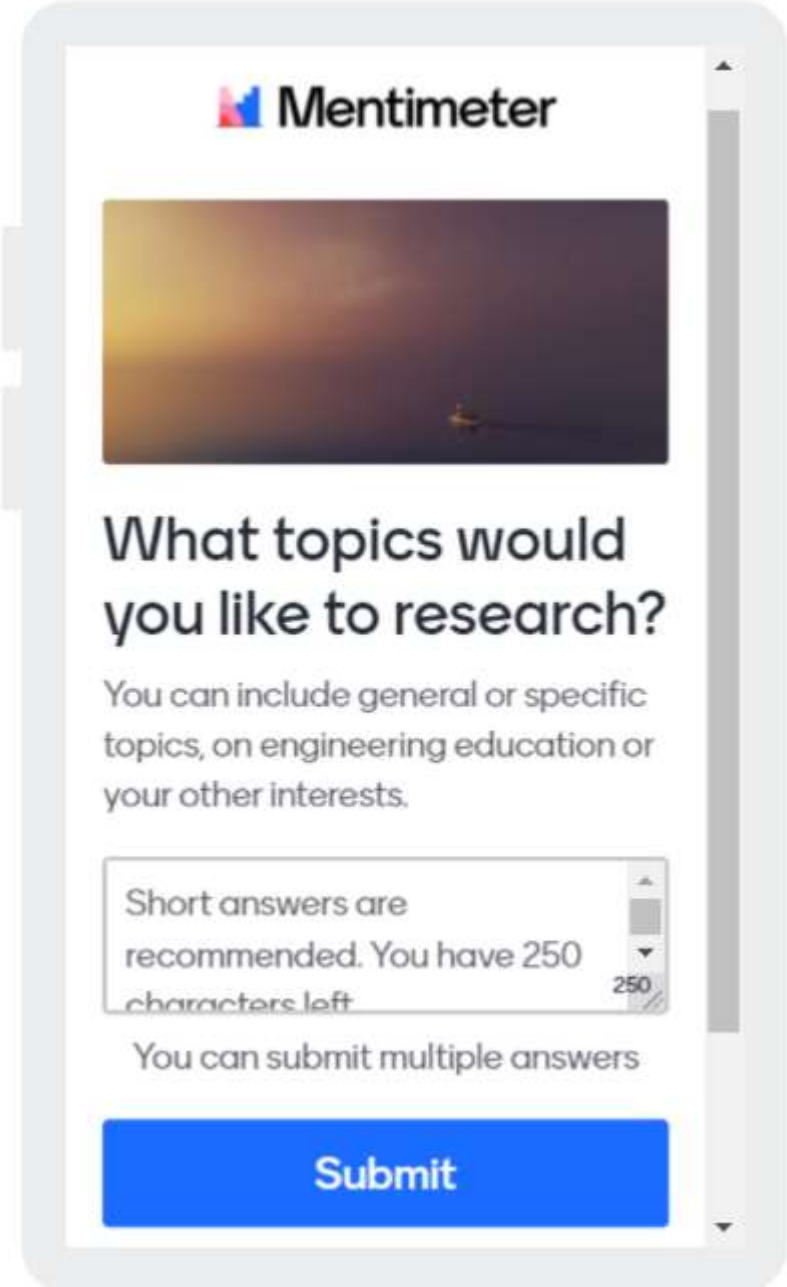


Welcome!

Go to **www.menti.com** and use the code **63 84 565.**

What topics would you like to research?

What topics would you like to research?

Learner autonomy

competence development

Sustainable development mindset

How can we support or trigger self-reflection of students?

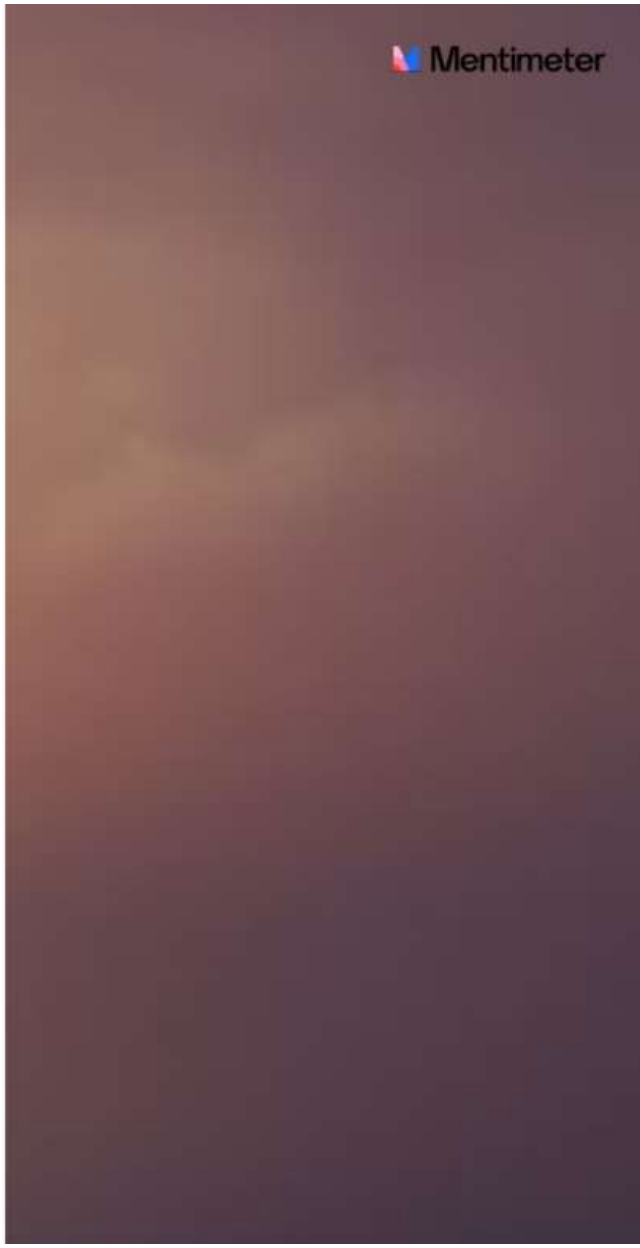
Digital learning environments for problem-based learning in engineering education

