Computing Education Research: 
Where is it and where is it going?

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September 18, 2019  
(version 2.CeADAR)
Overview

1. About me (quick, I promise)
2. What is Computing Education Research?
3. What are some current, important topics in CER?
4. How is the academic (third-level) CER community structured?
5. Conferences, journals & more information
6. Where is all this going?
7. How can you get involved?
Overview

• Throughout this talk I will include resources that I have found in my CER experiences
• Slides available (soon) at brettbecker.com/CeADAR
• Slides are designed to be a resource for those interested in getting more involved with CER
• Also see my CER blog at cszero.wordpress.org
About me

• Assistant Professor, School of Computer Science, University College Dublin and Beijing-Dublin International College

• BA CS, BA Physics, MSc Computational Sci, PhD CS, MA Higher Education

• PhD in Parallel Heterogeneous High Performance Computing

• Fairly involved in Computing Education community.
About me

• Lecturing in CS for 14 years
• Member SIGCSE*
• Reviewer for SIGCSE Technical Symposium, ITiCSE, ICER*, Steering Committee Chair CompEd, some other stuff...
• 4 ITiCSE working groups*

*More info on all of these later
What is Computing Education Research?
What is Computing Education Research

• I think that all CS educators can benefit from some participation in the CER community

• Even just being aware of current issues and approaches can help you teach and your students learn
What is Computing Education Research?

• A personal definition:
• CER seeks to find and promote best practice to improve student learning, engagement and outcomes.
• CER also seeks to address many important global and societal issues such as:
  • how to best include under-represented groups
  • how to address significant gender imbalances
  • how to best serve the needs of industry and society through education
What is Computing Education Research?

• A definition from Andy Ko¹

• Computing education research (CER) is the study of how people learn computing and the invention of better ways to teach computing.
  • CER is not teaching. Teaching is helping people acquire knowledge, skills, attitudes and beliefs. Research is discovering truth and inventing solutions.
  • Computing education researchers discover what is true about the teaching and learning of computing, and invent new techniques for teaching and assessing it (some pedagogical, some computational).

¹ [http://faculty.washington.edu/ajko/cer](http://faculty.washington.edu/ajko/cer)
What is Computing Education Research?

• CER is positioned to address research questions such as:
  • How should we teach computer science, from programming to advanced principles, to a broader and more diverse audience?
  • How can we ensure that we retain this more diverse audience through inclusive pedagogy and generally more effective teaching?
  • How can teaching approaches and their assessment (regarding student learning) scale effectively?

What is Computing Education Research?

• CER is positioned to address research questions such as:
  • What training should K-12 teachers receive? What methods have been shown to be effective?
  • How can computer science teaching adapt to how different people learn and build on age related learning progressions?
  • How should computing be taught and integrated into other disciplines?

What is Computing Education Research?

• An incomplete roadmap of resources to start finding out more:
  • [SIGCSE.org](https://www.sigcse.org)
  • [ACM Inroads](https://www.acm.org)
  • [Putting the Computer Science in Computing Education Research](https://www.computer.org) Diana Franklin
  • [What is computing education research?](https://www.computer.org) Andy Ko
  • [The Importance of Computing Education Research](https://www.computer.org) Steve Cooper, Jeff Forbes, Armando Fox, Susanne Hambrusch, Andrew Ko, and Beth Simon, for [Computing Research Association](https://www.computer.org), [Computing Community Consortium](https://www.computer.org)
  • [Computing Education Blog](https://www.computer.org) Mark Guzdial
CER is new, CER is burgeoning

• The first SIGCSE* Technical Symposium was held in 1970
• Many conferences started post-2000
  • And have been gaining good ground in participation and quality
• Attendance, participation, interest are on the rise, in a big way
  • Academic / Institutional
  • Multi-national
  • Corporations
  • Governments
  • More
    • Some of the input here is more, some less, on the research side

*Association of Computing Machinery (ACM) Special Interest Group on Computer Science Education (much more on this in a few minutes)
CER is new, CER is burgeoning

• CER is a growing area with substantial new funding opportunities, growing support from industry and highly-regarded venues for publication.

• CER is focused on how people learn about computing and improving that process, from the kindergartener programming a robot toy, to an undergraduate in CS1, to a statistician using the latest scriptable analysis tool.
  
