Comparing College Mathematics Courses with and without ALEKS

Tatjana Hrubik-Vulanovic
thrubik@kent.edu
Graduate School of Education, Health, and Human Services
Kent State University
Kent, Ohio
USA

Abstract
A growing number of college students are required to take developmental mathematics courses. Different backgrounds and levels of students' prior knowledge suggest that an individualized instructional approach may be the most effective in these courses. Such an approach is taken in the artificial intelligence-based online system ALEKS (Assessment and Learning in Knowledge Spaces). A large Midwestern university incorporated ALEKS in remedial mathematics courses. In the first semester of ALEKS implementation some remedial mathematics sections used ALEKS while some used the traditional lecture-based approach. This study compares the two methods regarding student achievement. The participants are students from two ALEKS and two corresponding lecture-based sections. The results show that, although student scores are higher in ALEKS, the difference is not statistically significant. Some insights into ALEKS implementation are given and possible changes in the delivery are proposed.

1. Introduction

Better jobs and better wages are typically linked to higher education. According to the U.S. Department of Education "Financial Report for 2010" [9] workers with college degrees earned 81% more than workers with high-school diplomas. Unemployment rate among college graduates was 4.4%, while it was 10% for high-school graduates and 15.4% for workers with no high-school diplomas. These are some of the reasons for the continuous increase in college enrolment. According to the U.S. Department of Education "Digest of Education Statistics: 2010" (see Table 8 of the digest) [10], the percentage of persons with college degrees rose from 25.6% in 2000 to 29.9% in 2010. The college enrolment in 2010 was 20.6 million with 40% non-traditional students (students 25 years of age or older).

The growing number of students is desirable because it is expected that jobs in the future will require more high-level skills [7], but at the same time student readiness for the college is at best stagnant if not declining. The ACT (American College Testing) report for 2010 [1] indicates that only 43% of high school graduates are ready for mathematics at the college level while 57% must take some form of remediation. Dealing with a huge number of underprepared students is a big challenge for colleges.

Colleges respond to this problem by introducing remedial/developmental courses that teach students basic skills and often do not count towards the college degree requirements. Boser and Burd [3] indicate that 99% of public two-year colleges and more than 75% of public four-year institutions offer developmental courses.

Remedial and low level college mathematics courses have several significant instructional challenges. Probably the biggest one is students' underdeveloped time management and study skills. In fact, this is a deficiency of many high-school graduates that affects their job and/or post-secondary education [3]. Teaching students to be organized and consistent in their study effort, as well as teaching them different learning techniques, is therefore of great importance for helping them to be successful both in classes and at future jobs.

The second big instructional challenge is mathematics anxiety and learned helplessness. Many students believe that they are bad at mathematics and that they cannot get better. Anxiety is typically tied to the feeling of having no control and bad past experiences. Nonesuch [8] points out the importance of creating a class environment where students feel safe and are encouraged to express their thoughts while working on mathematics problems. Clear expectations and communication also reduce anxiety because students know what to expect and, consequently, feel more in control.

The third challenge is the familiarity of the content because the majority of students recognize at least some topics in remedial classes. Isaacson and Was [5] showed that students tend to pay less attention to topics that they think they know. Their research indicates that knowledge monitoring can be taught and that it can improve learning. Frequent and different types of evaluation also can help students to better judge their knowledge.

The fourth challenge is the development of mathematics literacy. Students must know how to write mathematics in order to implement it properly, but in remedial courses they typically have very poor math-writing skills. The problem of mathematics literacy is so pronounced and persistent that even in higher level mathematics courses mathematics literacy must be addressed. For example, Understanding College Algebra [6] has sections specifically related to mathematics literacy.

Underdeveloped time management and study skills, learned helplessness, familiarity with the content and mathematics literacy can be addressed using different techniques and approaches, which greatly depend on the course delivery method. This study describes and compares two different approaches on student achievement: one approach is lecture-based while another relies primarily on the online software ALEKS [2].