self-regulated learning

Didactics

Global responsibility

engineering ethics



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SEFI@work

Growth mindset and the art of performing a systematic literature review

Dr Anita Campbell

Academic Support Programme for Engineering

UNIVERSITY OF CAPE TOWN
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Developing growth mindsets in engineering students: Work-in-progress on a systematic literature review

SEFI Annual Conference
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COMPLEXITY IS THE NEW NORMALITY



Anita Campbell, Inês Direito, Mashudu Mokhithi
University of Cape Town and
University College London

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Volume 46, 2021 - Issue 4

Articles

Developing growth mindsets in engineering students: a systematic literature review of interventions

Anita L. Campbell, Inês Direito & Mashudu Mokhithi

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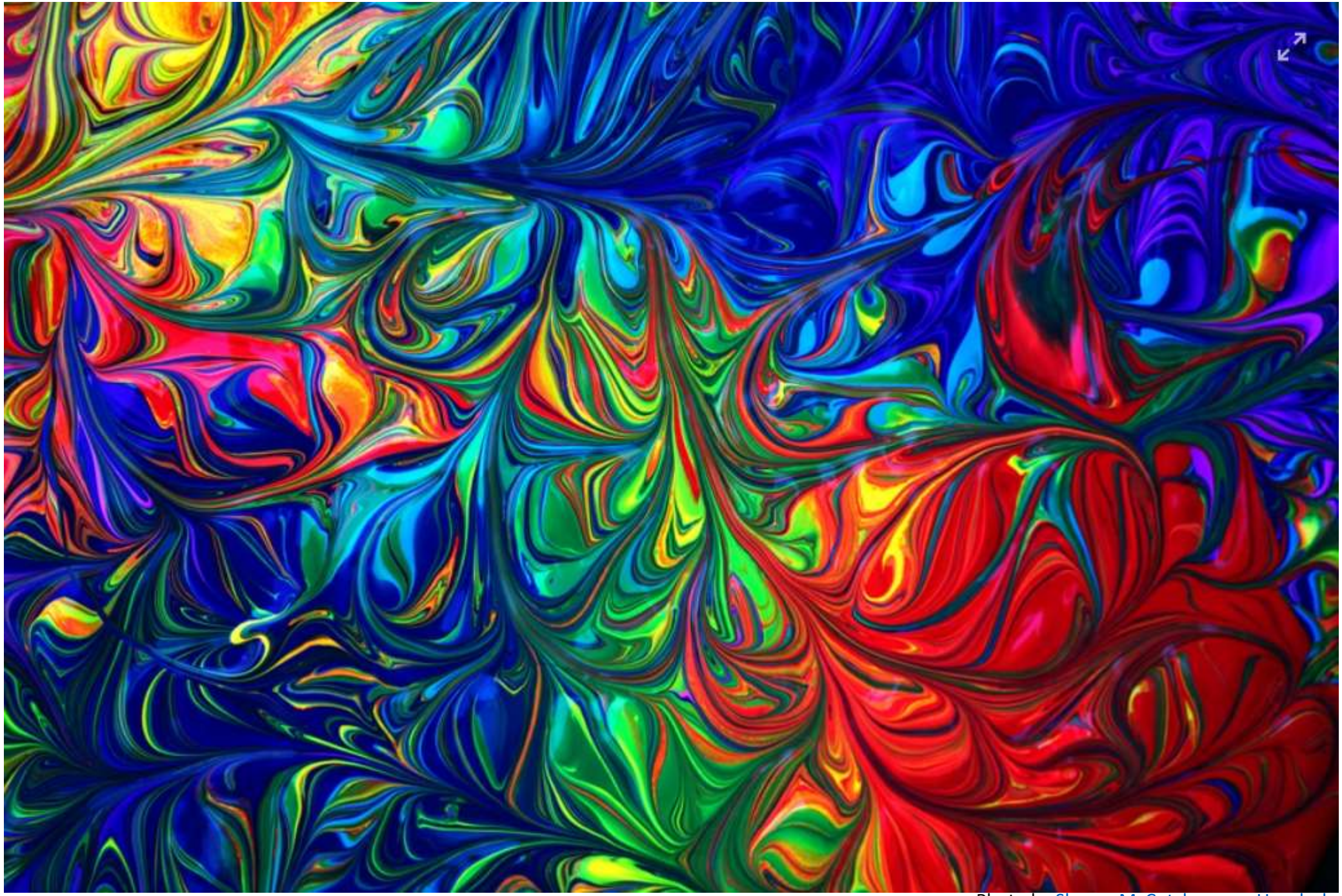