  • CS1 is a term for the required, introductory (undergraduate) programming course for CS majors

http://cra.org/cs-departments-embrace-computing-education-research/
An aside: CS1

- You won’t get far in CER before you encounter ‘CS1’
- CS1 is a term used to describe the required, introductory (undergraduate) programming course for majors
  - Regardless of language taught
  - No prerequisite
An aside: CS1 (and CS2 and CS0)

• CS2 is the introductory Data Structures and Algorithms course
  • CS1 and CS2 were first used in the 1979 ACM Computing Curricula¹

• The more recent term CS0²³ describes a course like CS1 (programming, not just computer literacy), but for non-majors, or students deciding if Computer Science is for them

See the following for an in-depth conversation on CS1 and CS2: Matthew Hertz. 2010. What do "CS1" and "CS2" mean?: investigating differences in the early courses. In Proceedings of the 41st ACM technical symposium on Computer science education (SIGCSE '10). ACM, New York, NY, USA, 199-203. DOI: http://dx.doi.org/10.1145/1734263.1734335
What’s in a name?

• One problematic area of computing in education is terminology\(^1\)

• Computing Education Research shares the same difficulty

• The broad area of Computing Education Research goes by many variants and acronyms:
  • Computing Education Research (CER)
  • Computer Science Education Research (CSER)
  • You will also see CSEd, and other variants that sometimes mean slightly different things

\(^1\) Neil Brown, [https://academiccomputing.wordpress.com/terminology/](https://academiccomputing.wordpress.com/terminology/)
What’s in a name?

• Computing Education in general (depending on how that is defined) and Computing Education Research (or whatever you call it) are two significantly related and non-disjoint areas
• Particularly, many current issues can overlap both
• This presentation has a research slant
Where’s the research?

• Two excellent articles that discuss the education, the research, and the combination
  • Diana Franklin. 2015. Putting the computer science in computing education research. *Commun. ACM* 58, 2 (January 2015), 34-36. DOI: [https://doi.org/10.1145/2700376](https://doi.org/10.1145/2700376)
  • Sally Fincher. 2015. What are we doing when we teach computing in schools?. *Commun. ACM* 58, 5 (April 2015), 24-26. DOI: [https://doi.org/10.1145/2742693](https://doi.org/10.1145/2742693)

• We need to combine
  • Cognitive research
  • Educational research
  • Computer Science research
  • Policy research
  • More!
(Some) current and important topics in CER
Current and important topics

• The following list is incomplete
• A slide or so on each topic does not do justice to any
• Some of these topics by themselves have resulted in papers, debates, books, careers!
• I have tried to include resources that are helpful in finding out more
• Some are more general CSED, some are definitely more on the research side
  • Many, probably most, have a place in both
Gender Equality

- Despite the rising numbers of graduates, women are still far underrepresented in CS, and they're gaining ground more slowly than men.
- Only 17.5% of 2015 US CS graduates were women. That's up slightly from about 17 percent the year before.
- Fewer women are earning degrees in the field now than in 2003.
- What's the year with the most female computer science graduates? 1987 (that’s 30 years ago!) just over 33%.

From: Computer Science Degrees Hit New Peak, April 4, 2017, Education Week
Gender Equality

• In 2016, 2 US states had 0 girls take the AP Computer Science Exam. 8 states had less than 10\(^1\)

• Some universities/colleges have high female enrolments (these are not the norm)
  • Harvey Mudd (55\%)\(^2\)
  • Carnegie Mellon (~50\%)\(^3\)
    • Review by Daniel Zingaro in ACM Inroads

• Women who try AP Computer Science in high school are 10 times more likely to major in computer science\(^4\)

• See [ACM-W](#) the ACM Council on Women in Computing
Diversity and access

• 18% of CS bachelors degrees in the US are earned by underrepresented minorities who represent 65% of the US population

• Black and Hispanic students who try AP Computer Science in high school are 7-8 times more likely to major in computer science

• Access to computing (programmes, resources, teachers, etc.) tends to be worse for many socio-economic groups

• See “What can undergraduate courses do to improve diversity in computing?”
Growing enrolments

- US CS graduates, 2003-2005

- Up 75% from 2009
- 2015 barely surpassed 2003
- Women are down from 2003
Growing enrolments

• CS is the largest department in Stanford, and other universities
• Growing pains exist
• Faculty staffing is a major issue
• How will this affect the discipline?
• How will this influence research?
• What can research do to help?

code.org
Non-majors

• There is a growing interest in non-CS majors taking CS courses

• How do we properly meet this demand and engage these students is currently being addressed by a multitude of approaches
  • Do we enrol them in special (CS0) courses?
  • Do we teach them side-by side with majors?

