Literature reviews: what, why and how

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What is a literature review?

It is …	It is not …
☐ an analysis/evaluation of a scholarly article	☐ a summary of an article
☐ a synthesis (connections/patterns)	☐ a chronological listing of events/content
☐ a presentation of an argument or comparison	☐

Why literature reviews?

- Learn from others
- Learn from yourself

- mental models
- mental magnets

Contemporary Issues in Technol

Think of how you can use new information, e.g. creating mental magnets

ways of thinking provide a mental framework for constructing K & approaching problem solving

computational thinking into core sub[...]rten to grade 12.

TCs' comments echo Papert's (1980) belief that young students need new cognitive models to be able to respond to the needs of the 21st century. More recently, Bower and Falkner (2015) argued that "preparing students to engage in current technologies and participate as creators of future technologies requires more than is currently being provided" (p. 37).

Attitudes Toward CT, Mathematics, and Teaching

TCs' expressed attitudes in relation to CT evolved throughout the Course. Table 3 shows how the expressions describing TCs' attitudes were distributed among the mind-maps and assignments.

Table 3
Frequencies of Expressions Related to CT

https://www.citejournal.org/volume-17/issue-4-17/mathematics/computational-thinking-in-mathematics-teacher-education/

Weeks

Mental model?

WAYS OF THINKING – SAMPLE QUESTIONS

The ways of thinking in the Digi Tech curriculum act as mental magnets bringing together relevant knowledge and skills to conceive of, and execute, digital solutions.

Computational Thinking	Design Thinking	Systems Thinking
• What is the problem? • What is causing the problem? • Have I seen this type of problem before? • What would solve the problem? • What data is needed to solve the problem? • What decisions do I need to make? • Are there any rules? • Are there any special requirements?	• Who will use or like this design? • What's the purpose of the solution? • Can I change a design I have used before? • What's the most important requirement of the design? • How should the solution work? • How will I know if my design will work? • What criteria will I use to decide on the best design idea for the solution?	• What are the parts? • What's the purpose of the system? • What will happen if I change part of the solution? • Who or what would benefit from the solution? • Who or what would be disadvantaged from the solution? • What parts of the solution are connected?

What is the structure (for our purposes)?

Asunda, P 2014, ‘A conceptual framework for STEM integration into curriculum through career and technical education’, *Journal of STEM Teacher Education,* vol. 49, issue 1, article 4.

There are three sections to each review: summary, analysis, reflection.

Summary

This article explores the benefits of an interdisciplinary STEM program in the quest for providing students with a holistic approach to problem-solving that reflects real-world practice. This is supported by a conceptual framework that comprises four constructs: systems thinking, situation learning theory, constructivism and goal-orientation theory.

Analysis

The author identifies several definitions of STEM including ‘STEM integration is an interdisciplinary teaching approach, which removes the barriers between the four [Science, Technologies, Engineering and Mathematics] disciplines’.

Asunda supports the generally agreed notion that STEM integration offers students the opportunity to learn about different concepts in a holistic fashion rather than learning about the individual pieces and assimilating them later.

Reflection

Asunda acknowledges that there is no ‘right’ way of integrating STEM into school programs; however, his contention that equal attention should be placed on at least two different disciplines in a learning period is interesting. It is also interesting to note Asunda’s contention about the role of standards in affecting student performance in this area.

How do you prepare the reviews?

Locate articles (authenticity, date, bias, relevance)

Curriculum Digital Tec

scholar.google.com/scholar?start=20&q=Australian+Curriculum+Digital+Technologies&hl=en&as_sdt=0,5

Facebook | Testimonials - Land... | TV Host (Volunteer)... | www.franciskurkdjia... | V8979 | Misses' Tun... | V1345 | Misses' Shir... | B561

S Edwards - European early childhood education research journal, 2013 - Taylor & Francis
… Faculty of Education, **Australian** Catholic University, Melbourne, **Australia** … The separation of play and **technologies** in early childhood **curriculum** documents persists despite rapid advances in the pace of digitisation in post-industrial societies (Hobbs 2010) and the …
Cited by 131 Related articles All 3 versions

ICT in the **Australian curriculum** — [PDF] ecu.edu.au
CP Newhouse - 2013 - ro.ecu.edu.au
… an online repository accessed through a tool known as Scootle (Education Services **Australia**, 2013) … **Australian Curriculum**, Assessment and Reporting Authority … Retrieved 12th November, 2012, from http://www.**australiancurriculum**.edu.au/GeneralCapabilities/Information-and …
Cited by 5 Related articles All 2 versions