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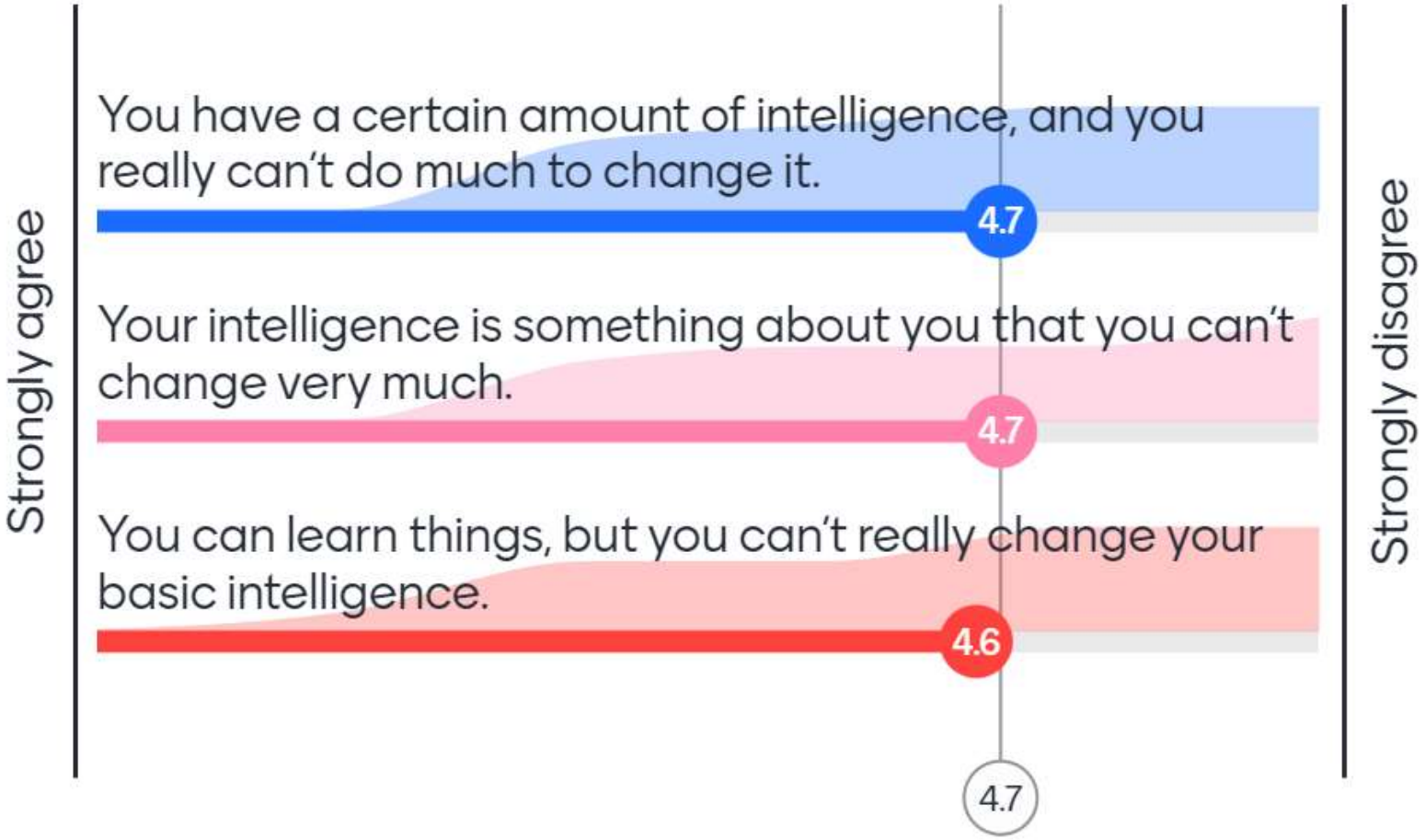
Where are you on the mindset spectrum?



Step 1:

Do you need to do a systematic literature review?

- Has one been done already?
- Would a scoping literature review be better?

Use a systematic literature review to …

- Uncover the international evidence
- Confirm current practice/ identify new practices / address variations
- Identify and investigate conflicting results
- Produce statements to guide decision-making
- Identify and inform areas for future research

- Munn, Z., Peters, M. D., Stern, C., Tufanaru, C., McArthur, A., & Aromataris, E. (2018). Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Medical Research Methodology*, *18*(1), 143. https://link.springer.com/article/10.1186/s12874-018-0611-x

Use a scoping literature review to …

- Identify the types of available evidence on a topic
- Clarify key concepts / definitions in the literature
- Examine how research is conducted on a certain topic or field
- Identify key factors related to a concept
- Identify and analyse knowledge gaps
- Direct a systematic review

Munn et al. (2018)

Systematic vs Scoping

Systematic literature review

- More focused
- Easier and faster
- Fewer citations to screen

Scoping literature review

- Needs multiple structured searches
- Good for a team to do

Other terms for a systematic literature review

“review of the evidence”

“comprehensive review”

“literature review”

“overview”

Google Scholar "systematic literature review" engineering

Articles About 106 000 results (**0,07** sec)

Any time
Since 2020
Since 2019
Since 2016
Custom range...