• These students represent an important and valuable group
  • We need to meet their needs in the best way possible

See Henry M. Walker. 2015. Priorities for the non-majors, CS course: programming may not make the cut. *ACM Inroads* 6, 1 (February 2015), 46-49. DOI: [http://dx.doi.org/10.1145/2727127](http://dx.doi.org/10.1145/2727127)
Faculty and resources

- Faculty staffing is an issue
- Small number of CS PhD grads
  - Most undergraduates go straight to lucrative industry positions
  - 55% of the small number of PhD grads do the same\(^1\)
  - 2014 US CS PhD graduates: 1,940\(^2\)
  - 2015: 1,780 (18% women)\(^2\)
- There is a 30% one-year (and 56% two-year) increase in the number of institutions searching for tenure-track faculty in CS\(^3\)
Faculty and resources

• See: Why CS Departments Should Embrace Computing Education Research
  • CER is a synergistic domain for collaboration with other areas of CS
• See: Putting the Computer Science in Computing Education Research
  • The time is right to provide resources for computing education research. Computer science departments have sat on the sidelines for too long, reacting rather than leading. These efforts greatly affect our current and future students—the future of our field.
Funding

• CER is a growing area with substantial new funding opportunities\(^1\)
• Still, it can be difficult to get funding for CER
• In many ways CER does not fit a typical research trajectory
• Funding is often required for tenure, etc.
  • This can be a disincentive for faculty to embrace CER
K-12 (US primary and secondary levels)

• How is CS taught at primary and secondary (K-12) levels?
  • There is very little consistency
  • This needs to be addressed

• 90% of parents want their child to study computer science but 40% of schools (US) teach computer programming\(^1\)

• Only 7/50 US states have CS standards\(^1\)

• CS can count towards high school graduation in 33/50 US states (up from 12 in 2013)\(^1\)

Computational Thinking

• There has been a lot of interest in teaching ‘computational thinking’ recently

• Computer science has analytical concepts and tools that offer educational benefits beyond simple IT fluency

• What is the role of computational thinking in education? How do we best teach it?

• How does training in computational thinking transfer to non-programming disciplines?

• Trying to answer these questions has at times led to debate

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Computational Thinking

• Professors of computer science should teach a course called “Ways to Think Like a Computer Scientist” to college freshmen, making it available to non-majors, not just to computer science majors. We should expose pre-college students to computational methods and models.¹

• The process of increasing student exposure to computational thinking in K-12 is complex, requiring systemic change, teacher engagement, and development of significant resources. Collaboration with the computer science education community is vital to this effort.²

² Valerie Barr and Chris Stephenson. 2011. Bringing computational thinking to K-12: what is Involved and what is the role of the computer science education community?. ACM Inroads 2, 1 (February 2011), 48-54. DOI=http://dx.doi.org/10.1145/1929887.1929905
Programming skills, learnability, expectations

• CS1 and computer programming prove problematic for students
  • High dropout rates
  • CS students/graduates with poor programming skills1, 2
    • Both of these influential ITiCSE working group* papers (and many others) have raised concerns over student programming ability
  • But maybe our expectations are too high!


* Explained later
Programming language design and learnability

• What language to use in CP1 has been a debate since (at least) the 1970s\(^1,\ 2\)
  • There are even acronyms: YATL - Yet Another Teaching Language or YAPL - Yet Another Programming Language\(^3\)
  • It has been argued though, that if we master teaching them, language choice becomes irrelevant\(^4\)

• Programming languages are the least usable, but most powerful human-computer interfaces ever invented\(^4\)
  • The concept of programming languages as a human-computer interface has resulted in many interesting avenues of thought
Compiler error messages

• My current research area
• Many compiler error messages are very poor
  • They have been shown to be a barrier to student success
  • In the absence of an instructor they are a programming student’s primary source of feedback on the errors they make
• This is related to the previous slides
  • It has implications for how computer programming is learned and taught
Compiler error messages

• This area has been attracting more attention recently
• See my papers
• Novice Programmer Errors – Analysis and Diagnostics
• Do Enhanced Compiler Error Messages Help Students?:
  Results Inconclusive (SIGCSE 2017)
  • It’s still an open problem!

