program Outcomes/Goals

Work with mathematical structures

Demonstrate an understanding of and work with axiomatic mathematical structures.

Student Learning Outcomes

SLO1 Matrix/Vector arithmetic

Perform matrix and vector arithmetic.

Supported Initiatives

Standards 1 General Education 2 Institutional Priorities 3 Strategic Initiatives

Action Plans for Improvement

Action Plans for Improvement Description

Fall 2016/Spring 2017: Students coming out of Math 2256 demonstrate a very strong understanding of how to do computations with vectors and matrices since 95% of students answered the relevant question correctly on the post-test. Therefore my plan for Math 2256 is to continue as I have been doing with assigning homework, having students work problems in class, and giving exams over the material on matrix and vector arithmetic. In the future, one might try starting the course with matrix and vector arithmetic first, instead of with linear systems, so that students have more time to practice with matrix computations.

Due Date

Aug 14 2017

Status

Planned

Measures

M1 Pre-Test Post-Test Questions

Answer Question 1 on the Pre and Post-Test which deals with matrix arithmetic.

Question 1: Asks students to do a matrix computation involving matrix multiplication and matrix subtraction.

Methodology

Give students a pre-test during the first week of class, and give them the same post-test during the last week of class.

Source of Evidence: Pre/post test

Target

50% reduction in incorrect answers

Target	Findings	Improvements Achieved from Previous Action Plans	Improvement Type	Status
There will be a 50% reduction in incorrect answers on the relevant questions	There was a 95% reduction in incorrect answers on Question 1	The action plan for this course was to start doing regular assessments based on pre-tests and post-tests, to start creating action plans for improving Math 2256, and to start implementing those action plans in the future. Math 2256 is now assessed by a pre-test and a post-test aligned with the learning objectives, so the first part of the action plan has been successfully implemented. I have created an action plan for this learning objective and this will be used in improving the course in the future, so all parts of the action plan have been successfully completed.	Assessment: Assessment Method Revised	Met

Analysis of Finding and Evaluation Results

- A. 22 students took both the pre-test and post-test.
- B. On the pre-test, 4.55% of the 22 students got this question correct, and on the post-test, 95.45% of the 22 students got this question correct.
- C. On the pre-test, 95.45% of the students got this question incorrect, and on the post-test 4.55% of the students got this question incorrect.
- D. On the pre-test, an average score would have been a 5% while on the post-test an average would have been 95% on this question.
- E. Students improved greatly on this question, with a reduction by 95% in the number of incorrect answers, testing their ability to perform matrix and vector arithmetic. This assessment shows no weakness in this area.
- F. Students improved greatly on this question, with a reduction by 95% in the number of incorrect answers, testing their ability to perform matrix and vector arithmetic. This assessment shows that this area is one of the strong topics for students in Math 2256 with great gains in learning on this topic.

SLO1 Solve systems

Solve systems of linear equations using matrix methods.

Supported Initiatives

2 **Successes** 1 **General Education** 0 **Institutional Framework** 3 **Strategic Initiatives**

Action Plans for Improvement

Action Plans for Improvement Description

Fall 2016/Spring 2017: Students coming out of Math 2256 demonstrate a very strong understanding of how to solve linear systems of equations since 100% of students answered the relevant question correctly on the post-test. Therefore my plan for Math 2256 is to continue as I have been doing with assigning homework, having students work problems in class, and giving exams over the material on systems of equations. In the future, one might try introducing more applications of linear systems of equations in other fields as to give students more practice with systems.

Due Date
Aug 14 2017

Status
Planned

Measures

M1 Pre-Test Post-Test Questions

Answer Question 4 on the Pre and Post-Test which deals with solving a system of linear equations.

Question 4: Asks students to solve a system of linear equations and give the solution set as a set of vectors.

Methodology

Give students a pre-test during the first week of class, and give them the same post-test during the last week of class.

Source of Evidence: Pre/post test

Target

50% reduction in incorrect answers

Target	Percentage	Improvements Achieved from Previous Action Plans	How Often is Target Met	Status
There will be a 50% reduction in incorrect answers on the relevant questions	There was a 100% reduction in incorrect answers on Question 4	The action plan for this course was to start doing regular assessments based on pre-tests and post-tests, to start creating action plans for improving Math 2256, and to start implementing those action plans in the future. Math 2256 is now assessed by a pre-test and a post-test aligned with the learning objectives, so the first part of the action plan has been successfully implemented. I have created an action plan for this learning objective and this will be used in improving the course in the future, so all parts of the action plan have been successfully completed.	Assessment Method Revised	Met