2. The Differences of ALEKS and Lecture Based Courses

ALEKS (Assessment and Learning in Knowledge Spaces) is an artificial intelligence-based online system that promotes individualized learning. The educational content presented in ALEKS is divided into categories of topics. Each topic represents a problem type. ALEKS maintains for each student a list of topics that student knows and a list of topics that student needs to learn. The intelligence of ALEKS is reflected through the fact that not all topics that student needs to learn are available to the student. Only topics that student is ready to learn (knows all the prerequisites) are available. As student learns some topics, they are moved to the list of mastered topics and new topics that student does not know but is now ready to learn are added to the list of available topics. The list of categories and topics is visually presented in the student's "pie" (see Appendix B). In addition to topics, ALEKS tracks other parameters of student progress such as time spent on topics and types of errors made. The collected information is used by ALEKS to guide student's progress and to generate efficient and individualized assessments. ALEKS can be implemented as a supplemental tool for lecture courses or it can be implemented in emporium style which means that students study at their own pace and there are no lectures but instructors are available in classes to answer student's questions. ALEKS offers courses in different subjects. Mathematics courses range from elementary school to college calculus. This study is about ALEKS emporium-style implementation in basic algebra courses.

Basic Algebra I, II, III and IV are four remedial mathematics courses intended to prepare students for college-level mathematics courses. Curriculum and syllabi for these courses were created by the mathematics department. The courses were delivered in lecture format until the Fall of 2011 when some sections were delivered in ALEKS emporium while some sections remained in lecture format. The courses included in this study are Basic Algebra I and Basic Algebra II, each delivered in both ALEKS emporium and lecture format. Lecture format was eliminated in subsequent semesters. ALEKS courses were customized by the mathematics department to cover same topics as the existing lecture courses.

A Basic Algebra ALEKS emporium course starts with an initial assessment. The student solves 30 problems generated by ALEKS and based on the result, ALEKS generates a list of topics that student knows, a list of topics that student needs to learn, and a list of topics that student is ready to learn i.e. the student knows all prerequisites for these topics. The topics that student is ready to learn are presented in 8 categories in a "pie" – see Appendix B. There are no lectures so the students work at their own pace in a classroom and at home. When students work in the classroom, they have instructor available for help. As a student selects a category and a topic within it, ALEKS presents the student with the problem to solve – see Appendix C. There are no hints or help – the student must come up with a solution and enter it in a required format. If unable to solve a problem, the student can use the "Explain" button and review a complete step-by-step solution that includes links to the appropriate chapter(s) in the electronic book. If viewing the solution does not provide enough guidance, the student may ask the instructor for help. The student must independently and accurately solve 3 problems of the same type before ALEKS counts it as mastered. At that point ALEKS moves the topic to the list of topics that student knows. As the student learns topics that may be prerequisites for some other topics, these other topics become available for student to learn and show up in the "pie". The students had several progress assessments during the course. These assessments were scheduled by ALEKS for each student after the student spent certain number of hours in ALEKS or mastered certain number of topics. Neither the student nor instructor could view assessments and see where student made mistakes but ALEKS automatically returned into the student's list-of-topics-to-cover all problems that student missed. "Progress Report" (see Appendix B), shows the results of progress assessments that student took, the number of topics mastered between progress assessments, and time spent in ALEKS. The final examination in ALEKS is done at college and is scheduled and supervised by the instructors. The role of instructor in ALEKS emporium courses is to answer students' questions while students work in class, to monitor students' progress, and offer advice and guidance.

Lecture-based courses had electronic books, online labs and a final examination, and a paper midterm exam, all created by the mathematics department. The instructor conducted lectures, created five graded paper homework assignments, electronic class notes and several formula sheets. The instructor opted for paper homework assignments over electronic ones so that feedback on student mathematics writing can be provided. Electronic labs were also a type of homework because students were able to work on them both at school and at home. Midterm and final examinations were done in class.

Both lecture and ALEKS emporium courses had a significant amount of online material. The main difference was that lectures had structured presentation of content while in emporium courses students worked on problems in random order and only when they needed they consulted the electronic book or instructor for help.

3. Research Question

The shift from traditional lectures to an online system has many implications. The goal of this study is to document and evaluate the change from lecture-based to ALEKS emporium-style delivery of remedial basic algebra courses. The research question answered by the quantitative analysis of the final grades is: Do different instructional methods produce statistically significant difference in student achievement?