Sort by relevance
Sort by date

include patents
include citations

Create alert

[HTML] Systematic literature reviews in software **engineering**–a **systematic literature review**
B Kitchenham, OP Brereton, D Budgen… - Information and software …, 2009 - Elsevier
Background In 2004 the concept of evidence-based software **engineering** (EBSE) was introduced at the ICSE04 conference. Aims This study assesses the impact of systematic literature reviews (SLRs) which are the recommended EBSE method for aggregating …
Cited by 2371 Related articles All 23 versions

[HTML] Lessons from applying the **systematic literature review** process within the software **engineering** domain
P Brereton, BA Kitchenham, D Budgen, M Turner… - Journal of systems and …, 2007 - Elsevier
A consequence of the growing number of empirical studies in software **engineering** is the need to adopt systematic approaches to assessing and aggregating research outcomes in order to provide a balanced and objective summary of research evidence for a particular …
Cited by 1738 Related articles All 16 versions

[HTML] Motivation in Software **Engineering**: A **systematic literature review**
S Beecham, N Baddoo, T Hall, H Robinson… - Information and software …, 2008 - Elsevier
Objective In this paper, we present a **systematic literature review** of motivation in Software **Engineering**. The objective of this review is to plot the landscape of current reported knowledge in terms of what motivates developers, what de-motivates them and how existing …
Cited by 550 Related articles All 21 versions

Google Scholar

"systematic literature review" "engineering education" -"software engineering"

Articles

About 5 690 results (**0,24** sec)

Any time
Since 2022
Since 2021
Since 2018
Custom range...

Sort by relevance
Sort by date

Any type
Review articles

include patents
include citations

Create alert

The study of grit in **engineering education** research: a **systematic literature review**
I Direito, S Chance, M Malik - … Journal of **Engineering Education**, 2021 - Taylor & Francis
… Using methodological recommendations for conducting a **systematic literature review** in **engineering education** developed by Borrego, Foster, and Froyd (2014), this paper presents an overview of the publications that had, as of March 2018, reported empirical research on grit …
Save Cite Cited by 13 Related articles All 9 versions

[HTML] Conceptualizing authenticity in **engineering education**: A **systematic literature review**
J Wang, M Dyehouse, NR Weber… - 2012 ASEE Annual …, 2012 - peer.asee.org
… for K-12 **engineering education** curriculum developers based on thesefindings?MethodologyThe methodological framework for this study is a **systematic literature review** … Following theCRD guidelines of conducting a **systematic literature review**, we followed four major steps: (a)…
Save Cite Cited by 15 Related articles

Systematic literature reviews in **engineering education** and other developing interdisciplinary fields
M Borrego, MJ Foster, JE Froyd - … of **Engineering Education**, 2014 - Wiley Online Library
… Empirical studies of pair programming for CS/SE teaching in higher education: A **systematic literature review** Quantitative review of quantitative studies (also some qualitative discussion of a broader group) 10 databases, citations, conferences 73 Good adaptation of meta-…
Save Cite Cited by 404 Related articles All 5 versions

Step 2: Narrow the research question

Broad:

- What is know about X?

Narrow:

- Is X effective under particular conditions?
- What factors influence X?

