Fundamentals CQI

Analyzed Semester: Fall 2022

During Fall of 2022 there were 8 primary instructors (and two Googlers in Residence) teaching 10 sections of the 3 fundamentals courses:

- CS1301/1101: Akbar/Garrett, Gurijala, Jimenez Velasco, and Mejia; • CS 2401:

  Akbar, Ceberio/Gamez, and DeBlasio;

- CS 2302: Aguirre, Fuentes, and Mejia.

In general, most instructors continue to see some recovery from online versions of the courses. It is noted that in general the DF rate seems to be around 20% (a bit higher for CS1).

1 General Recommendations

While each instructor made their own individual recommendations, below are some common themes that appeared in multiple analyses.

- All courses moved away from the zyBook this semester and elected the Pearson Revel book as a general adoption, and while this seems to be a good thing, some instructors noted we may want to revisit this closer to the next CQI cycle. In general, we still encourage new instructors and in early fundamentals courses (i.e. CS1) to heavily rely on a published textbook, but individuals may choose to use their own resources.
- Continue to include review of the previous material early in the semester, in most cases the recommendation was to do this outside class. It is recommended that these reviews be coordinated between sections to reduce per-instructor effort and increase availability.
- The committee would like the curriculum committee to evaluate if it is feasible to re-include a 1 credit hour lab section in CS3 (making it CS 2402).
- Consult with other committees to move the teamwork outcomes (ABET required) to upper-level courses (such as Databases).

2 Course Change Recommendations

It is noted that several of the individual reports include some suggestions for changes to outcomes. Due to time constraints, we do not propose the faculty vote on these now, as we will

being the changes indecently at another time. These suggestions have not been vetted by the entire committee and thus will be tabled until they have been. We iterate them here as a summary of the instructors current thoughts.

Individual justifications can be found in the summary reports for the respective courses. Note some of these changes relate to reverting changes made only recently.

2.1 CS 1301

- Replace outcome 2.7 with a level 1 outcome: “Understand the use of hexadecimal and binary in problem solving and computer science in general”.
- Remove “Use Linked List” from level 2 and add the following as a level 1 outcome: “Understand basic linked list representation and manipulation”

2.2 CS 1101

- Remove outcome 2.7 (binary, etc).
- Remove using linked lists as a level 2 outcome

3 Proposal to Aquire Longitudinal Analysis Data

For the purposes of improving our ability to adjust the fundamentals courses to the needs of our students the committee would like to request information in order to do a longitudinal study. We request the following information about students over the past 5 years:

1. grades, semesters, sections, and instructors for each attempt of each of the fundamentals classes.
2. grades in the CS4s (CS 3331, CS 3350, CS 3360, CS3432).
3. which classes (if any) did a student get credit for taking at another institution.
4. student entry point/previous institution and program (community college, high school, etc)

We understand these results will likely need to be anonymized to protect student information. We think this will allow us to make additional recommendations in future CQI cycles. Some of the questions we would like answered are:

- Does taking fundamentals classes over the summer correlate in any way with progress in future classes?
- Does this change if those classes are taken in the summer as a second or third attempt?

- Does receiving credit from another institution impact later progress?
- Does CS2101/2202 vs MATH2300 impact outcomes in other cases?
- Are repeated attempts of fundamentals classes indicative if grades in CS4s?

One of the reasons we would like to do this is to help adjust decision making in final grades, it may also help us identify students who may need additional help early in a semester.

The University of Texas at El Paso
Department of Computer Science
Fall 2022 CQI
CS 1301 & CS 1101 Summary

CS 1301 & CS 1101 were evaluated during the Fall 2022 semester. In general, all sections of CS 1301 & CS 1101 were successful. In comparison to all the sections, a majority of all the sections had an acceptable passing rate – two sections of CS 1301 and CS 1101 had a higher-than-expected failure rate. Below is a breakdown of all the sections as a whole as well as course recommendations.

The instructors for the semester were:

- Akbar, Monika
- Gurijala, Bhanukiran
- Jimenez Velasco, Maria
- Mejia, Daniel

<u>CS 1301:</u>

- 5 Sections
- 197 students were issued a grade ○ 145 students passed (A, B, C) – 73.6% ○ 52 students failed (D, F) – 26.4%
- 26 students withdrew (W)

<u>CS 1101</u>

- 5 Sections
- 201 students were issued a grade ○ 128 students passed (A, B, C) – 63.7% ○ 73 students failed (D, F) – 36.3%
- 27 students withdrew (W) Grade Distribution:

				A	B	C	D	F	W	TOTAL EARNING GRADES	A	B	C	D	F	ABC	DF
Akbar	18414	CS	1301	22	12	7	1	6	3	48	45.8%	25.0%	14.6%	2.1%	12.5%	85.4%	14.6%
Akbar	18685	CS	1101	22	7	5	3	11	3	48	45.8%	14.6%	10.4%	6.3%	22.9%	70.8%	29.2%
Gurijala	15665	CS	1301	5	6	9	5	15	8	40	12.5%	15.0%	22.5%	12.5%	37.5%	50.0%	50.0%
Gurijala	15662	CS	1101	9	7	2	4	18	8	40	22.5%	17.5%	5.0%	10.0%	45.0%	45.0%	55.0%
Jimenez	20440	CS	1301	3	3	3	6	2	9	17	17.6%	17.6%	17.6%	35.3%	11.8%	52.9%	47.1%
Jimenez	20441	CS	1101	4	2	3	8	1	10	18	22.2%	11.1%	16.7%	44.4%	5.6%	50.0%	50.0%
Jimenez	15666	CS	1301	22	8	5	2	7	5	44	50.0%	18.2%	11.4%	4.5%	15.9%	79.5%	20.5%
Jimenez	16430	CS	1101	14	9	8	1	15	5	47	29.8%	19.1%	17.0%	2.1%	31.9%	66.0%	34.0%
Mejia	15619	CS	1301	14	13	13	3	5	1	48	29.2%	27.1%	27.1%	6.3%	10.4%	83.3%	16.7%
Mejia	15637	CS	1101	21	11	4	1	11	1	48	43.8%	22.9%	8.3%	2.1%	22.9%	75.0%	25.0%