4. Methods

4.1 The Sample

This study covered one 16-week long semester. The participants were students from the four halfsemester sections of the Basic Algebra (BA) courses. The treatment (ALEKS instructional method) was implemented in two sections: Basic Algebra I (BA_I_ALEKS) and Basic Algebra II (BA_II_ALEKS). The two control sections had lecture format: Basic Algebra I (BA_I_Lecture) and Basic Algebra II (BA_II_Lecture). All four sections were taught by the same instructor. This was the first time that the instructor taught all four courses in these formats. Course days and times are indicated in the Table 1. There were 87 participants. Students did not know that there will be differences in the delivery methods when they registered for classes.

Although ALEKS emporium-style and lecture-based instructional methods are very different, every attempt has been made to make content the same. Consistency is reflected in the course names that are identical regardless of the delivery method.

Instruments for measuring student achievement in lecture-based sections were midterm and final examinations, 6 labs and 5 homework assignments. In ALEKS sections achievement measure was the final grade on the comprehensive assessment generated by ALEKS.

One difference between ALEKS and lecture courses is how students score points that are reflected in the final grade. In ALEKS courses, students immediately get a score after the initial assessment. On average, this was 30% in BA_I_ALEKS and 50% for in BA_II_ALEKS. In lecture courses students started at 0%. As a result, students that fail an ALEKS course typically have a higher percent grade than students that fail the corresponding lecture course. To reduce this grading disparity, when ALEKS and lecture courses are compared on final grades, Academic Mark is used instead of the percent grade achieved in the course. Table 1 presents Percent scores and corresponding Academic Marks.

Table 1 - Grading Scale

Percent score	Academic Mark (Letter Grade)		Percent score	Academic Mark (Letter Grade)
93-100%	4.00 (A)		73-76%	2.00 (C)
90-92%	3.70 (A-)		70-72%	1.70 (C-) not a passing grade
87-89%	3.30 (B+)		67-69%	1.30 (D+) not a passing grade
83-86%	3.00 (B)		60-66%	1.00 (D) not a passing grade
80-82%	2.70 (B-)		0-59%	0 (F) fail
77-79%	2.30 **(C+)**			

Student demographic data was collected in all sections through the survey presented in Appendix A with the goal to verify the equivalency between sections.

4.2 Procedures and Research Design

All courses followed the departmental curriculum and all required a C course grade (73%) or better in order to progress to the next course. All lower scores required repeating the course. In addition, lecture courses had a requirement of passing the final examination with at least 70%. Students that did not achieve 70% on the final but had a cumulative score higher than 73% received the final course grade of C-. In BA_I_Lecture three students had their grades adjusted to C- for this reason (cumulative scores were 75%, 77%, and 79%). In BA_II_Lecture no scores have been adjusted. ALEKS courses had a requirement of passing the final examination with 73% and achieving a certain percent on progress assessments as well as spending required hours in ALEKS. Two scores in BA_II_ALEKS were adjusted to a C- because students did not meet the progress assessment requirement (scores on the final were 73% and 77%).

The design of a study is quasi-experimental. Course final grades were processed by two-factor ANOVA (2 teaching methods, times 2 course levels). The model is presented in the Table 2.

Table 2. The Two-way ANOVA Model		
Method/Course level	Basic Algebra I	Basic Algebra II
ALEKS	BA_I_ALEKS	BA_II_ALEKS
Lecture	BA_I_Lecture	BA_II_Lecture

5. Results

The total number of participants was 87 with 54 females and 33 males. One participant did not provide survey data so statistics related to age and Personal Computer (PC) use had 86 participants:

a) age range was 18 to 36; 62 participants were 21 of age or younger (72%) while 24 were older than 21.
b) 84 participants used a PC at home, work or school, while 2 did not use a PC at all

All sections were comparable regarding gender, age and PC use:

- Kruskal-Wallis H-Test on gender is not significant: $H(3) = 0.186,\ p = 0.980$
- Kruskal-Wallis H-Test on age is not significant: $H(3) = 1.455,\ p = 0.693$
- Kruskal-Wallis H-Test on PC use is not significant: $H(3) = 1.681,\ p = 0.641$

All students in Basic Algebra II (BA_II_ALEKS and BA_II_Lecture) sections took some Basic Algebra course earlier in the same semester and all used online material in that previous course. For that reason only BA_I_ALEKS and BA_I_Lecture were compared with respect to the year of last mathematics class taken and the use of online material in a mathematics course. Out of 47 participants in Basic Algebra I that provided survey data:

a) 31 took a last mathematics course in 2010 or 2011; 16 took a last course between 2004 and 2009,
b) Seven participants used online material in their previous mathematics classes while 40 did not.