Analysis of Finding and Evaluation Results

- A. 22 students took both the pre-test and post-test.
- B. On the pre-test, 22.73% of the 22 students got this question correct, and on the post-test, 100% of the 22 students got this question correct.
- C. On the pre-test, 77.27% of the students got this question incorrect, and on the post-test 0% of the students got this question incorrect.
- D. On the pre-test, an average score would have been a 22.73% while on the post-test an average would have been 100% on this question.
- E. Students improved greatly on this question, with a reduction by 100% in the number of incorrect answers, testing their ability to solve systems of linear equations. This assessment shows no weakness in this area, especially since all students answered this question correctly on the post-test.
- F. Students improved greatly on this question, with a reduction by 100% in the number of incorrect answers, testing their ability to solve systems of linear equations. This assessment shows that solving systems of linear equations is a topic is a strength for this course, with a good decrease in the number of incorrect answers and all students getting the question correct on the post-test. Of all the questions on the pre-test, this was the second highest number of correct answers, showing that students tend to come into the course with some knowledge on this subject, but do leave knowing it very strongly.

SLO3 Compute determinants

Compute determinants of matrices and apply determinants to situations involving invertibility of matrices, linear independence, and bases of vector spaces.

Supported Initiatives

Action Plans for Improvement

Action Plans for Improvement Description

Fall 2016/Spring 2017: Students coming out of Math 2256 demonstrate a good understanding of how to compute and apply determinants of matrices, since 100% of students answered Question 5 correctly on the post-test and 72% of students answered Question 6 correctly on the post-test. Since Question 6 was one of the weaker questions for students on the post-test, I might try spending more time on the ideas of linear independence, span, and bases in order to increase this percentage. One way to achieve this is to break this content into its own unit and give the students an exam on just this material.

Due Date

Aug 14 2017

Status

Planned

Measures

Pre-Test Post-Test Questions

Answer Question 5 and Question 6 on the Pre and Post-Test which deals with applying determinant calculations to the invertibility of a matrix and to a question about bases of a vector space.

Question 5: Asks students to compute the determinant of a given matrix and determine whether the matrix is invertible based on this.
 Question 6: Asks students to determine which set amongst given sets of vectors represents a basis of \mathbb{R}^2 , which can be done with determinant calculations.

Methodology

Give students a pre-test during the first week of class, and give them the same post-test during the last week of class.

Source of Evidence: Pre/post test

Target

50% reduction in incorrect answers

Target	Findings	Improvements Achieved from Previous Action Plans	Assessment Type	Status
There will be a 50% reduction in incorrect answers on the relevant questions.	There were decreases of 100% and 67% in incorrect answers on Questions 5 and 6	The action plan for this course was to start doing regular assessments based on pre-tests and post-tests, to start creating action plans for improving Math 2256, and to start implementing those action plans in the future. Math 2256 is now assessed by a pre-test and a post-test aligned with the learning objectives, so the first part of the action plan has been successfully implemented. I have created an action plan for this learning objective and this will be used in improving the course in the future, so all parts of the action plan have been successfully completed.	Assessment Method Revised	Met

Analysis of Finding and Evaluation Results

- A. 22 students took both the pre-test and post-test.
- B. On the pre-test, 18.18% of the students got Question 5 correct and 18.18% got Question 6 correct. On the post-test, 100% of students got Question 5 correct and 72.73% got Question 6 correct.
- C. On the pre-test, 81.82% of the students got Question 5 incorrect and 81.82% got Question 6 incorrect. On the post-test, 0% of students got Question 5 correct and 27.27% got Question 6 correct.
- D. On the pre-test, the average score would have been 18.18%, and on the post-test the average score would have been 86.37% between the two questions.
- E. Students improved significantly on both questions. The assessment shows that Question 6 was the weaker of the two questions, and this question asked students to determine which of given sets of vectors was a basis for a vector space. While Question 5, with 100% of student getting it correct on the post-test, showed that students can compute determinants by the end of the course, this question showed that students may have more issues with applying the information to other situations.
- F. The assessment showed that Question 5 was the stronger question for students, showing that by the end of the course all students knew how to compute a determinant and use that information to determine whether a given matrix was invertible or not. This was one of three questions on the post-test where all 22 students got the question correct.

Linear transformations

Use linear transformations between vector spaces and compute the matrix associated to a given transformation.

Supported Initiatives

Action Plans for Improvement

Action Plans for Improvement Description

Fall 2016/Spring 2017: Students coming out of Math 2256 demonstrate a good understanding of how to compute the matrix associated to a linear transformation since 77% of students answered the relevant question correctly on the post-test. In order to increase this percentage, one might try to reorder the material in the course so that linear transformations appear earlier. During the relevant semester, I covered linear transformations near the end of the

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Status

semester and had to rush through them in order to get to the very important topic of eigenvalues and eigenvectors. In the future, one might try covering transformations immediately after covering vector spaces and subspaces to allow for more time for the material to absorb. Planned

Measures

M1 Pre-Test and Post-Test Questions

Answer Question 2 on the Pre and Post-Test which deals with computing the matrix associated to a given linear transformation.

Question 2: Asks students to compute the matrix associated to a given linear transformation.