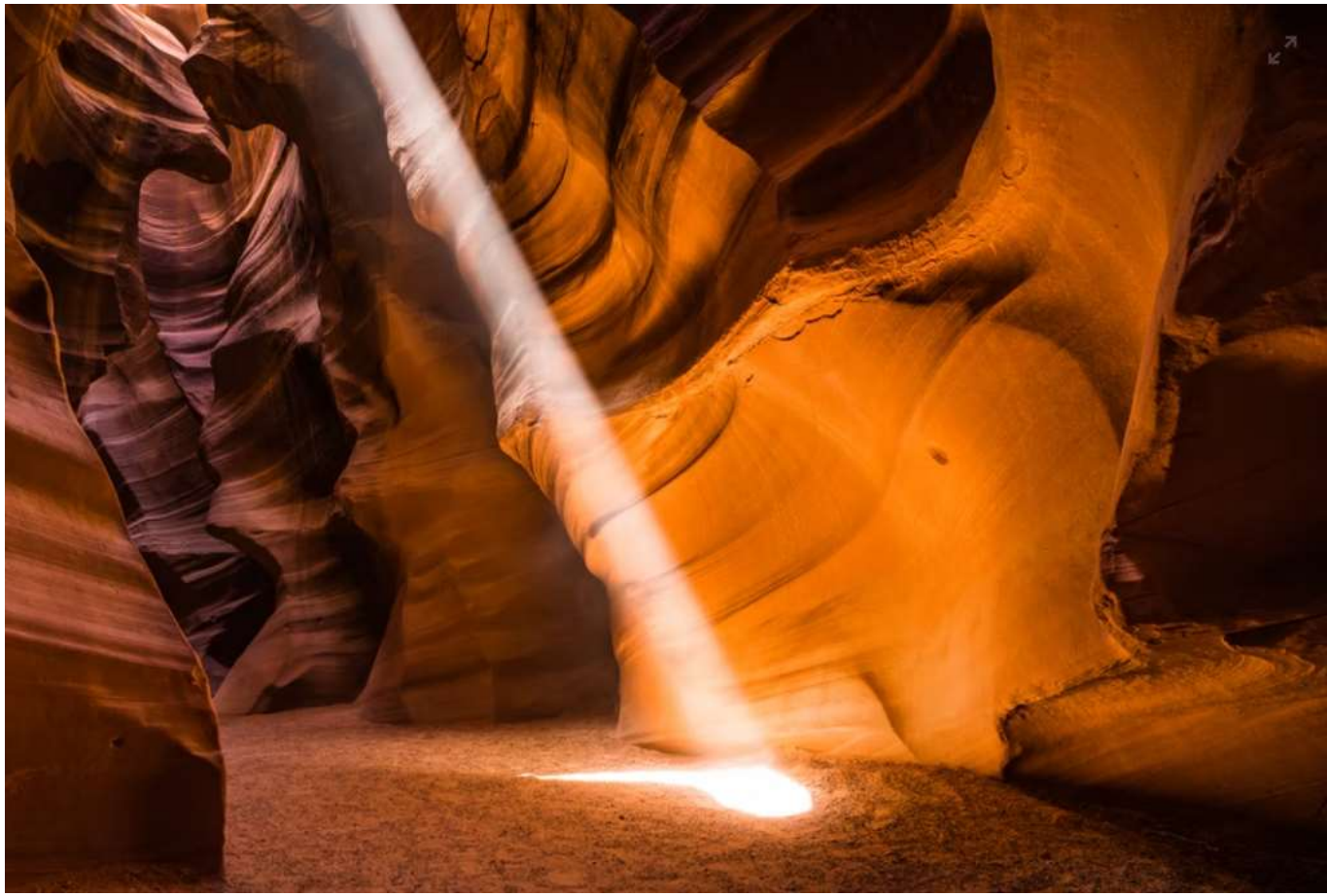


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Table 2 Example Systematic Review Questions for Effectiveness and Qualitative Reviews

Effectiveness examples	Qualitative examples
Which active learning pedagogies have been shown to increase conceptual understanding in engineering science courses?	How is engineering design conceptualized in K-12 formal and informal education?
What types of peer mentoring program designs effectively increase retention of engineering undergraduate students from underrepresented groups?	What barriers and perceptions prevent more engineering faculty members from using student-centered pedagogies?
Do engineering design activities in afterschool programs increase K-12 students' interest in engineering?	What reasons are given to explain underrepresentation of women in engineering in different countries or regions?
	How do students decide to persist or switch out of engineering during their first year of college?

Note. Adapted from National Institute for Health and Clinical Excellence (2009).

Borrego, M., Foster, M. J., & Froyd, J. E. (2014). Systematic Literature Reviews in Engineering Education and Other Developing. *Journal of Engineering Education*, *103*(1), 45–76. Retrieved from http://web.b.ebscohost.com.ezproxy.staffs.ac.uk/ehost/pdfviewer/pdfviewer?sid=9ec1bf6e-5e58-4156-b2c6-fa6dfaec9ec4%40sessionmgr112&vid=4&hid=122

Step 3:

Define inclusion criteria

- Which databases to search – See Borrego et al. (2014)
- Maybe include snowballing
- Define a search string
- Explain how this addresses research question

- Borrego, M., Foster, M. J., & Froyd, J. E. (2014). Systematic Literature Reviews in Engineering Education and Other Developing. *Journal of Engineering Education*, *103*(1), 45–76. Retrieved from http://web.b.ebscohost.com.ezproxy.staffs.ac.uk/ehost/pdfviewer/pdfviewer?sid=9ec1bf6e-5e58-4156-b2c6-fa6dfaec9ec4%40sessionmgr112&vid=4&hid=122

Table 3 Databases for Systematic Review Searches

Type of database	Examples
Subject specific databases	Education: ERIC, Education Full Text (EBSCO) Engineering: Compendex, Inspec Psychology: PyscINFO (ProQuest) Communication: Communication Abstracts (EBSCO), Communication & Mass Media Complete (EBSCO)
General databases	Academic Search Complete, JSTOR, Scopus
Journal databases	Science Direct, Wiley, Directory of Open Access Journals
Gray literature databases	Gray literature overall: OpenDOAR (Directory of Open Access Repositories), Open Grey, National Technical Information Service (NTIS), Google Conference papers: Conference Proceedings Citation Index (ISI), Proceedings First (OCLC) Dissertations/Theses: ProQuest Dissertations & Theses, Open Thesis Government documents: GOP Access, LexisNexis Books: World Cat, Google Books

Research questions

What interventions to develop growth mindsets have been implemented with engineering students, and what measures have been used to assess the effectiveness of the interventions?

Revised to:

1. How effective are different interventions to develop growth mindset in engineering students?
2. What measures have been used in assessing the effectiveness of these interventions?
3. Who benefited from these interventions, in terms of gender and year of study?

Method

Search terms were created to find studies that met the following conditions:

1. The research design involved an intervention aimed at developing growth mindsets.
2. The interpretation of ‘growth mindset’ aligned with Carol Dweck’s theory of mindsets.
3. The intervention involved engineering students in tertiary studies (college or university).

("growth mindset" OR "incremental mindset" OR "malleable intelligence" OR "implicit theories of intelligence")	**AND (“engineering student*” OR “engineering class”)**	**AND (intervention* OR experiment* OR compar*)**	**NOT “middle school”**

Tricks

- Where a database allowed, a **suffix of *** was used for multiple endings, e.g. compar* for compare and comparison.
- Some databases, e.g. Engineering Village, did not allow the use of * inside quotation marks.
- Where the **search string was too long** for the database (e.g. JSTOR), multiple searches were made to eliminate phrases that did not produce more results.
- Two **subject librarians** validated the iterative development of the search string and confirmed that it met the inclusion and exclusion criteria.