BA_I_ALEKS and BA_I_Lecture were comparable regarding the year of the previous mathematics class and the use of online material in mathematics classes:

- Kruskal-Wallis H-Test on the year when the last mathematics class was taken is not significant: $H(1) = 0.018,\ p = 0.893$
- Kruskal-Wallis H-Test on the use of online material in mathematics classes is not significant: $H(1) = 1.630,\ p = 0.202$

In conclusion, the majority of participants were younger and almost all participants used a PC at home, school and/or work. The four sections were comparable on gender, age and PC use.

The participants and average final grades are presented in Table 3.

Table 3. The Participants and Average Grades for the Four Sections					
Course	Number of participants	Withdrew	Number of participants statistically processed	Passed	**Average grade***
BA_I_ALEKS	24	0	24	13 (54%)	**2.17**
BA_I_Lecture	26	2 (7%)	24	11 (42%)	**1.70**
BA_II_ALEKS	25	0	25	16 (64%)	**1.97**
BA_II_Lecture	17	3 (17%)	14	8 (57%)	**1.89**
* Average grade is on the scale 0-4 as presented in Table 1. Passing grade is 2 and above.					

A two-way ANOVA was conducted to examine the effect of the instructional methods (ALEKS and lecture) and the courses (Basic Algebra I and II) on the student final grade. Assumption of homogeneity of variance and normality were checked:

1. Since the group sizes were not equal (24, 24, 25 and 14), homogeneity of variance was tested using Brown-Forsythe method. Homogeneity of variance was not violated: $F(3, 61.65) = 0.471,\ p = 0.704$
2. The normality of final grades was violated for the BA_I_Lecture: Kolmogorov-Smirnov $p = 0.004$ but, according to Hinkle, Wiersma, and Jurs [4], ANOVA is robust to the violation of normality as long as homogeneity of variance is met.

A two-way ANOVA showed that the interaction between instructional method and course level was not statistically significant: $F(1, 83) = 0.417,\ p = 0.520$.
The main effect for the method was not statistically significant: $F(1, 83) = 0.869,\ p = 0.354$
The main effect for the course was not statistically significant: $F(1, 83) = 0.001,\ p = 0.988$

Although statistical difference was not found between ALEKS and lecture sections, this is a positive finding for ALEKS courses because, as a new approach, it has a great potential for improvement and adjustment while the material for lectures has already been organized and improved over the years. Also, the instructor was new to ALEKS, but not to the lecture approach.

It is important to observe that the average grade in BA_II_ALEKS was lower than in BA_I_ALEKS, while the opposite happened in the lecture sections (see Figure 1).

These are the reasons to look closer at the delivery of ALEKS courses because in subsequent semesters all Basic Algebra courses will utilize ALEKS.