• There are languages that attempt to provide good (useful) error messages
  • Elm
  • Clang
Programming language design

• In 2018 a Dagstuhl Seminar (18061) focussed on evidence about programmers for programming language design, with these objectives
  • to form a diverse community of scholars around programming language design based on evidence of programmer impacts
  • create an organized set of priorities for new studies in the area along with the evidence standard to be used
  • to discuss or create theories that can guide the community in understanding and framing the evidence gathered over time
National curricula at secondary level

• Many countries are developing national curricula at secondary level
  • CS has been an academic subject in Israeli high schools since the mid 1970’s\(^1\)
  • The UK implemented a national computing curriculum in 2014\(^2\),*
  • Ireland started in 2018\(^3\)
  • New Zealand, India, Scotland, Greece, South Korea and others have varying approaches

*For insightful accounts of the UK’s curriculum journey, see:
High dropout rates

• CS dropout rates in some countries is high
  • Ireland has double digit CS drop out rates\(^1\)
  • Many other countries have a similar problem
    • 11% UK\(^2\)
  • See my MA Thesis (p. 6) for more
    • Difficulties with computer programming is frequently cited as a cause

• The first two years in CS is critical and there is an approximate 40% dropout rate for these years, varying from 30-40% depending on institution\(^3\)

• Introductory programming courses (as part of programs) are similar\(^4\)
Positioning Computer Science

• 3% of all bachelor’s degrees are in CS
• 8% of STEM degrees are CS
• But computing jobs are the #1 source of new wages in the US at nearly 17%, and this is projected to grow at twice the rate of all other jobs

From code.org  Sources: Bureau of Labor Statistics, National Center for Education Statistics
More research topics

• A tiny sample of more CER topics:
  • Subgoal labelling
  • Concept inventories
  • Whether block-based / frame-based language learning transfers and how to do it best
  • Threshold concepts
  • Notional machines

• Assessment topics
  • Many: ACM Digital Library search for ‘assessment’ yields >15,000 articles
  • See www.brettbecker.com/publications and search for ‘mastery’
More research topics

• Shamelessly lifted from the ICER* 2017 CFP but made a little more brief and excluding topics already covered:
  
  • discipline-based education research (DBER) in CS
  • pedagogical environments
  • design-based research, learner-centered design, and evaluation of educational technology
  • learning sciences work in the computing content domain

*discussed later
More research topics

• Shamelessly lifted from the [ICER 2017 CFP](#) but made a little more brief and excluding topics already covered:
  
  • learning analytics and educational data mining
  • informal learning experiences related to programming and software development
  • measurement instrument development and validation
  • research on CS/computing teacher thinking and professional development models at all levels

• See [SIGCSE*](#) and [ITiCSE*](#) CFPs also

*discussed later
How is the academic (third-level) CER community structured?
How is the academic CER community structured

• From some points of view, loosely!
  • Many groups, many based on volunteers, conferences, journals, global network of researchers
  • Some industry/corporate/governmental involvement

• From another point of view, more SIGCSE-driven
  • Global network of CER researchers, often using SIGCSE as a vehicle/glue.
  • SIGCSE runs several conferences, including the largest
How is the academic CER community structured

• In this brief section I present a view which is admittedly SIGCSE heavy
  • With a third-level focus

• However, the overall structure is best seen taking all other sections of this talk into account
  • The people, issues, groups, students, everyone, all play important roles
SIGCSE

• SIGCSE is the ACM (Association of Computing Machinery) Special Interest Group on Computer Science Education (SIGCSE)
  • [www.sigcse.org](http://www.sigcse.org)
  • Mission Statement: SIGCSE provides a forum for educators to discuss issues related to the development, implementation, and/or evaluation of computing programs, curricula, and courses, as well as syllabi, laboratories, and other elements of teaching and pedagogy
  • Pronounced SIG-SEE or SIG-C

See [http://sigcse.org/sigcse/about/profile](http://sigcse.org/sigcse/about/profile) for more on what SIGCSE is and what it does
SIGCSE

- 2,882 members (Dec 2018)
- Volunteer driven, Membership based
- I personally don’t know what I would do without being a member of SIGCSE. Highly recommended!
- Membership benefits
  - ACM Inroads (magazine)*
  - SIGCSE Bulletin*
  - Mailing List*
  - Free access to SIGCSE publications*
  - Reduced rates to SIGCSE Conferences*
  - More
- Professional/affiliate/institutional electronic-only: $25