Revised search string

("growth mindset" OR "incremental mindset" OR "malleable intelligence" OR "implicit theories of intelligence")	AND (“engineering student*” OR “engineering class”)	AND (intervention* OR experiment* OR compar*)	NOT “middle school”

revised to:

("growth mindset" OR "growth mindsets" OR “fixed mindset” OR “fixed mindsets” OR "incremental mindset" OR "incremental mindsets" OR "malleable intelligence" OR "implicit theories of intelligence")	AND (“engineering student” OR “engineering students” OR “engineering class” OR “engineering classes” OR “engineering classrooms” OR “incoming first-year students”)	AND (intervention OR interventions OR experiment OR experiments OR measure OR measurement OR compare OR comparison)

Database	Total records	Duplicates	Excluded	Included
Engineering Village	16	2	9	5
Scopus	63	8	53	2
PsycARTICLES	30	0	29	1
ERIC	1	0	0	1
Education Database	14	1	13	0
ScienceDirect	5	0	5	0
PsycINFO	4	0	4	0
Wiley Online Library	2	1	1	0
Academic Search Premier	1	0	1	0
Directory of Open Access Journals	1	0	1	0
ECO Papersfirst	0	0	0	0
ECO Proceedings	0	0	0	0
JSTOR	0	0	0	0
Proceedings (OCLC)	0	0	0	0
Total	137	12	116	9

Database	Total records	Duplicates	Excluded	Included
Academic Search Premier	2	1	1	0
Education Database	87	19	67	1
Engineering Village	13	9	2	2
ERIC	3	2	0	1
JSTOR	3	2	1	0
Proquest Dissertations and Theses	373	40	327	6
PsycARTICLES	1	0	1	0
PsycINFO	2	2	0	0
ScienceDirect	7	0	7	0
Scopus	126	18	104	4
Web of Science	4	3	0	1
Wiley Online Library	21	5	16	0
Total	**642**	**101**	**526**	**15**

Category	Inclusion criteria	Exclusion criteria	Rationale
Publication type	Peer-reviewed journal articles, conference papers, books, book chapters and doctoral dissertations.	Not peer-reviewed.	Quality assurance of the research; more credible results.
Publication language	Publications in any language found from database searches using English search terms.	Article not able to be translated into English, or translation quality weak.	The number of translations required were small; including more studies increases the value of the review.
Participants	Engineering students and students sharing classes with engineering students.	Not involving engineering students as the group targeted for the intervention.	The research questions target engineering students in post-school settings.
Purpose of intervention	The intervention aims to develop growth mindsets, or changes in mindset are reported.	The intervention does not aim to develop growth mindsets, or there is no assessment of students' mindsets.	The research questions focus on developing growth mindsets.
Theory used	Dweck's (1986, 2008) theory of growth/incremental and fixed/entity mindsets.	A use of the term 'mindset' different from Dweck's theory.	The research questions focus on Dweck's theory of mindsets.
Outcome measures	An assessment of the effectiveness of the intervention is made.	No assessment of the intervention is made.	The research questions ask for measures for assessing the effectiveness of the intervention.
Date	Published before 1 January 2020 and after 31 December 1982.	Published after 1 January 2020 and before 1 January 1983.	A final check for new results was made on 1 January 2020. Dweck's work on growth mindsets was not available before 1983.