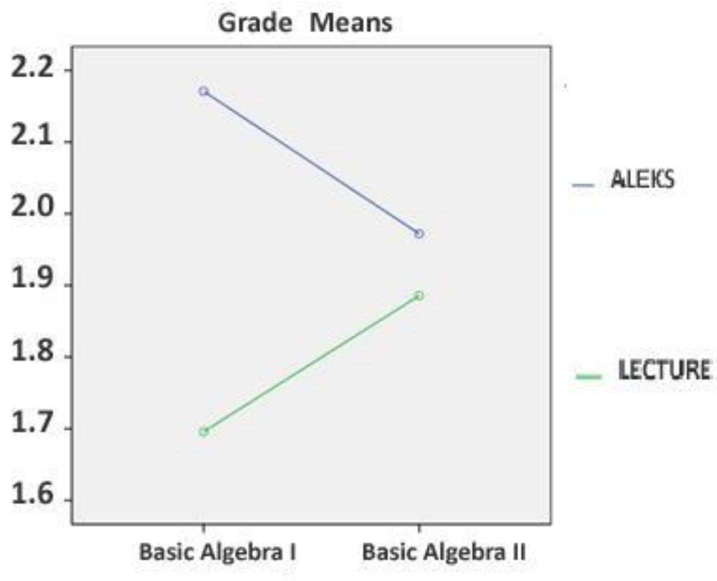


Figure 1

6. Instructor Observations

Both ALEKS and lecture instructional approaches have their own challenges. In the lecture sections, systematic and structured content presentation, labs and instructor feedback on homework assignments were intended to help students learn. A significant number of students did not use these features to their advantage and often were late with lab and homework submissions or skipped them altogether while continuing to attend lectures. After missing several deadlines, students had no way of making up lost points and they were more likely to drop the course. On the positive side, students in lecture classes communicated with the instructor, asked questions and used office hours for extra help. Despite these efforts, the grades in lecture sections were lower compared to ALEKS sections enforcing the instructor's feeling that students in ALEKS studied more.

The time management is addressed through ALEKS reports that show students what topics they have covered, what they still need to cover, and how much time they have spent in the course. Technically it was never too late to put an extra effort to fulfil requirements, so students did not give up on the course although many left much more work for the end. Repeated instructor's advice to students to work regularly and consistently had very small effect. One option to improve student's time management is to provide a detailed schedule of topics that need to be covered by specified dates. This may motivate students to ask for more help in class in order to make these intermediate deadlines.

Anxiety caused by the feeling of no control is addressed in ALEKS by allowing the student to select next topic to work on and by presenting only topics that student is ready to learn and likely to master. The likely success in mastery also improves student's self-motivation and self-confidence and eliminates learned helplessness.

Mathematics writing in ALEKS is enforced only through the requirement of entering answers in the proper format. It is up to the instructor to correct students' writing as they work in class. The instructor pointed out the importance of organized and complete notes in both ALEKS and lecture sections, and showed good ways of taking notes in all sections. Still some students in all sections tried to write as little as possible. In ALEKS sections the writing problem was even more pronounced because some students thought that they can use scrap paper and never even create notes since they "only work on problems". Those of ALEKS students who created notes often had notes unorganized because students in ALEKS typically jump between different problem types. Unorganized notes forced students to look through all pages when they reviewed the material, and did not provide the type of structured overview that properly organized notes would. The instructor observed that students did improve their note taking skills over time but it was at a slow rate.

ALEKS students freely pick next topic to work from the list of available topics. The freedom is motivational and promotes a feeling of being in control, but at the same time it allows students to jump between different problem categories which results in inefficient learning and unorganized notes (this is unintended effect of ALEKS software). The "Time and Topic" report in BA_II_ALEKS showed that students on average did not complete 35-40% of topics that they started. Some of unfinished topics were due to students ending their study session, but the instructor observed that students left hard topics for later without seeking help. Towards the end of the course, the students jumped between topics and categories even more in the search for the easier ones. This resulted in chaotic comprehension, if any, or disorganized notes at least. It would be beneficial to investigate what topics students abandon most often so that course content can be enhanced. Some structure in the form of a short overview of major topics may encourage students to jump between the topics less. Overviews based on the electronic book and practice problems from ALEKS will probably be best accepted by students because they will be consistent with ALEKS provided problem explanations that students use in most cases anyway.

In ALEKS sections students mainly relied on ALEKS explanations provided for the problems and rarely asked for help in the class or consulted the electronic book. The majority of students focused on recognizing patterns in examples and did not go deeper. In other words, they knew mechanics but did not generalize and were not even aware that they missed mathematics understanding. For example, better ALEKS students knew examples of functions but did not know the definition while lecture students knew both examples and the definition. Insufficient mathematics understanding in ALEKS may be addressed by having more problems that require explicit knowledge of the mathematics definitions and rules.

Table 4 shows some of the statistics in ALEKS sections. Although the students on average spent 26% more time in BA_II_ALEKS they had 10% lower grade compared to BA_I_ALEKS.

This indicates that students had harder time in ALEKS as topics became less familiar.

Table 4. Comparison of ALEKS Sections

Course	Number of participants	Passed	Average				
			Start percent in ALEKS	End percent in ALEKS	Percent increase	Hours in ALEKS	Grade
BA_I_ALEKS	24	13 (54%)	30.16 %	72.42 %	42.26 %	21.92	2.17
BA_II_ALEKS	25	16 (64%)	51.52 %	74.84 %	23.32 %	27.71	1.97

ALEKS features that worked very well include the high quality, varied, and unique problems and good diagnostic tools that identify what students know and what they still need to learn. More complex problems are introduced gradually and all the problems have detailed explanations. The students that made sure that they understood each problem in majority of cases were able to make substantial progress. The downside of this approach is that students do not recognize when they can learn enough by just doing problems and when they need to consult the online book or seek the instructor's help. Very few students consulted the online book and they also asked very few questions while in class.