Digital Technologies: A new **curriculum** implementation
N Reynolds, D Chambers - Society for Information **Technology** & …, 2015 - learntechlib.org
… a vision for **Australian** schooling through the creation of a common **curriculum** for **Australia** … **Digital Technologies Curriculum Digital Technologies** in the **Australian Curriculum** (and the draft AusVELS) is a 58 page document (http://www.**australiancurriculum**.edu.au …
Cited by 3 Related articles All 3 versions

✓

✗

FREE

PURCHASE

Process

Read the abstract

Digital Technologies: A new curriculum implementation

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Abstract: The release of a brand new curriculum containing, for the first time, a subject dedicated to Digital Technologies, provided the impetus for a small project that investigated school and teacher readiness for such a new initiative and the capacity of schools and teachers to understand and implement this curriculum. Through this project three approaches to curriculum implementation were identified and are presented in this paper. The project showed that when supported by a critical friend, teachers developed units of work that are appropriate and, at times, innovative responses to the curriculum and its intentions.

Process – reading the article

Read the article, asking key questions and using recording techniques

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Open Access Materials | Free Resources | Press and Media

Reading strategies: Differences between summarizing and synthesizing

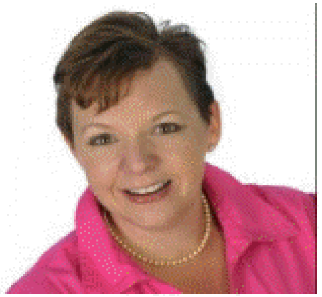
This semester I am teaching a course on Becoming an Effective Learner at the University of Calgary. I have asked my students to do a reading synthesis assignment on the different readings we have each week. In today's post I'm sharing some of the information I gave them about the differences between summarizing and synthesizing information in terms of reading strategies and research.

If you teach reading and you'd like to share it with your own students, you can download a copy here: difference-between-summarizing-and-synthesizing

Summarizing and synthesizing are both strategies used in reading and research. They are important skills, as they help learners make sense of what they reading.

Search

S. EATON



Dr. Sarah Elaine Eaton is an educational leader, researcher, author and professional speaker.

https://drsaraheaton.files.wordpress.com/2010/09/difference-between-summarizing-and-synthesizing.pdf

Process – asking key questions

Read the article, asking key questions and using recording techniques

What are the key concepts (connections to Digital Technologies)?

What is the focus and how relevant is it?

Are there any models/key theories?

What are the key findings? How relevant are they to Digital Technologies?

What are the results?

Is the research methodology valid?

Process – recording techniques

From Computational Thinking to Systems Thinking:

A conceptual toolkit for sustainability computing

author argues that CT tends not to consider the context (narrow or broad) within which the solution will apply

Steve Easterbrook
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empowers students to shape/control preferred futures

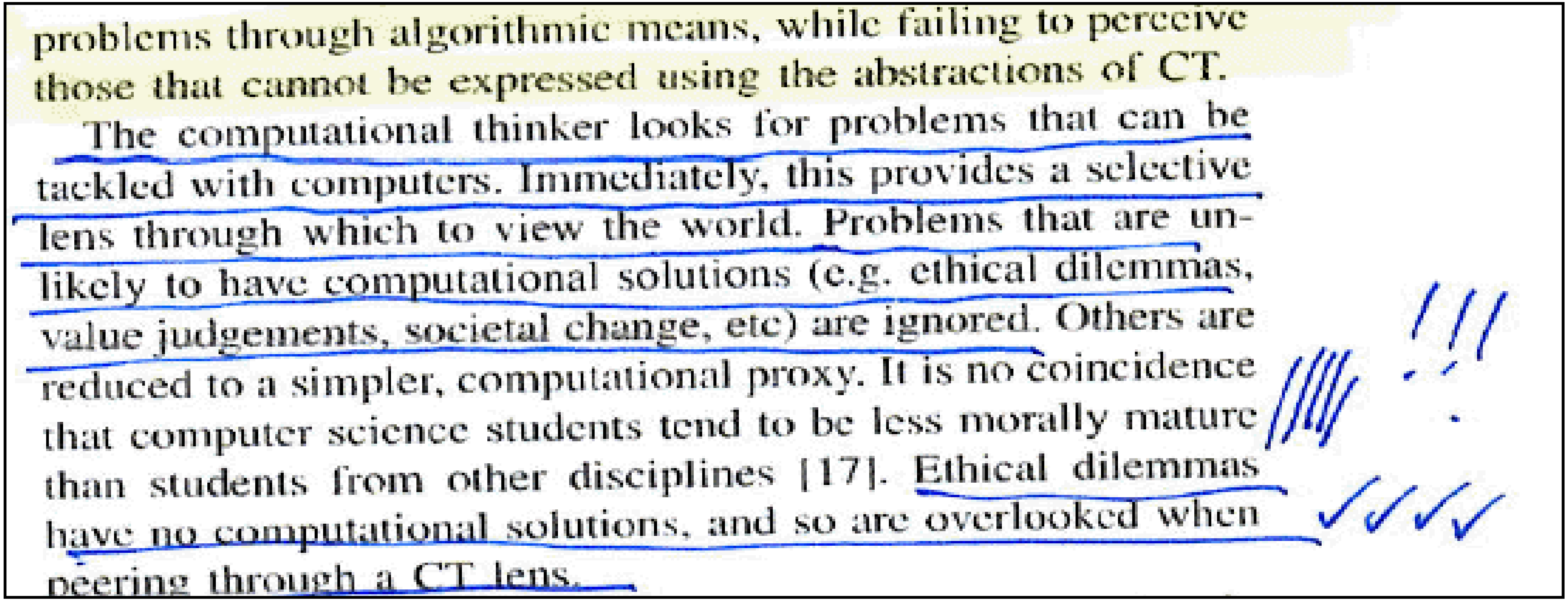
Abstract—If information and communication technologies (ICT) are to bring about a transformational change to a sustainable society, then we need to transform our thinking. Computer professionals already have a conceptual toolkit for problem solving, sometimes known as *computational thinking*. However, computational thinking tends to see the world in terms a series of problems (or problem types) that have computational solutions (or solution types). Sustainability, on the other hand, demands a more systemic approach, to avoid technological solutionism, and to acknowledge that technology, human behaviour and environmental impacts are tightly inter-related. In this paper, I argue that *systems thinking* provides the necessary bridge from computational thinking to sustainability practice, as it provides a

