

**Program Outcome Assessment Summary Report  
2015/2016 Academic Year**

Department of Computer Science  
Eastern Washington University

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## **1. Summary of Actions Taken in Response to AY14/15 Assessment**

The following actions were made as a result of AY 14/15 assessments

1. Updates to the Outcome Related Learning Objectives (ORLOs) for CSCD 210 and 211 for topics moved between 210 and 211 were completed.
2. Assessment Committee examined Program Outcome a.i – Use of planning tools such as flowcharts and pseudo-code in CSCD 110. An assignment related to this learning objective was created so that a.i is now assessable and quantifiable.
3. Ethics topics were incorporated into CSCD 110, 210, and 211 upon recommendations of the Assessment Committee and the updated ORLO for 110 was applied in Spring 2016. Assessment of ethics topics in 210 and 211 were delayed until Fall of 2016 and will appear in the AY 16/17 report.
4. The recommendation of conducting ORLO assessment by each instructor for the same course taught within a given year, was implemented this year.
5. Instructors reviewed the ABET standard course description ensuring that the topics were up to date and matched the course ORLOs.
6. Topics in CSCD 211 were reviewed and were adjusted to more closely align with topics in CSCD 327 and CSCD 349.

## 2. Summary of Program Outcome Assessment in AY15/16

The following summarizes the assessments of Program Outcomes applied during the 2015/2016 academic year.

Program Outcome	Assessed Via
a) Students will have the ability to use current techniques, skills, and tools necessary for computing practice.	Advancement Programming Exam (APE), CSCD 110, CSCD 210, CSCD 211, CSCD 240, CSCD 300, CSCD 320, CSCD 327, CSCD 330, CSCD 340, CSCD 349, CSCD 350, CSCD 371, CSCD 372, CSCD 378, CSCD 379, Senior Capstone Technical Rubric
b) Students will recognize the need for, and will have the ability to engage in, continuing professional development.	CSCD 340, Senior Capstone Oral Communication Rubric
c) Students will have the ability to analyze the local and global impact of computing on individuals, organizations, and society.	CSCD 340, CSCD 350
d) Students will have the ability to communicate effectively with a range of audiences.	Senior Capstone Oral Communication Rubric
e) Students will have an understanding of professional, ethical, legal, security, and social issues and responsibilities.	CSCD 110, CSCD 210, CSCD 211, CSCD 350
f) Students will have the ability to function effectively on teams to accomplish a common goal.	Senior Capstone Teamwork Rubric
g) Students will have the ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.	APE, CSCD 210, CSCD 211, CSCD 260, CSCD 300, CSCD 320, CSCD 327, CSCD 330, CSCD 340, CSCD 349, CSCD 350, CSCD 371, CSCD 372, CSCD 378, CSCD 379, Senior Capstone Technical Rubric
h) Students will have the ability to analyze a problem and identify and define the computing requirements appropriate to its solution.	APE, CSCD 210, CSCD 211, CSCD 260, CSCD 300, CSCD 320, CSCD 350, Senior Capstone Technical Rubric
i) Students will have the ability to apply knowledge of computing and mathematics appropriate to the discipline.	APE, CSCD 110, CSCD 210, CSCD 211, CSCD 240, CSCD 260, CSCD 300, CSCD 320, CSCD 330, CSCD 349, Senior Capstone Technical Rubric

Program Outcome	Assessed Via
j) Students will have the ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.	CSCD 300, CSCD 320, Senior Capstone Technical Rubric
k) Students will have the ability to apply design and development principles in the construction of software systems of varying complexity.	CSCD 349, CSCD 350, CSCD 371, CSCD 372, CSCD 378, CSCD 379, Senior Capstone Technical Rubric

The following table summarizes assessment findings from each of the major assessment methods that were used in AY15/16. The ORLO category only lists courses where concerns were found. See Section 5 for a summary of the ORLO report findings from each course.

Assessment Instrument	Result of Assessment
APE Exam	APE should be standardized into a test bank of questions with unit tests to make grading easier. Also, change the format so the test is given at the end of 210 and 211 as part of the course final. This will reduce the need for all faculty to grade the APE during the year and should result in more consistency for the students. Regular APE tests will still be given for transfer students. It is noted in the APE scores that there was a simultaneous decrease in scores for both Linked Lists and Recursion.
CSCD 110 ORLO	Concern that tools used to measure student knowledge of Boolean logic and arithmetical order of operations did not truly measure the students' understanding. In the future, other assessments should be used to show this.
CSCD 327 ORLO	Instructor has concern with student outcome, g. i i - integrate a relational database into Java. Students had difficulty with Java in one assignment in particular, shown by a lower than expected pass rate. Recommended that instructor provide more Java examples for students.