Some students enjoyed working at their own pace and commented that they were never lost as they would be if they missed something in the lecture. On the other hand, some students preferred a lecture format and were not able to get enough from the online system. For these students "mini" lectures may make a big difference. The contradictory student reactions are to be expected because of different learning styles.

ALEKS had very few technical issues and general concerns. The main concern was related to the security of final examinations although no actual problems were observed (students could log off during the examination and log on as someone else). This potential problem was recognized by the ALEKS development team and assessment scheduling has been made more robust for the upcoming semesters. Instructors will be able to use a proctor password thus preventing the possibility of impersonation of another student. Security concerns are present in every online system and, as the online environment changes, new security concerns emerge and must be addressed.

ALEKS changes how the students study: the majority of students in Basic Algebra I did not use online instructional material in their previous mathematics classes. Teaching students how to effectively use online resources and self-regulate their learning is one of the new challenges in developmental mathematics courses delivered with ALEKS.

ALEKS changes the role and responsibility of the instructor significantly. Overall, the instructor spent less time in ALEKS than on lecture courses indicating greater efficiency of ALEKS sections.

7. Conclusions

Basic Algebra courses delivered in lecture format and in ALEKS emporium were compared on student achievement in this study. Although students in ALEKS emporium achieved higher grades, no statistical difference was found. This is a positive finding for ALEKS because the study was conducted in the first semester of ALEKS implementation while lecture courses have been improved over years.

ALEKS was good at motivating students to work, but a detailed schedule of topics/dates provided by instructor may help students to manage their study time even better. Short introductory overviews based on ALEKS material and delivered by instructor may improve student's mathematics understanding and reduce jumping between topics that caused unorganized notes and made learning harder. It would also be very beneficial to determine which topics in ALEKS were the hardest for students. This can be done by investigating how much time students spent on topics and what topics were abandoned the most. Mathematics understanding may be enforced if more problems that test the meaning behind the mathematics rules are added. Mathematics literacy is not strongly enforced in ALEKS. It is up to the instructor to review and correct student writing. As with any online system, ALEKS is susceptible to security problems so test taking procedures must be regularly re-examined.

In addition, answers to the following questions may be helpful for the future adjustments of ALEKS courses:

1. How does the role of instructor change in ALEKS? What are possible obsolete tasks and what are new responsibilities?
2. How do students from remedial mathematics courses delivered in ALEKS perform once they leave ALEKS environment and take college-level lecture mathematics courses?

8. References

[1] ACT. (2010). The condition of college & career readiness 2010. *American College Testing.* Retrieved from: http://www.act.org/research/policymakers/cccr10/pdf/ConditionofCollegeandCareerReadiness2010.pdf.

[2] ALEKS (plug-in Version 3.14) [software]. (2012). ALEKS Corporation. Retrieved from: http://www.aleks.com/

[3] Boser, U. & Burd, S. (2009). Bridging the gap: how to strengthen the pk-16 pipeline to improve college readiness, *New America Foundation*. Retrieved from: http://www.newamerica.net/files/NAF%20Bridging%20the%20Gap.pdf.

[4] Hinkle, D. E., Wiersma, W., & Jurs S. G. (2003). *Applied statistics for the behavioral sciences* (5th ed.), Boston, MA: Houghton Mifflin Company.

[5] Isaacson, R. M., & Was, C. A. (2010). Believing you're correct vs. knowing you're correct: A significant difference? *The Researcher*, *23*(1), 1-12.

[6] Levitan, M., Koleman, B., Shapiro, A., & Vulanovic, R. (2012). *Understanding College Algebra*, Redding, CA: BVT Publishing.

[7] The National Mathematics Advisory Panel (2008). Foundation for success: the final report, *U.S. Department of Education, Education Publications Center.* Retrieved from: http://www2.ed.gov/about/bdscomm/list/mathpanel/report/final-report.pdf.