			Total 1301	66	42	37	17	35	26	197	**33.5%**	**21.3%**	**18.8%**	**8.6%**	**17.8%**	**73.6%**	**26.4%**
			Total 1101	70	36	22	17	56	27	201	**34.8%**	**17.9%**	**10.9%**	**8.5%**	**27.9%**	**63.7%**	**36.3%**

Outcomes:

A majority of the course outcomes were assessed in all the sections. However, there were a few that were not assessed in some sections. In general, all course outcomes were met with 70% or above.

CS 1301

- Level 1 outcomes appear to be the least met ○ Purpose of multi-dimensional arrays ○ Classes of programming languages
- Level 1 outcomes tend to be on the edge of the scope of the course
- Level 2 outcomes are mostly met except for ○ String manipulations ○ Binary arithmetic
- Level 3 outcomes are well met and assessed by all sections

CS 1101

- Level 2 outcomes were mostly met except ○ Binary arithmetic ○ Usage of linked lists
- Level 3 outcomes are well met and assessed by all sections

Observations:

1. Some level 1 outcomes are difficult to integrate into the course when attempting to focus on other outcomes (i.e., level 3)
2. Students spend a significant amount of time learning level 3 outcomes, as such level 1 & 2 outcomes are discussed less
    a. Students need the additional time working on level 3 outcomes (i.e., practicing loops, methods, and arrays) **Recommendations:**

General

1. Continue monitoring the textbook effectiveness
    a. Revisit the textbook recommendation during the next CQI cycle
2. Continue monitoring the following outcomes to determine how they fit within the scope of the course
    a. Compilation & Interpretation
    b. Classes of programming languages

CS 1301

1. Remove binary arithmetic outcomes from the course
    a. Level 2:
        i. Apply Binary arithmetic to solve problems. This includes:

            1. Conversion between binary, decimal, and hexadecimal numbers,
            2. Application of arithmetic operations on binary and hexadecimal numbers
        ii. RATIONALE: This outcome does not align to the scope of the course
2. Move Linked List to a level 1 outcome
    a. Describe the purpose of linked lists
        i. RATIONALE: This outcome comes near the very end of the course and often does not have enough time to be reasonably covered as a level 2 outcome

<u>CS 1101</u>

1. Add file reading as a Level 2 outcome:
    a. Level 2:
        i. Read/write files (e.g., .txt, .csv)
        ii. RATIONALE: Reading files is critical for lab assignments and is considered a fundamental skill for introductory students
2. Remove using linked lists as a level 2 outcome
    a. RATIONALE: Linked lists appears near the end of the course and does not have enough time to be implemented.
3. Remove level 2-11 outcome
    a. Use teamwork roles and strategies in the classroom
    b. RATIONALE: This cannot be appropriately and objectively assessed in the course as students do not engage in paired programming. Students work with one another in informal settings, however, it is not practical to assess in an introductory course.

CS2401

A summary of the overall observations and recommendations (in blue) are below. Specific observations from each section are included after.

Outcomes. All outcomes were met in all sections of the course.

Textbook. All 3 sections of the course used a new textbook this round, though with three very different approaches: (1) required with assigned homework, (2) optional but with a single recommended text, and (3) no specific textbook recommended, just something relevant. In all cases, this change seemed to be an improvement from the previous use of a zyBook. Continued disuse of the zyBook is recommended.

Review. All instructors noted the needed to heavily review CS1 concepts. While this is typical, this is a theme that occurs on a regular basis. It is highly recommended that instructors of CS2 begin doing review sessions outside class time early in the semester, as this tends to bring everyone up to skill level before covering new material.

DF Rate. Compared to previous semesters, the DF rates seem to be about the same, being between 13% and 24%, compared to the about 18% in 2020. A summary can be found in Table 1.

Table 1: Summary of grades

	A	B	C	D	F
Akbar	21	11	6	3	3
Ceberio/Gamez	27	9	3	12	1
DeBlasio	6	17	10	4	4
Total	54 39.4%	37 27.0%	19 13.9%	19 13.9%	8 5.8%
	Pass 80.3%			Did not pass 19.7%	

Course Outcomes: CS 2401, CRN: 18415 Fall 2022

Links For Reports

Intro to Computer Science

CS 1301 (CRN: 18414) Akbar

CS 1301 (CRN: 15665) Gurijala

CS 1301 (CRN: 15666) Jimenez

CS 1301 (CRN: 15619) Mejia

Laboratory for Intro to Computer Science

CS 1101 (CRN: 18685) Akbar

CS 1101 (CRN: 15662) Gurijala

CS 1101 (CRN: 16430) Jimenez

CS 1101 (CRN: 15637) Mejia

Data Structures & Algorithms

CS 2401 (CRN: 18415) Akbar

CS 2401 (CRN: 12970) Ceberio

CS 2401 (CRN: 18419) DeBlasio

Data Structures

CS 2302 (CRN: 18421) Fuentes

CS 2302 (CRN: 11889) Mejia