CSCD 260 ORLO	Although CASH-IEE portion of Objective g.ii - Students will be able to describe CPU internals and the memory hierarchy, is marginally met, the class average should be better. Future course offerings will give more examples and provide in-class exercises to make students go through actual calculations.
CSCD 372 ORLO	Recommendation made that ORLOs, originally written to apply generically to all Graphical User Interface (GUI) courses (C#, Java GUI, Android, iOS) be tailored to specifically address some unique features of Android. ORLO proposals are expected Spring quarter 2016. Also, recommendation made that we consider requesting assessment data for Discrete Math from the Math Department, or look into re-creating our own Discrete Structures and require Linear Algebra instead of Discrete Math.
Senior Capstone Oral Presentation Rubric	No concerns.
Senior Capstone Teamwork Rubric	No concerns.
Senior Capstone Technical Performance Rubric	No concerns.
Masters Oral Presentation Rubric	No concerns.

2.1. Assessment Recommendations

The following recommendations are made as a result of AY 15/16 assessments.

1. The APE should be standardized into a test bank of questions with unit tests to make grading easier. Also, that the APE format change so the test is given at the end of CSCD 210 and 211 as part of the course final, with a target implementation for Fall 2016. Regular APE tests will still be given for transfer students. It is recommended that assessment committee meet with the instructors of CSCD 210 and 211 to determine whether those instructors can offer possible causes for a simultaneous drop in linked list and recursion scores on the APE, and whether anything should be done in response.
2. Another form of assessment be used in CSCD 110 to demonstrate the students' understanding of Boolean logic and arithmetic order of operations.
3. Hold a meeting with all CSCD 211, 349, and 350 instructors to examine how packages are being covered in 211 and whether it is sufficient for the needs of 349 and 350. Also whether some added experience with packages in 349 is feasible.
4. Recommend that we query Math department for assessment data from Discrete Math, especially with regards to coverage of rotation matrices, which is not a standard topic in

discrete math texts. Also ask how they would feel about us offering a Discrete Structures course to replace our requirement for Discrete Math.

### 3. Advancement Programming Exam Scores

APE scores support Program Outcomes (a), (g), (h), and (i). APE exams were administered during each quarter of the academic year plus Summer 2016. An 80% is required to pass the exam. Exam section topics are:

- (1) Linked List Manipulation 20%
- (2) Recursion 20%
- (3) Data Abstraction and Class Design 30%
- (4) General Programming 30%

Summary data for AY 15/16 and the preceding two years:

	Previous Year	Last Year	This Year
Number of Exams Taken	166	201	137
Overall Average Score	81.4%	72.7%	74.5%
Overall Pass Rate	68.2%	52.2%	60.4%
Failures on 3+ Attempt	4.0%	4.0%	4.0%

AY15/16, AY14/15 and AY13/14 APE Scores

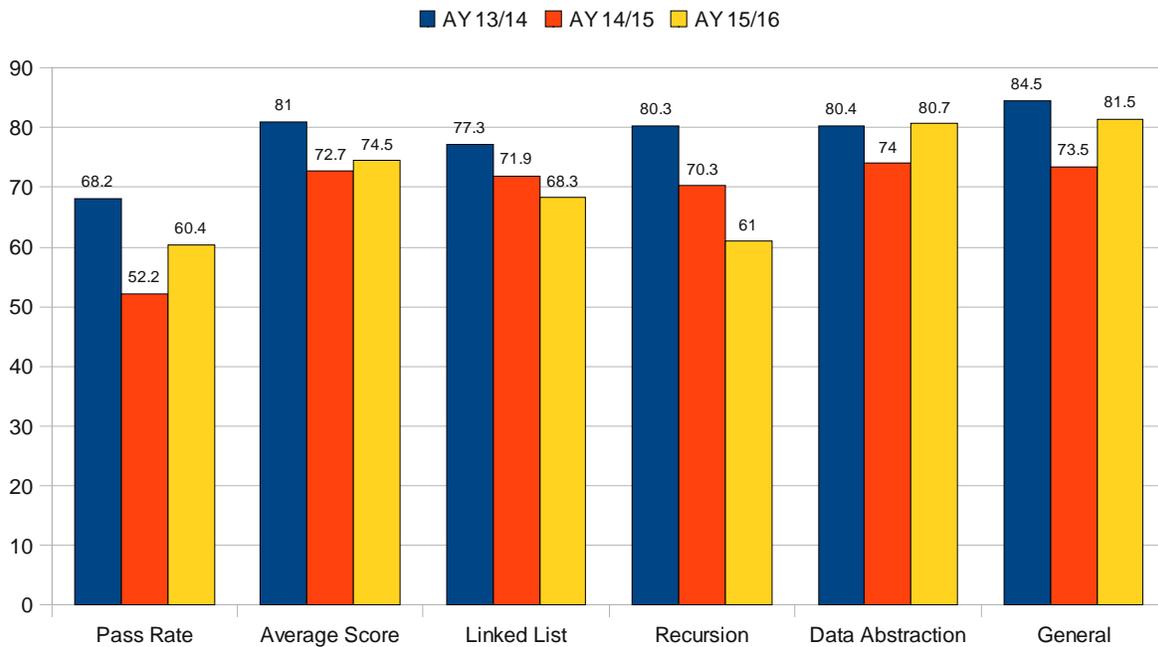


Fig 3.1 APE test scores along with pass rates for this year and the previous two years.