[8] Nonesuch, K. (2006). Changing the way we teach math, *Project funded by the Canadian National Office of Literacy and Learning* (NOLL). Retrieved from: http://www.nald.ca/library/learning/mathman/cover.htm.

[9] U.S. Department of Education (2010). Agency financial report, Washington D.C., 2010. *U.S. Department of Education.* Retrieved from: http://www2.ed.gov/about/reports/annual/2010report/agency-financial-report.pdf.

[10] U.S. Department of Education (2010). Digest of educational statistics, Washington D.C., 2010. *U.S. Department of Education*. Retrieved from: http://nces.ed.gov/programs/digest/d10/.

Appendix A – Survey Data from Consent Form

Survey data included on the consent form approved by IRB (Institutional Review Board) is presented below. This data established the equivalency between four Basic Algebra sections on gender, age and PC use.

SURVEY DATA
Participant name (please print):
I use PC at home, school and/or work (Y/N):
I use YouTube or other web-site to view videos (Y/N):
I completed my last mathematics class in (YYYY):
My last mathematics class prior to this one was: (for example: Basic Algebra I at Kent State, Algebra in high school …)
I used online material in some of my previous mathematics classes (Y/N):
My age is:

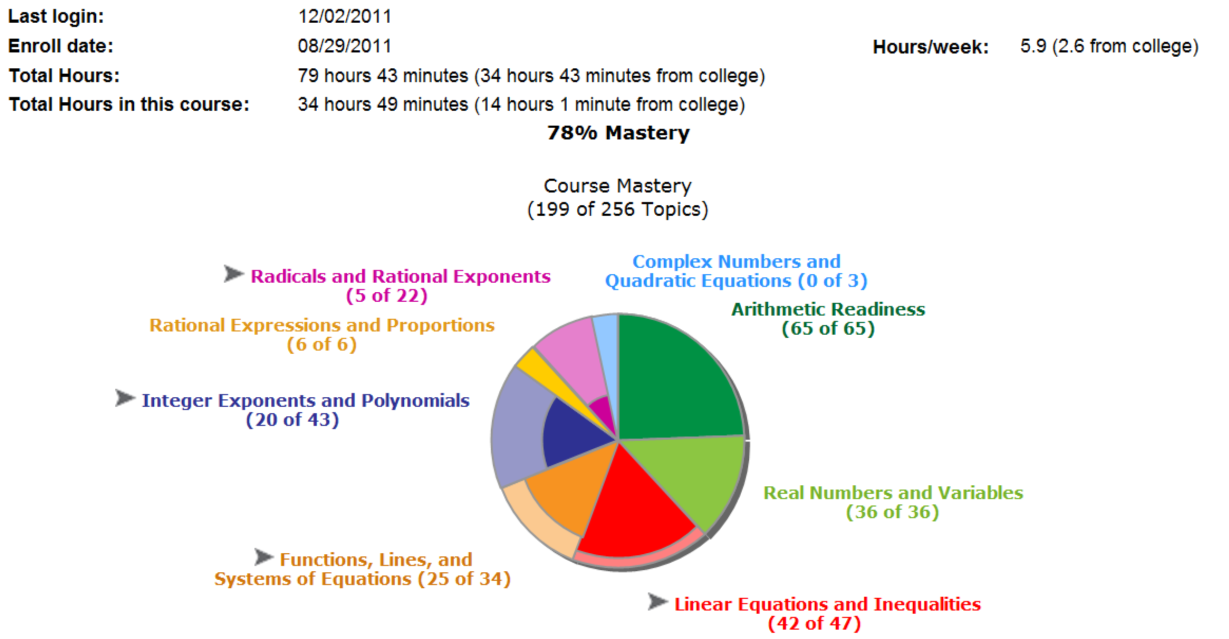
Appendix B – ALEKS "Progress Report" and "pie"

Student progress report is shown below. First number under each progress bar is percent of mastered topics, also represented as a blue (dark shade) part of the bar. Second number is percent learned since the last assessment, also represented as a green (light shade) part of the bar.