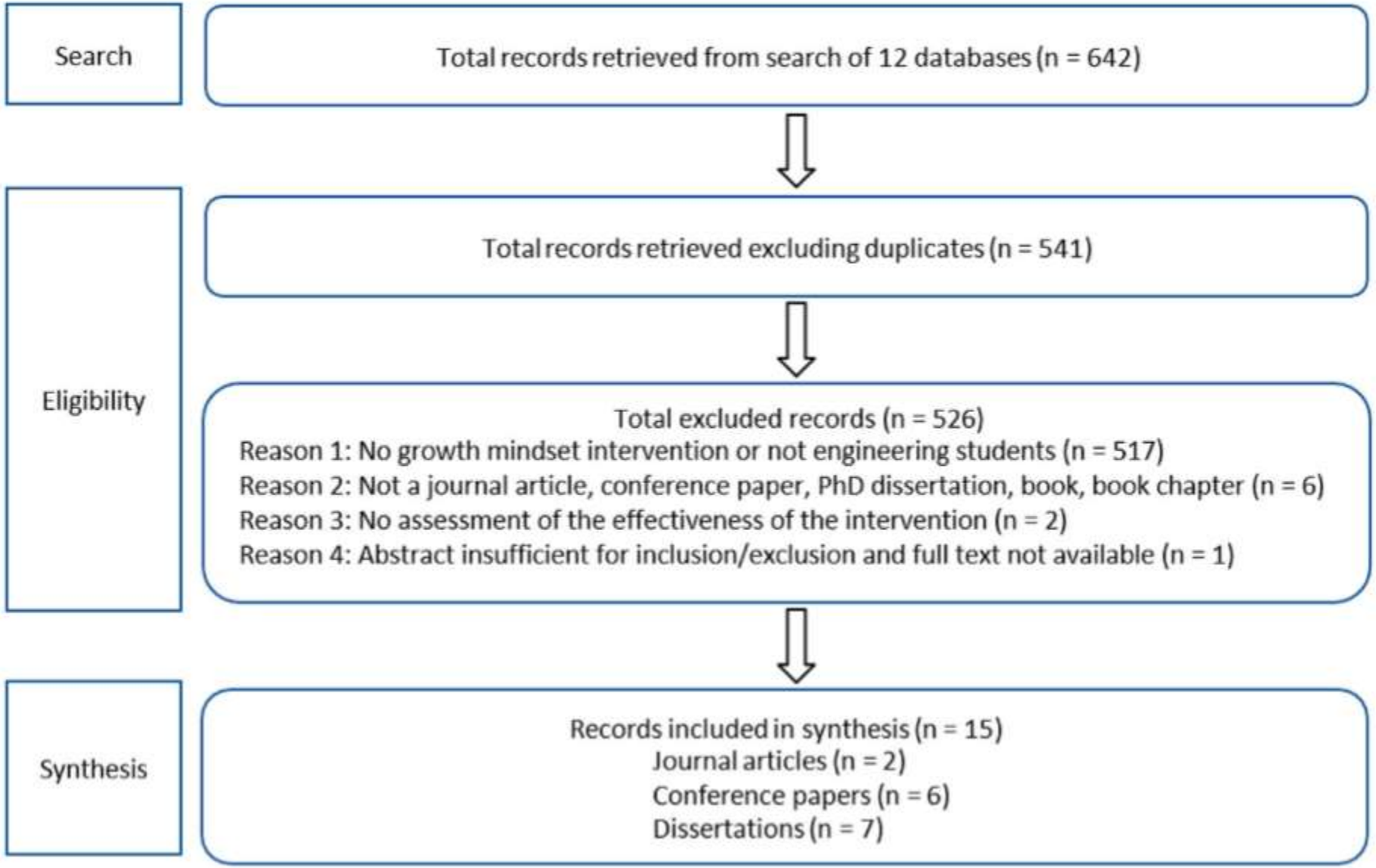

Figure 1. Flow diagram for the selection and analysis of included literature.

Campbell, Direito & Mokhithi (2021)