The average overall exam score for AY 15/16 was 74.5%, which was higher than last year but lower than the previous year. The overall pass rate was right in the middle of the pass rate for the three years. The proportion representing failures on a third attempt was about 4% which is the same as the other years.

In past years we have observed tradeoffs between the scores on Linked Lists and Recursion, such that one would increase when the other decreased and vice-versa. In 15/16 we see a simultaneous decrease in both scores that seems worthy of further investigation. It is recommended that assessment committee meet with the instructors of CSCD 210 and 211 to determine whether those instructors can offer possible causes, and whether anything should be done in response.

#### **4. Senior Capstone Rubric Scores**

Oral Communication rubrics were applied to senior capstone teams during Winter, Spring, and Summer, in CSCD 490.

Teamwork and Technical Performance rubrics were applied to the work of CSCD 490 senior capstone teams during Winter and Summer.

These assessments are tied to Program Outcomes as follows:

Oral Communication Rubric Scores: (b), (d)

Teamwork Rubric Scores : (f)

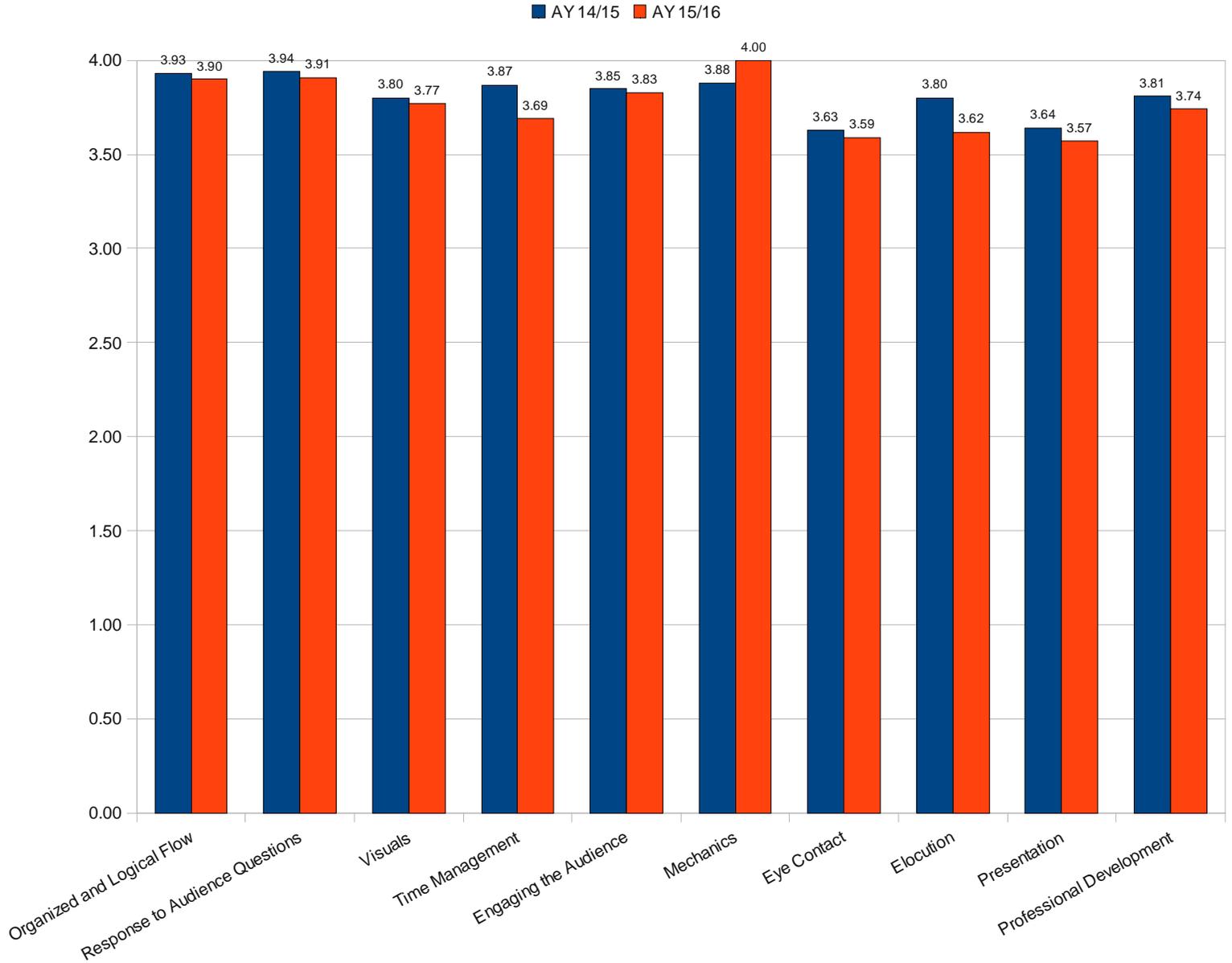
Technical Rubric Scores: (g), (h), (i), (j), (k)