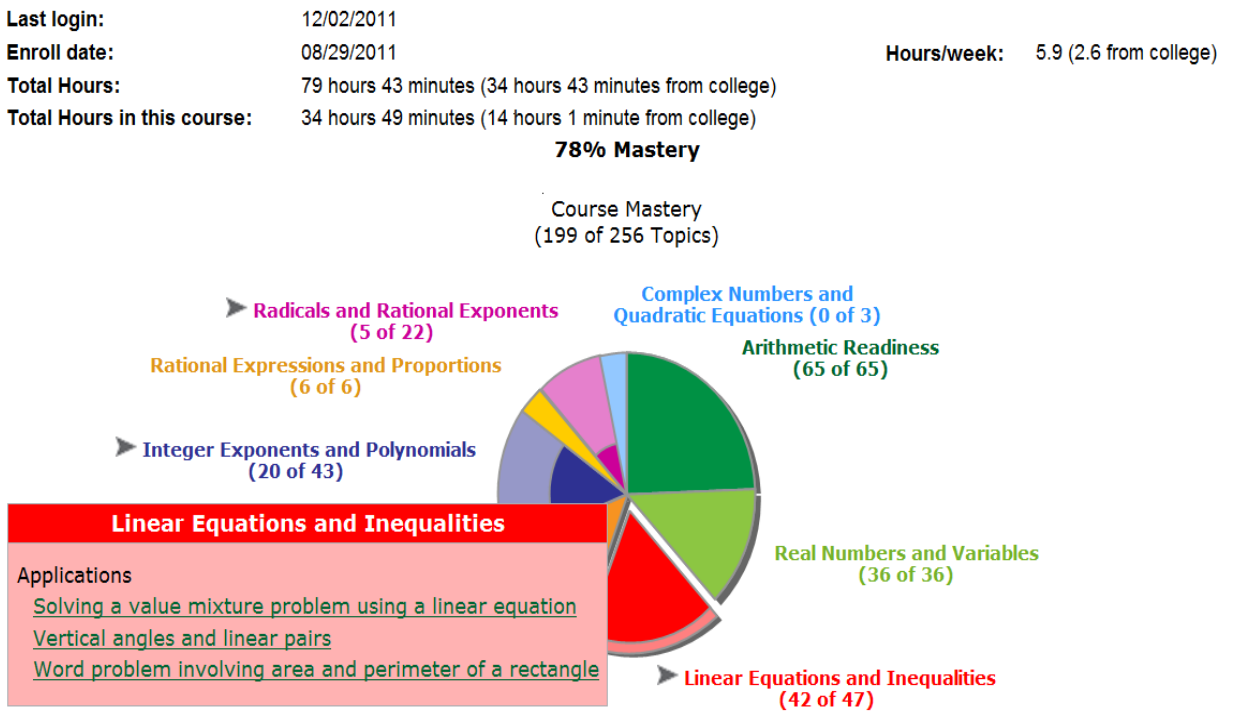
Last login:	12/02/2011		
Enroll date:	08/29/2011	**Hours/week:**	5.9 (2.6 from college)
Total Hours:	79 hours 43 minutes (34 hours 43 minutes from college)		
Total Hours in this course:	34 hours 49 minutes (14 hours 1 minute from college)		

	Last assessment	Assessment performance Course Mastery	Learning data since last assessment		
			Topics learned since last assessment	Hours in ALEKS since last assessment	Topics learned per hour since last assessment
Login Time Assessment	12/01/2011	71 +7 %	18	3.4	5.3
P Requested Assessment 4	11/19/2011	68 +7 %	17	10.3	1.7
P Requested Assessment 2	11/08/2011	62 +8 %	19	5.6	3.4
P Requested Assessment 1	10/29/2011	59 +6 %	14	2.9	4.8
Requested Assessment (at School)	10/14/2011	56 +7 %	19	6.4	2.9

The screenshot below shows ALEKS "pie" with 8 categories (course Objectives) of Basic Algebra II. At the moment, the student mastered 78% of the material (199 topics out of 256). In "Linear Equations and Inequalities" category there are still 5 topics that this student needs to learn.



This student is ready to learn three topics from "Linear Equations and Inequalities" category. Since there are 5 topics under that category that student needs to learn, this means that for 2 more topics student is not ready yet and therefore they do not show in the list. As a result, the student cannot choose to work on them at this time.



Appendix C – An Example of a Problem in ALEKS

When student selects the topic from the "pie", ALEKS presents a problem and students needs to enter an answer in required format. If student does not know the answer, s(he) can use "Explain" button to get a step by step solution that often includes a link to the appropriate chapter in the electronic book.