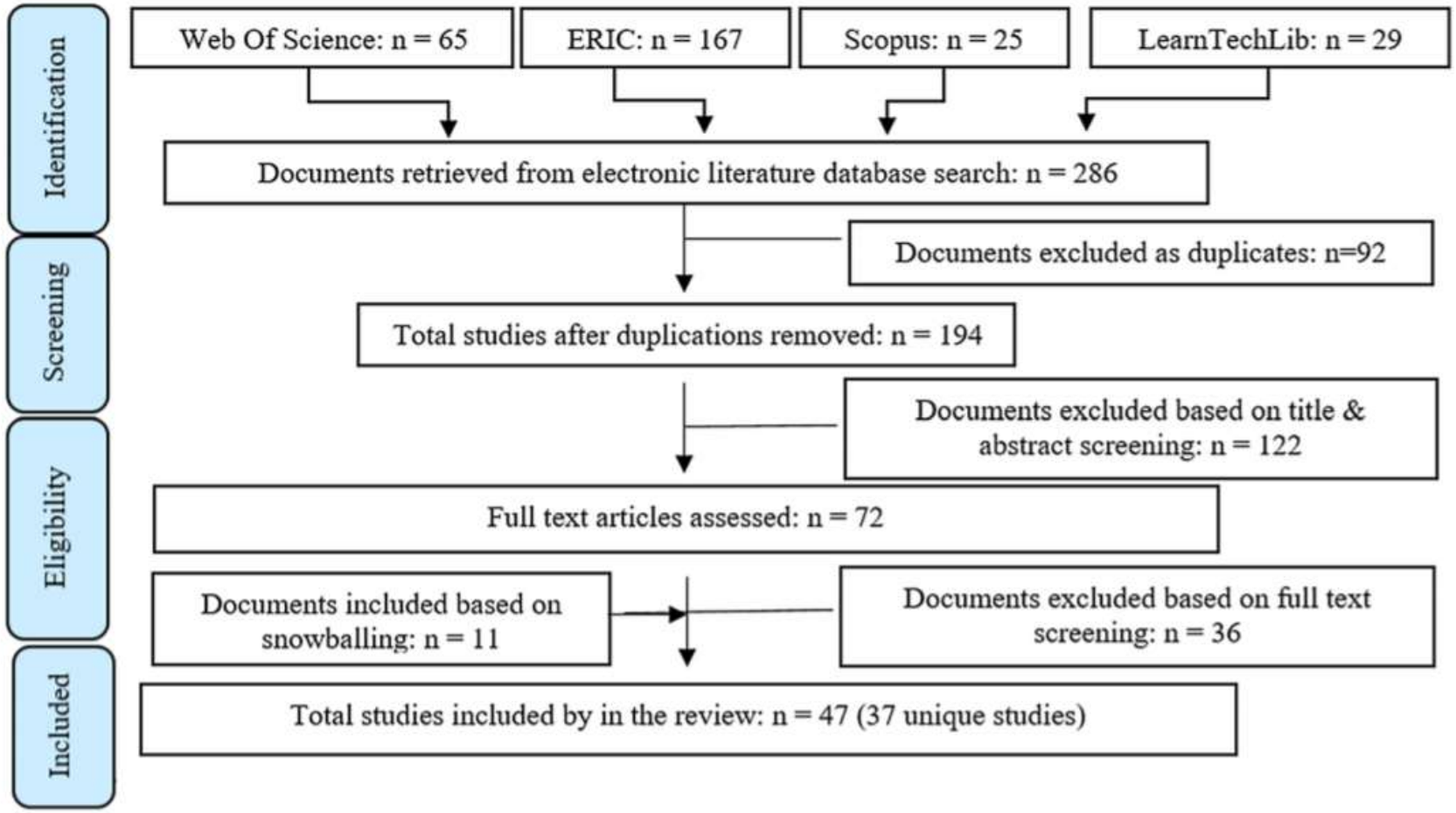

Fig. 3 Overview of the search conducted in May 2019 based on PRISMA statement

Raes, A., Detienne, L., Windey, I., & Depaepe, F. (2020). A systematic literature review on synchronous hybrid learning: gaps identified. *Learning Environments Research*, *23*(3), 269-290. https://link.springer.com/article/10.1007/s10984-019-09303-z

Recommendations to develop growth mindsets in engineering students

1. Introduce mindsets through **lectures or online tutorials** rather than readings.

2. Create opportunities to **discuss and reflect** on the importance of growth mindsets for learning.

3. Make students feel that their **written reflections will be of value to others**, either as advice for future students, or as part of graded coursework.

Questions are welcome!

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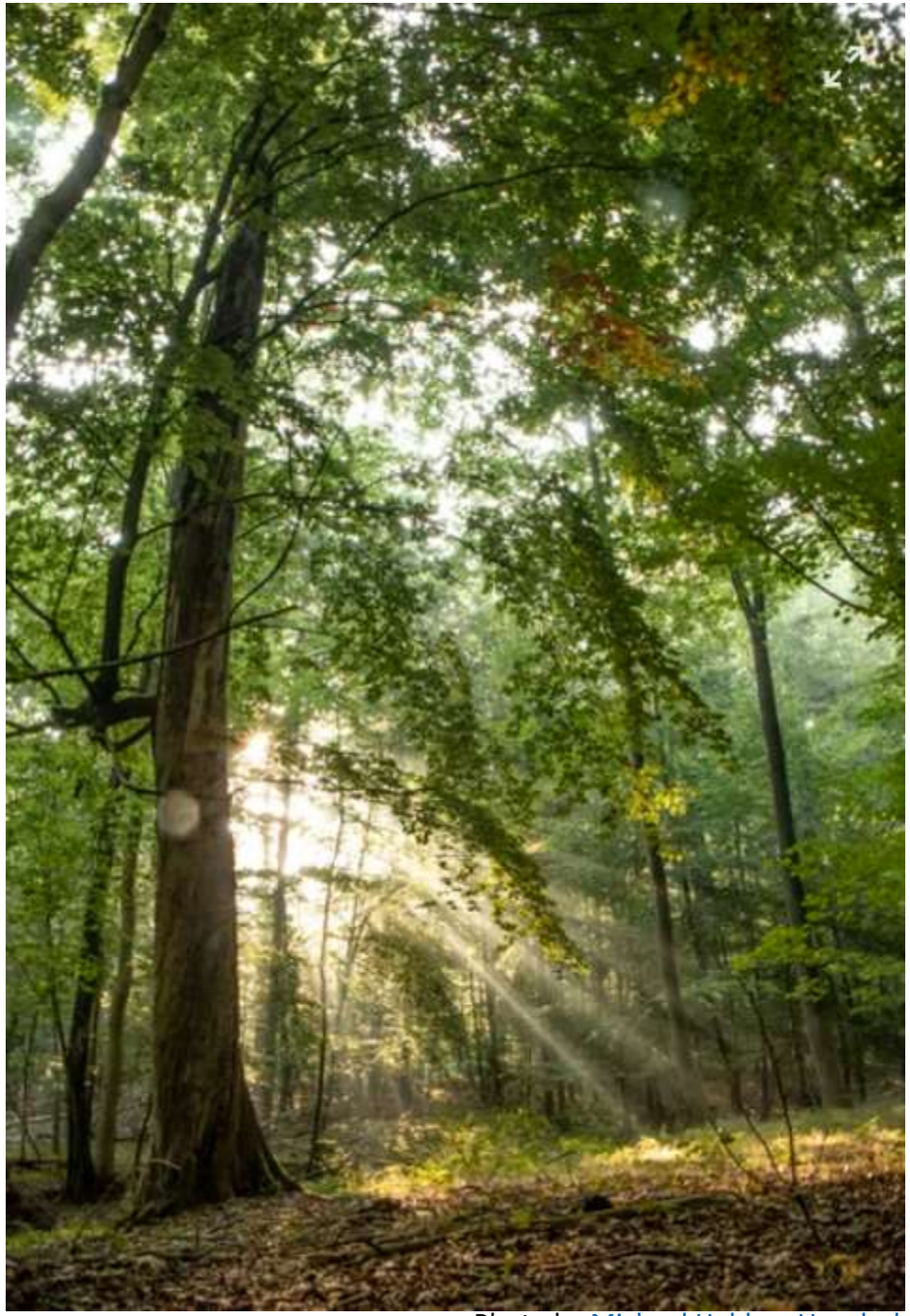
Photo by Sharon McCutcheon on Unsplash



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