##### **4.1. Oral Communication**

Fig 4.1 shows the average scores for presentations from the Winter, Spring, and Summer offerings of CSCD 490. The Professional Development Awareness score relates to Program Outcome (d), and the other scores relate to Program Outcome (b).

Please refer to Figure 4.1 on the next page.

# Capstone Oral Communications

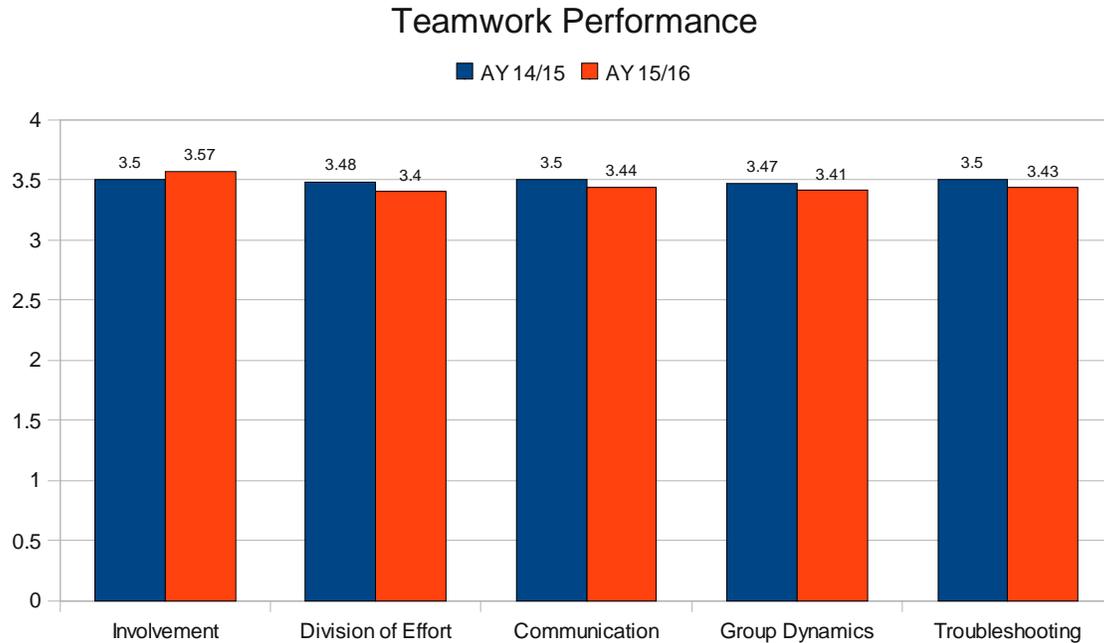


**Fig. 4.1 – Project Oral Communication Rubric Scores**

The scores indicate that students' are performing well against these learning objectives. No action based on Oral Communication data is recommended.

## 4.2. Teamwork

Fig 4.2 shows the average scores for the teamwork performance of 9 senior capstone teams from the Winter and Spring offerings of CSCD 490. These scores relate to Program Outcome (f).