*All discussed in more detail later
SIGCSE Chapters

• China ACM SIGCSE Chapter
  • china.acm.org/SIGCSE
• Australasian ACM SIGCSE Chapter
  • sigcseaus.wordpress.com
• UK Chapter
  • https://uki-sigcse.acm.org/
• Ireland Chapter
  • Email me (brand new)
• For more, see
  • sigcse.org/sigcse/programs/local-chapters
Other groups

- Consortium for Computing Sciences in Colleges (CCSC) [www.ccsc.org](http://www.ccsc.org)
  - Sponsors 10 regional CSCC conferences (USA)
- **Google CSED**
- **IEEE Computer Society (IEEE-CS)**
  - IEEE-CS Technical Community on Education
  - **ACM/IEEE-CS cooperation**
    - Joint ACM/IEEE Computing Curricula

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Other groups

- **Code.org**
  - Code.org® is a non-profit dedicated to expanding access to computer science, and increasing participation by women and underrepresented minorities.
  - **Hour of Code** campaign has reached 10% of all students in the world

- **Psychology of Programming Interest Group** (PPIG)
  - There are many other specialist academic interest groups
Initiatives: CS4All

• There are many initiatives these days, with CS4All being one of the larger by many measures

• Computer Science for All is an Obama administration initiative (2016) to empower all American students from kindergarten through high school to learn computer science and be equipped with the computational thinking skills they need to be creators in the digital economy, not just consumers, and to be active citizens in our technology-driven world.

https://obamawhitehouse.archives.gov/blog/2016/01/30/computer-science-all
CS4All

- $4 billion (USD) for states, $100 million for school districts, for expanding K-12* CS
- $135 in funding from NSF and CNCS
- Action around AP (US Advanced Placement) curriculum
- Involving governors, mayors, education leaders
- Engaging CEOs, philanthropists, creative media, technology and education professionals to deepen CS commitments
- Outcomes and influence will affect research, hopefully research also informs it!

* US primary and secondary level
Industry Involvement

• **Apple** is committing to expand coding opportunities for children with continued investment in training workshops and curriculum development.

• **Cartoon Network** $30 million campaign to engage young people in creative coding.

• **Facebook** will expand its outreach to parents, guardians, and learners in communities that are under-represented in the technology sector, and connect them to the resources to get started on how to code.

• **Microsoft** is announcing its campaign to have all states adopt “Make CS Count” policies and invest in CS education as a complement to existing $75 million initiative to support CS education.

• **Salesforce.org** is announcing its plan to invest $13 million in 2016 to support CS and STEM education.

• **Qualcomm** will collaborate with Virginia Tech to create a Thinkabit Lab — part Maker Space, lab, and classroom — on its campus, with the goal of supporting computer science education for middle school students in the region.

• **Code.org** is committing to give computer science instruction workshops and other supports for 25,000 additional teachers this year.

[https://obamawhitehouse.archives.gov/blog/2016/01/30/computer-science-all](https://obamawhitehouse.archives.gov/blog/2016/01/30/computer-science-all)
Conferences, journals, and more information

Conferences
Conferences

• Four SIGCSE conferences
  • SIGCSE Technical Symposium
  • Annual Conference on Innovation and Technology in Computer Science Education (ITiCSE)
  • International Computing Education Research (ICER) conference
    • SIGCSE Doctoral Consortium (DC) is also normally held in conjunction with ICER
  • ACM Global Computing Education Conference
• Other SIGCSE ‘in association’ conferences
• Other non-SIGCSE conferences
SIGCSE Technical Symposium

• The SIGCSE flagship conference
  • sigcse.org/sigcse/events/symposia

• Almost always just called SIGCSE
  • So you have to figure out when someone says SIGCSE, do they mean the group, or the ‘conference’
    • Did you see that post on the SIGCSE mailing list?
    • Are you going to SIGCSE in March?