Methodology

Give students a pre-test during the first week of class, and give them the same post-test during the last week of class.

Source of Evidence: Pre/post test

Target

50% reduction in incorrect answers

Target	Findings	Improvements Achieved from Previous Action Plans	Improvement Type	Status
There will be a 50% reduction in incorrect answers on the relevant questions	There was a 74% reduction in incorrect answers on Question 2.	The action plan for this course was to start doing regular assessments based on pre-tests and post-tests, to start creating action plans for improving Math 2256, and to start implementing those action plans in the future. Math 2256 is now assessed by a pre-test and a post-test aligned with the learning objectives, so the first part of the action plan has been successfully implemented. I have created an action plan for this learning objective and this will be used in improving the course in the future, so all parts of the action plan have been successfully completed.	Assessment Method Revised	Met

Analysis of Finding and Evaluation Results

- A. 22 students took both the pre-test and post-test.
- B. On the pre-test, 13.64% of the 22 students got this question correct, and on the post-test, 77.27% of the 22 students got this question correct.
- C. On the pre-test, 86.36% of the students got this question incorrect, and on the post-test 22.73% of the students got this question incorrect.
- D. On the pre-test, an average score would have been a 13.64% while on the post-test an average would have been 77.27% on this question.
- E. Students improved significantly on this question, with a reduction by 74% in the number of incorrect answers, testing their ability to find a matrix corresponding to a given linear transformation. This assessment shows no significant weakness in this area, but with only 77.27 of students getting this question correct on the post-test, there is definitely room for improvement in this area.
- F. Students improved greatly on this question, with a reduction by 74% in the number of incorrect answers, showing that there is significant learning in topic of finding matrices associated to linear transformation.

M2.00 Eigenvalues and Eigenvectors

Compute the eigenvalues and eigenvectors of square matrices.

Supported Initiatives

2 Standards 1 General Education 0 Institutional Initiatives 3 Strategic Initiatives

Action Plans for Improvement

Action Plans for Improvement Description

Fall 2016/Spring 2017: Students coming out of Math 2256 demonstrate a very strong understanding of how to solve linear systems of equations since 100% of students answered the relevant question correctly on the post-test. Therefore my plan for Math 2256 is to continue as I have been doing with assigning homework, having students work problems in class, and giving exams over eigenvalues and eigenvectors. In the future, one might try spending more time on eigenvalues and eigenvectors, since this topic usually appears at the end of the course and often feels rushed. Allowing more time in the schedule for this topic would allow for more applications and more time for students to practice these problems.

Due Date
Aug 14 2017

Status
Planned

Measures

M1 Pre-Test and Post-Test Questions

Answer Question 3 on the Pre and Post-Tests which deals with computing the eigenvalues of a given matrix.

Question 3: Asks students to compute the eigenvalues of a square 3x3 matrix.

Methodology

Give students a pre-test during the first week of class, and give them the same post-test during the last week of class.

Source of Evidence: Pre/post test

Target

50% reduction in incorrect answers

Target	Findings	Suppose the Achievement Goal Previous Action Plan	Intake/Outcome Type	Status
There will be a 50% reduction in incorrect answers on the relevant questions	There was a 100% reduction in incorrect answers on Question 3	The action plan for this course was to start doing regular assessments based on pre-tests and post-tests, to start creating action plans for improving Math 2256, and to start implementing those action plans in the future. Math 2256 is now assessed by a pre-test and a post-test aligned with the learning objectives, so the first part of the action plan has been successfully implemented. I have created an action plan for this learning objective and this will be used in improving the course in the future, so all parts of the action plan have been successfully completed.	Assessment: Assessment Method Revised	Met

Analysis of Finding and Evaluation Results

A. 22 students took both the pre-test and post-test.
 B. On the pre-test, 22.73% of the 22 students got this question correct, and on the post-test, 100% of the 22 students got this question correct.
 C. On the pre-test, 77.27% of the students got this question incorrect, and on the post-test 0% of the students got this question incorrect.
 D. On the pre-test, an average score would have been a 22.73% while on the post-test an average would have been 100% on this question.
 E. Students Improved greatly on this question, with a reduction by 100% in the number of incorrect answers, testing their ability to compute eigenvalues. This assessment shows no weakness in this area, especially since all students answered this question correctly on the post-test.
 F. Students Improved greatly on this question, with a reduction by 100% in the number of incorrect answers, testing their ability to compute the eigenvalues of a matrix. This assessment shows that the topic of eigenvalues for this course is a strong topic, with all students getting the question correct on the post-test.

Related Projects

There are no related projects to this project.

Project Collaborators











Project Attachments

SyllabusMath2256Fall2016.docx

Exam1Math2256Fall2016.pdf

Exam2Math2256Fall2016.pdf

FinalExamMath2256Fall2016.pdf

Exam3Math2256Fall2016.pdf

Math2256PrePostTest.pdf

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