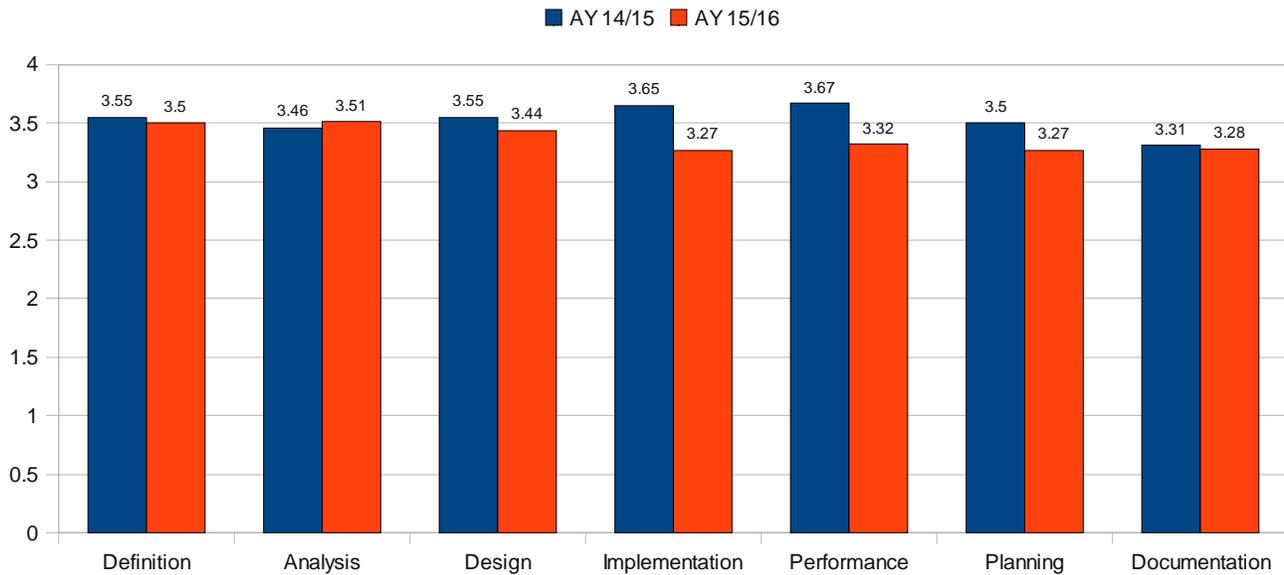
**Fig. 4.2 – Project Teamwork Rubric Scores**

The scores indicate that students' are performing well against these learning objectives. No specific action based on Team performance data is recommended. Scores are similar between the two years.

## 4.3. Technical Performance

Fig 4.3 shows the average scores for the technical performance of 7 senior capstone teams from the Winter and Spring offerings of CSCD 490. These scores relate to Program Outcomes (g), (h), (i), (j), (k).

## Capstone Technical Performance



**Fig. 4.3 – Project Technical Performance Rubric Scores**

The scores indicate that students are performing well against these learning objectives. There is a slight lowering of scores between the two years but not significantly lower. No specific action based on team performance data is recommended.

## 5. Course-specific Outcome-related Learning Objectives

Course-specific assessments were conducted for the following courses. Here we summarize the findings for each course.

Course	Term	Outcomes	Result of Assessment
CSCD 110	Winter 16	(a),(e),(i)	Objectives met.  However, concern that the tools used to measure student knowledge of Boolean logic and arithmetical order of operations did not truly measure the students understanding. In the future, other assessments should be used to show this.
CSCD 210	Spring 15	(a),(e),(g),(h),(i)	Objectives met.
CSCD 211	Spring 15	(a),(e),(g),(h),(i)	Objectives met.
CSCD 240	Spring 16	(a),(i)	Objectives met.
CSCD 260	Spring 16	(g),(h),(i)	Although CASH-IEE portion of Objective (ii) is marginally met, the class average should be better. Future course offering will give more examples and provide in-class exercise to make students go through actual calculations.
CSCD 300	Fall 15	(a),(g),(h),(i),(j)	Objectives met.
CSCD 320	Fall 15	(a),(g),(h),(i),(j)	Objectives met.