• Always held in US major cities (Feb/March)

• Attendance regularly 1,500+
  • 2017: 1500+
  • 2019: 1800+
    • Many international delegates

• First held in 1970, 2020 will be 51st
SIGCSE Technical Symposium

- Papers*
- 2020 in Portland Oregon, Maryland (USA)
  - Feb 21-24
- Panels*
- Special Sessions*
- Workshops*

- Birds of a Feather Sessions
- Posters
- Demos
- Lightning Talks
- ACM Student Research Competition
- Pre-Symposium events

* Normally due end of August. Others normally due end of October.
SIGCSE Technical Symposium

• Many, many nice things
  • In some years there is an excellent ‘new educator’s workshop’ that is highly recommended
  • First timers’ lunch is well known and loved
  • Highly recommended for anyone who is interested in CER
  • More than a conference. An experience. Seriously!
Annual Conference on Innovation and Technology in Computer Science Education (ITiCSE)

• Normally held in Europe (although 2016 was Peru)
  • Normally in July
  • 2020: Trondheim, Norway
  • iticse.acm.org/
  • sigcse.org/sigcse/events/iticse
• Attendance normally around 300
• Some say this is more ‘teaching’ oriented
• Papers and Working Groups normally due in January
Annual Conference on Innovation and Technology in Computer Science Education (ITiCSE)

- Known for its Working Groups (WGs)
  - WG proposals are due with papers
  - Approved WGs are then open for researchers to apply to
  - Max of 10 per group
  - Members work remotely pre-conference, and meet in person 2 days before main conference
    - Work continues throughout conference, and remotely post-conference
  - Results in a paper on the WG topic
  - Reviewed and if accepted, published
    - The mechanism for this has changed over the years. Currently WG papers are published in the [ACM Digital Library](https://dl.acm.org).
International Computing Education Research (ICER) conference

• 2020 is 16\textsuperscript{th} year
  • Otago, New Zealand, August 2020
    • icer.acm.org/
    • sigcse.org/sigcse/events/icer

• Quite research-oriented

• Alternates one year in USA, one year out, on a roughly USA – Europe – USA – Australia/New Zealand schedule

• Attendance a little short of 100

• Papers due around April, Conference in August/September
ACM Global Computing Education Conference (CompEd)

• 2019 was 1st year
  • Beijing
    • ACMcomped.org
• Roams the globe – never USA/Canada/Europe
• Attendance a little short of 150 (2019)
• Held every 2 years (at any time of the year)
SIGCSE Doctoral Consortium

• Since 1998
• Goals:
  • To offer a friendly forum for students to discuss their work and receive constructive feedback.
  • To offer relevant information on issues important to doctoral candidates.
  • To nurture a community of researchers.
• The DC is designed primarily for PhD students in computing-related areas who are planning a career in academia.
• Students whose research focus is related to computing education are a primary focus, although doctoral students in any computing-related area are welcome to apply.
Koli Calling International Conference on Computing Education Research

- Normally called Koli or Koli Calling
- In cooperation with SIGCSE
- Held at the same location in Finland in November
- [www.kolicalling.fi/](http://www.kolicalling.fi/)
- Small and intimate
  - Around 40 delegates, all in one hotel in a forest park
  - All sessions are plenary
  - Basically, three days with the same people all day
  - Highly recommended by those I know who have been!
Australasian Computing Education Conference (ACE)

• 2020 will be 22\textsuperscript{nd} year.
• Held in Australasia.
• Coincides with Australasian Computer Science Week (end of January / beginning of February)

• [2020 website]
International Conference on Learning and Teaching in Computing and Engineering (LaTiCE)

• 2017 (5th) was in Hong Kong.
• 2020 is in Vietnam (April 24-26)
• Keep your eyes on their website (always in spring)
• The previous four LaTiCE conferences have been in Macau (2013), Malaysia (2014), Taiwan (2015), and Mumbai (2016)
More conferences

• SIGCSE has a great list
  • sigcse.org/sigcse/resources/publish
  • Every one has a link!
Conferences, journals, and more information
ACM Transactions on Computing Education (TOCE)

• The ACM Transactions on Computing Education (TOCE) publishes high quality, peer-reviewed, archival papers in computing education.
  • Papers published in TOCE take a scholarly approach to teaching and learning, establish a clear connection to student learning, and appeal to a broad audience interested in computing education: instructors, researchers, curriculum designers, and administrators.
Computer Science Education (Taylor & Francis)

- **Computer Science Education** aims to publish high-quality papers with a specific focus on teaching and learning within the computing discipline that are accessible and of interest to educators, researchers, and practitioners alike.
IEEE Transactions on Education (ToE)

• Publishes significant and original scholarly contributions to education in electrical and electronics engineering, computer engineering, computer science, and other fields within the scope of interest of IEEE.

