Audience and Content Areas of Online Software Engineering Education and Training: A Systematic Review

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Key Takeaways

- Security and HCI have few studies published regarding online SEET
- Mostly traditional students targeted; little into K-12 or industry professionals
- Wide ranging vocabulary leads to vast search results

Outline

1. Background
2. What was done
   - Results
3. Future Work
4. Conclusion

Existing Content Area Categorizations

IEEE-CS Software Engineering Competency Model (hereafter, SWECOM)

Software Engineering 2014: Curriculum Guidelines for Undergraduate Degree Programs in Software Engineering (SE2014)

Graduate Software Engineering 2009: Curriculum Guidelines for Graduate Degree Programs in Software Engineering (GSwE2009)

Dilbert (well, Wally) says...

Figure: Dilbert Dec. 21, 1997 (abridged)

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Systematic Literature Review

Following the Guidelines for performing Systematic Literature Reviews in Software Engineering

Recommended sources, inspection, and inclusion/exclusion process

Research Questions

R1. What content is being taught by online SEET courses?

R2. Who is the audience of online SEET courses?

R3. What is the trend of research of online SEET courses, measured by studies published year over year?

Query

(online OR on-line OR distance OR MOOC OR
SPOC OR remote* OR e-learn* OR eLearn* OR
internet OR virtual*)
AND
("software engineering" OR
"requirements engineering" OR "software design" OR
"software architecture" OR "software testing" OR
"software project management")
AND
(education OR training OR course* or teach*)

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Search Results Statistics

Source	Search Results	Full-text Reviews	Works Used
IEEE Xplore	2681	50	21
ACM Digital Library	286	21	9
Google Scholar	107	10	6
Engineering Village	1948	6	1
ASEE Peer	1951	3	0
ScienceDirect	368	6	0
Search Totals	7237	89	31
Manual Inspection	36	17	10

Key Audiences

- Only 3 studies targeted industry professionals specifically
- Only 1 study targeted post-graduate work specifically
- Only 1 study targeted K-12 students specifically

SWECOM Coding

Skill Set	Subject: Students	Subject: Ind. Prof.	Set Total
Requirements	8	4	11
Design	12	3	14
Construction	9	4	11
Testing	5	2	6
Sustainment	4	1	4
Process and Lifecycle	9	5	13
System Engineering	2	0	2
Quality	3	3	5
Security	1	1	1
Safety	0	0	0
Configuration Mgmt	1	0	2
Measurement	2	2	3
HCI	1	0	1

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What should we do next?

- Establish guidelines for systematic review in SEET
- Complete multivocal literature review of online SEET
- Establish clear guidelines for tagging SEET work using established guidelines (SWECOM, SE2014, GSwE2009)

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We need more...RESEARCH!

Several topics are well represented, while others need more attention.

Modified guidelines for the performance of systematic literature reviews where software engineering meets education and training would be beneficial.

Fin

SLR-SE Guidelines

Guidelines for performing Systematic Literature Reviews in Software Engineering

- Published in 2007 by lead authors Kitchenham and Charters
- Evidence-Based Software Engineering (EBSE) technical report
- Software Engineering Group of Keele University and the Department of Computer Science of the University of Durham, both of the UK.

Sources

- IEEExplore
- ACM Digital Library
- Google scholar (scholar.google.com)
- ScienceDirect (www.sciencedirect.com)
- Engineering Village (EI Compendex and Inspec Archive) (https://www.engineeringvillage.com/)
- American Society for Engineering Education (ASEE) PEER (https://peer.asee.org/)

Example of specific searching: ACM Digital Library

(acmdlTitle:(online distance MOOC SPOC remote e-learn* eLearn* internet virtual*) OR recordAbstract:(online distance MOOC SPOC remote e-learn* eLearn* internet virtual*) OR keywords.author.keyword:(online distance MOOC SPOC remote e-learn* eLearn* internet virtual*)) AND (acmdlTitle:("software engineering" "requirements engineering" "software design" "software architecture" "software testing" "software project management") OR recordAbstract:("software engineering" "requirements engineering" "software design" "software architecture" "software testing" "software project management") OR keywords.author.keyword:("software engineering" "requirements engineering" "software design" "software architecture" "software testing" "software project management")) AND (acmdlTitle:(education training course* teach*) OR recordAbstract:(education training course* teach*) OR keywords.author.keyword:(education training course* teach*))

GSwE2009 Coding

Knowledge Area	Subject: Students	Subject: Ind. Prof.	Area Total
Ethics	1	0	1
System Engineering	3	0	3
Requirements Engineering	8	4	11
Software Design	13	3	15
Construction	9	4	11
Testing	8	5	11
Maintenance	5	2	5
Configuration Mgmt	1	0	2
Management	7	5	11
Process	7	3	9
Quality	5	2	7

SE2014 Coding

Knowledge Area	Subject: Students	Subject: Ind. Prof.	Area Total
Professional Practice	3	1	4
Modeling and Analysis	7	0	8
Req. Analysis and Spec.	8	4	11
Software Design	10	4	13
HCI	1	0	1
V&V	7	5	10
Software Process	12	6	16
Quality	5	2	7
Security	1	1	1