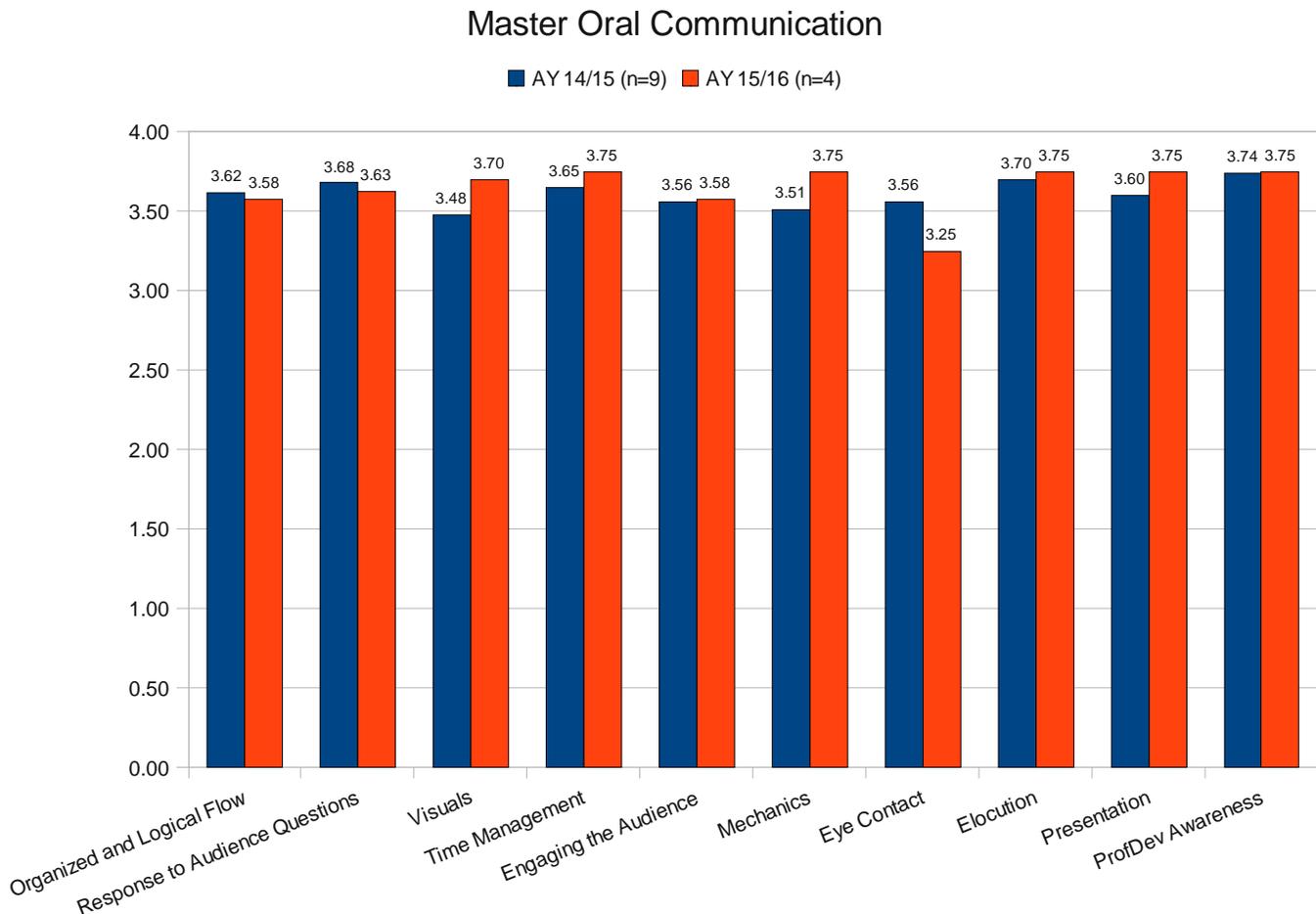
CSCD 327	Fall 15	(a),(g)	<p>Objectives met.</p> <p>Yet for Outcome (g), some students still demonstrated inadequate Java programming experience. Some students could solve the SQL queries but couldn't figure out how to use the related Java objects to implement them. Reasons for this: First, some students took this course with prerequisite of CSCD 255 (instead of CSCD 211) thus making it difficult to learn Java during the course. Second, the assignment was given during Thanksgiving weekend, and some students complained (in the course evaluation) that they didn't have enough time to work on it. Future plan is to give students additional time to work on the assignment, and provide a complete Java example to show how to connect to and use databases in Java. If students still demonstrate inadequate background in Java, will consider removal of CSCD 255 from prerequisite. More examples will be provided to improve this area.</p>
CSCD 330	Winter and Spring 16	(a),(g),(i)	Objectives met.
CSCD 340	Winter 15	(a),(b),(c),(g)	Objectives met.
CSCD 349	Fall 15	(a),(g),(i),(k)	<p>a.i Objective not met, g.ii Objective not met</p> <p>Not all objectives were met, but there was a clear pattern of improvement from the start to the end of the quarter.</p> <p>The class started out very weak. Tasks 1, 2, and 3 each had to be done twice before the class got a decent overall grade. Earlier courses need to push the students harder instead of babying them.</p> <p>Combining multiple design patterns into single tasks is problematic because it adds to the complexity and makes it difficult for students to separate the parts. Students are supposed to be developing these skills, but for many, having to address multiple aspects at the same time is overwhelming. While a separate task for each design pattern could be given, logistically, this approach is not an option with 23 patterns, plus supporting material. Unless each is of trivial rigor, there is no way for students to be exposed to all of them in a quarter system.</p>