Journal of Computing Sciences in Colleges

• The Journal of Computing Sciences in Colleges contains the conference proceedings for each of the regional conferences sponsored by CCSC. It is distributed to around 600 faculty in over 350 colleges and universities
  • Open access via ACM Digital Library
More journals

• SIGCSE has a great list
  • [sigcse.org/sigcse/resources/publish](http://sigcse.org/sigcse/resources/publish)
  • Every one has a link!
Conferences, journals, and more information
ACM Inroads

- Quarterly magazine, 2010 - present
- "Paving the Way Toward Excellence in Computing Education"
- SIGCSE sponsored
  The goal of the publication is to generate new ‘inroads’ in the theory and practice of computing education and to share those discoveries by fostering dialogue, cooperation, and collaboration with educators worldwide.
  
- [inroads.acm.org](http://inroads.acm.org)
  - [sigcse.org/sigcse/resources/publications](http://sigcse.org/sigcse/resources/publications)
Communications of the ACM

- **Communications of the ACM** (CACM)
  - A leading online and print publication for the computing and IT fields
  - Often has Computing Education Research articles, blog posts and more
SIGCSE Bulletin

• Quarterly newsletter, 1969 - present
• A brief guide to recent SIGCSE activities
• Excellent way to keep your ‘thumb on the pulse’
• [sigcse.org/sigcse/about/bulletin](http://sigcse.org/sigcse/about/bulletin)
  • [sigcse.org/sigcse/resources/publications](http://sigcse.org/sigcse/resources/publications)
SIGCSE Mailing Lists

• Lively, frequent and worthwhile
  • I have personally made research collaborations and been made aware of several things that I would have otherwise missed through this list
  • Based on March 2017, average of 2 emails per day
• Access given to all SIGCSE members
• Excellent way to get connected and stay informed
• sigcse.org/sigcse/membership/mailing-lists
Publication Repositories

• ACM Digital Library: [dl.acm.org](http://dl.acm.org)
  • Comes with most ACM memberships
  • Full-text papers from SIGCSE, ITiCSE, ICER, Koli Calling, ACE, TOCE, ...
  • Also indexes (but may or may not include full-text of) IEEE ToE, and many, many other venues and journals

• IEEE Xplore: [ieeexplore.ieee.org](http://ieeexplore.ieee.org)
Where to get (more) information

• Blogs
  • My blog has a list of other blogs (currently a little less than 20)
  • Mark Guzdial’s Blog is extremely insightful, detailed and informative – a true resource.
  • Andy Ko

• Twitter
  • Virginia Grande maintains a list of individuals and organizations active in CER on twitter
  • Alfred Thompson maintains a list of CS teachers on twitter
Where is this all going?
Where is this all going?

• It is an exciting time, for an exciting field
• The balance between Computing Education and Computing Education Research is important, and one affects the other
  • There is a lot of computing education in the news
    • That is probably a goal!
  • There is less computing education research in the news
    • But that’s probably not a big goal!
Where is this all going?

• There is a lot of money going into computing education
  • This could affect what we research
• There may be A LOT of CS students in the future, if:
  • If the access, diversity, dropout, enrolment, etc. issues are handled
  • the economy keeps going
  • numbers keep increasing
  • ...
• How will we cope with this? How will it affect research?
Where is this all going?

• Personally, I think that one of the greatest challenges facing CER is the future of the communities that are working together to solve today’s challenges
  • We must ensure that we (continue to) have a good structure with good, open communication channels

• I believe that the most important inroads (sorry for the pun) can be made by the most passionate people
  • Will the institutions, organizations and entities that have the ability to let these people do their best work give them the opportunity?
  • CER needs a strong voice, not just for the causes it serves but for the people that make up the community
Where is this all going?

_Educating the students who will soon actively shape the everyday experiences of billions of users must be done with intent, and the best knowledge and practices_.

_This should be informed by sound research_
How can you get involved?
How can you get involved

• Join SIGCSE
  • In my opinion this is one of the most important and easiest ways. This gets you in touch with a lot of people, and a lot of resources

• Read Inroads,
  • Get proceedings and papers from the ACM Digital Library
    • Also, read some of the blogs and other information sources

• Collaborate!
  • Reach out – see who is doing something similar to what you are interested in. The SIGCSE and wider CER community is so friendly!

• Email me if you have any questions
More about the speaker

• www.brettbecker.com
• cszero.wordpress.com
Thank you!

Questions?