Alternative Evaluation in CS Education Research: A Systematic Literature Map

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Abstract

There is a growing movement in the education community to re-evaluate grading practices and find ways of evaluating students that are more flexible, equitable, and focused on student growth. A wide variety of alternative evaluation systems have been developed, including mastery grading, specifications grading, contract grading and ungrading.

In this work, we perform a systematic literature search to find studies of alternative evaluation models in computer science education. A total of 37 papers were analyzed and coded on three metrics: Feature, Evaluation, and Population.

This map represents a tool for educators to find and evaluate research on alternative evaluation systems, resources for researchers to identify areas of future research, and a foundation for a future detailed literature analysis. The complete bibliography and literature map are available for download.

Search and Mapping Protocol

- Query: (”mastery grading” OR ”alternative grading” OR ”specification grading” OR ”specifications grading” OR ”mastery learning” OR ”specs grading” OR ”grading for equity” OR ”equitable grading” OR ”ungrading” OR “un-grading” OR ”contract grading”) AND (“programming” OR “computer science” OR “coding”)
- 376 papers retrieved from ACM Digital Library, Scopus, Science Direct and IEEE Xplore
- Inclusion Criteria: full papers, peer reviewed, measuring some form of alternative grading on some aspect of CS education - final corpus of 37 papers
- All papers double coded for criteria (Cohen’s Kappa = 0.7860), with discrepancies decided by group discussion

Dimensions and Categories

Intervention:

- Binary Grading
- Bucketed Grading
- Mastery Learning
- Re-submissions
- Minimum Grades
- Student Input

Evaluation Metric:

- Grades/Course Outcome
- Engagement
- Student Preferences
- Psychological Factors
- Teaching Workload
- Student Workload

Population:

- K-12
- Undergraduate
- Educators
- Introductory learners
- Gender
- Race
- Accessibility

Heat Map of Number of Papers by Category

Interventions vs Measurements

	Grades	Engage-ment	Prefer-ences	Psycho-logical Factors	Admin Workload	Student Workload
Binary Grading	8	3	8	2	5	6
Bucketed Grading	10	2	9	3	5	5
Mastery Learning	21	13	20	6	11	13
Resubmissions	15	10	18	3	8	14
Minimum Grades	1	1	1	0	0	1
Student input	2	0	2	1	1	2

Measurements vs Populations

	K-12	Under-graduate	Instruc-tors	Introduc-tory Course	Gender	Race	Accecssi-bility
Grades	1	27	2	9	2	2	2
Engagement	0	16	1	5	1	1	1
Preferences	1	27	3	7	1	1	1
Psychological	1	6	0	1	0	0	0
Admin Workload	0	14	4	4	1	1	0
Student Workload	0	18	2	4	2	2	1

Populations vs Interventions

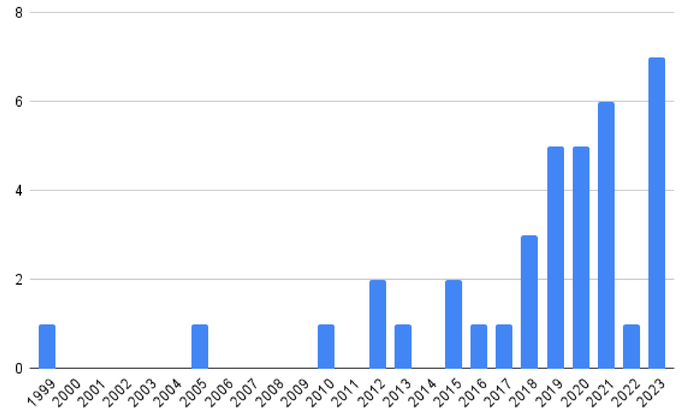
	Binary Grading	Bucketed Grading	Mastery Learning	Resub-missions	Minimum Grades	Student input on grade
K-12	0	0	1	1	0	0
Undergraduate	8	12	25	19	1	2
Instructors	1	2	2	3	0	0
Introductory Course	2	3	11	5	0	0
Gender	1	1	2	2	0	0
Race	1	1	2	2	0	0
Accecssibility	1	0	1	1	1	0

Resources & Downloadable Map

The complete mapping is available as either a PDF or downloadable CSV with accompanying bibliography file at

https://github.com/BrianHarringtonUTSC/SIGCSE2024AltGradingLitMap

Paper Counts by Year



Findings & Future Work

- Rapidly growing area: over 50% of papers published in past 5 years)
- Very little consistency in terminology and intervention selection across studies
- Inconsistent implementation of specific interventions: e.g., “unlimited” re-submissions or number of “buckets” in bucketed grading
- Imbalance in study density: many studies on undergraduate + grades or mastery learning + preferences, but only 4 papers evaluating impact on educators, and only 2 analysing by race/gender

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