CSCD 349	Spring 16	(a),(g),(i),(k)	Objectives met.
CSCD 350	Winter 16	(a),(c),(e),(g), (h),(k)	Objectives met.
CSCD 350	Spring 16	(a),(c),(e),(g), (h),(k)	Objectives met. However, some thoughts below. My approach to this class has always been to introduce fundamental mechanics (unit testing, versioning, iteration planning, software installer, reporting weekly time) using tools commonly found in industry. Students get a fundamental set of requirements for a project, and then they discover as a team how to best solve the project in the requirements framework I set before them. A rigid framework is not provided whereby students must design against. If taught again, focus on working within an established framework so that students learn to critically think about the existing framework and ask important questions so they build the software to specifications and with an understanding of the consequences of the choices they made.
CSCD 370, 371, 372, 373	Fall 2015	(a),(g),(k)	CSCD 372 – Android Objectives met. Recommendation made that ORLOs, originally written to apply generically to all GUI courses (C#, Java GUI, Android, iOS) be tailored to specifically address some important features of Android that are unique to Android. Proposal for that ORLO is expected sometime Spring quarter 2016.  Also, recommendation made that we look into obtaining assessment data from Math 301 and the possibility of replacing it with a CSCD Discrete Structures course.
CSCD 378, 379	ORLO Created Spring 15	(a),(g),(k)	ORLO written during AY 14/15 and will be applied during AY 15/16.
CSCD 490	Spring 15	(a),(b),(d),(f), (g),(h),(i),(j),(k)	Please see Section 4

## 6. Masters Oral Communication Rubric Scores

The Oral Communication rubric was also applied at the defense of Master's degree candidates during AY 15/16. The rubric was applied by audience members present at the oral defense. The results are summarized in Fig. 6.1.

**Fig. 6.1 – Master's degree Oral Communication Rubric Scores**

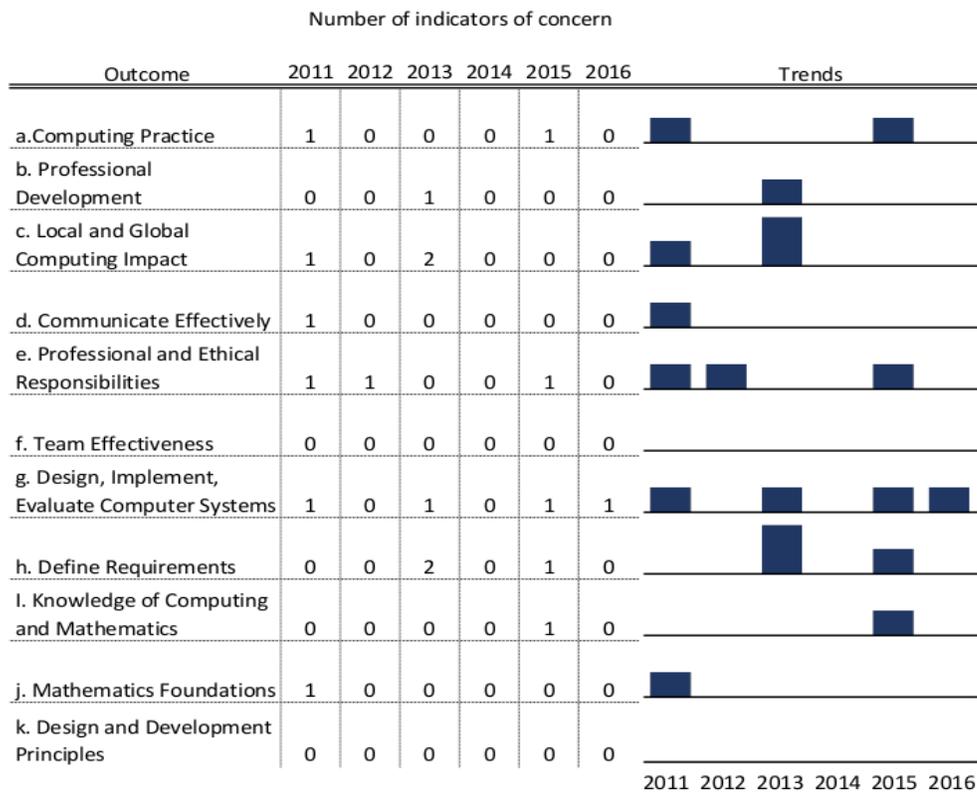


The scores were mostly higher than the previous year. Because of our research methods class, we believe our Master's students are well prepared for their thesis defenses.

## 7. Longitudinal Analysis of Student Learning Outcomes

### 7.1 Creation of Longitudinal Graphic

In this section, we have created a way to perform longitudinal tracking of data related to the student learning outcomes by creating a graph that shows each student outcome and the associated course related concerns over several years. Consequently, it will be easy to track the outcome over a relatively longer time frame than is captured in the annual assessment report. The graph was created by compiling results of the ORLO report for each course. These reports capture whether the course expectations for student learning outcomes were met for the year. Instructors that teach these courses are responsible for identifying and documenting concerns with learning outcomes in each course ORLO report. The longitudinal graphic below displays Student Learning Outcome data for the past six years, 2011 – 2016.



**Figure 7.1 Longitudinal Trend Data – Student Learning Outcomes  
2011 – 2016**

## 7.2 Longitudinal Explanation of Student Learning Outcomes

Each student learning outcome is displayed along its own trend line with the number of concerns per year also shown. For outcomes that have no course related concerns for a given year, the value is zero. A histogram visually displays the outcomes showing concerns for a given year and displays nothing for zero concerns. Student outcomes with persistent concerns for the past six years are explained below as to why the concern exists along with proposed solutions.

This graphic and trend data for each student outcome is updated yearly from the course specific ORLO reports.

### **Student Learning Outcome a. - Current techniques, skills and tools for computing practices**

This learning outcome had a concern in 2011 from the data structures course regarding an assignment that was not met. This was solved by moving the assessment to a more appropriate class, Algorithms. Another concern was noted in 2015 because of transfer of topics between our lower level Java courses. A rewrite of the ORLOs for these courses solved the concern.

### **Student Learning Outcome b. - Professional development**

For this learning objective, there were no concerns as expressed in the annual ORLO reports for courses mapped to this learning outcome. This can easily be seen from the Longitudinal graph.

### **Student Learning Outcome c. - Local and global impact of computing on individuals and society**

This outcome was mapped to the Ethics course, PHIL 212 and was a concern in 2011 because of the difficulty in extracting the assessment data needed from the generic ethics essays. The next year, 2012, this learning outcome was not assessed due to the unavailability of data from PHIL 212 shown by a negative data point on the graph. Assessment of this student outcome was incorporated into CSCD 350 and CSCD 340 as a solution. The next year, 2013, showed that both instructors from CSCD 340 and CSCD 350 felt that objectives were weakly met.

### **Student Learning Objective d. - Communicate effectively**

This objective was covered in 2011 by the PHIL 212 Ethics essay. and the Senior Capstone Oral communication rubric. In 2011, the problems of obtaining good data from the Ethics essay resulted in a concern with this learning objective. The recommendation that we try to obtain good assessment data from PHIL 212 did not result in better data. Thus, for this particular learning outcome, it was considered sufficient to assess it through the Senior Capstone Oral communication rubric.

### **Student Learning Objective e. - Professional, legal, ethics and security issues and responsibilities**

This learning objective was affected in 2011 and 2012 by the assessment concern from PHIL 212 as previously noted. Ethics content and assessment was added to several CS courses to ensure that ethics assessment data was obtained. In 2015, CSCD 210 - Ethics was not assessed. In 2016, CSCD 210 and 211 were assessed with regard to ethics. It appeared to the faculty that assessment of ethics within the programming courses were not consistently done. Thus, the

solution to the inconsistency in assessing ethics is to once again teach ethics within our curriculum. See the narrative under our response to Weakness 2. - Ethics.

**Student Learning Objective f. - Function as teams**

As displayed by the Longitudinal Graph, for the years 2011 to 2016 there are no concerns for this learning objective.

**Student Learning Objective g. - Design, implement and evaluate a computer-based system, process or program**

In 2011, Data Structures had a concern about binary trees. This was solved the same as before; move assessment to the Algorithms course. In 2013, Operating Systems assessed this as weak due to students' problems with number systems conversions. The recommendation was to add bitwise operations and number system conversions to an earlier course. In 2015, the database course had a concern that students were not adequately prepared in Java programming. The solution was to offer more Java assignments within the database course. This was still a concern in 2016.

**Student Learning Outcome h. - Analyze and define requirements**

In 2013, two concerns were noted from instructors of CSCD 240 and CSCD 350. In CSCD 240 there was a problem with adequacy of an assignment and a recommendation to consolidate h into learning objective i. The CSCD 350 instructor expressed concern that students had a general lack of software design ability and proposed that our Design Patterns course currently taught at a senior level be renumbered as CSCD 349, a junior level course, and be required as a prerequisite to CSCD 350. In 2015, a concern was noted in CSCD 210 and suggestion made that Student Outcome i. be combined in one outcome under h. This was accomplished.

**Student Learning Outcome i – Knowledge of computing and mathematics**

From 2011 – 2014, there were no concerns. In 2015, the changes noted in g. for CSCD 210 also affected Student Learning Outcome i as several outcomes originally in i were consolidated under h. In 2016, there were no concerns for this learning objective.

**Student Learning Objective j. - Mathematics foundations.**

In 2011, the CSCD 300 binary tree problem noted previously also affected this learning objective. The same solution, not assessing binary trees in CSCD 300, is also applicable to this learning outcome. For years 2012 – 2016 no concerns were noted.

**Student Learning Objective k. - Design and development principles**

For all the years 2011 – 2016 and the courses mapped to this learning outcome, there were no concerns as can be seen from the Longitudinal graph.