This growing consumption of ICT products is driven, in part, by an alarming set of technology industry trends, all of which push society further away from a sustainable level of consumption of energy and material goods. These are largely unacknowledged in the mainstream computing literature:

- A computer industry that sells gadgets with ever shorter shelf-lives, without regard to environmental and social impact of their manufacture, and disposal of the resulting e-waste [6].
- A tendency towards *technological solutionism*, which treats complex societal problems in a simplistic way, such

Process – recording techniques

Read the article, asking key questions and using recording techniques



problems through algorithmic means, while failing to perceive those that cannot be expressed using the abstractions of CT.

The computational thinker looks for problems that can be tackled with computers. Immediately, this provides a selective lens through which to view the world. Problems that are unlikely to have computational solutions (e.g. ethical dilemmas, value judgements, societal change, etc) are ignored. Others are reduced to a simpler, computational proxy. It is no coincidence that computer science students tend to be less morally mature than students from other disciplines [17]. Ethical dilemmas have no computational solutions, and so are overlooked when peering through a CT lens.

!!!

Process – recording techniques

Read the article, asking key questions and using recording techniques

Voskoglou, M & Buckley, S 2012, 'Problem solving and computers in a learning environment', *Egyptian Computer Science Journal*, ECS, vol. 36, no. 4, pp. 28–46, September

Idea/topic	**Page**	**Quote/paraphrasing**
Definition of problem-solving	30	'activity that makes use of cognitive or cognitive and physical means to overcome obstacles (problem) and develop a better idea of the world that surrounds us'. PS is at the heart of mathematics and Digi Tech
When should computational thinking be taught?	33	Authors contend that CT needs to be taught *early* and *often*. Students must be good users of digital tools and great creators of digital tools (solutions)
CT and programming	34	CT develops skills in logic, reasoning, creativity and helps develop inventiveness and innovative thinking. 'CT is a learned approach and there's no better way to learn it explicitly than through programming.

Process – language use

Writing the review

You can indicate your attitude to the sources you cite by choosing specific verbs to refer to them. Don't just keep repeating "Smith says." There is a wide choice of such verbs in English. Use a dictionary to check that you have chosen a verb with the nuance you intend.

Here are some grammatical patterns to follow in using these verbs: **Pattern 1**: *reporting verb* + **that** + *subject* + *verb*

acknowledge	admit	agree	allege	argue
assert	assume	believe	claim	conclude
consider	decide	demonstrate	deny	determine
discover	doubt	emphasize	explain	find
hypothesize	imply	indicate	infer	note
object	observe	point out	prove	reveal
say	show	state	suggest	think

https://advice.writing.utoronto.ca/english-language/referring-to-sources/

Process – language use

Some language for talking about texts and arguments:

It is sometimes challenging to find the vocabulary in which to summarize and discuss a text. Here is a list of some verbs for referring to texts and ideas that you might find useful:

account for	clarify	describe	exemplify	indicate	question
analyze	compare	depict	exhibit	investigate	recognize
argue	conclude	determine	explain	judge	reflect
assess	criticize	distinguish	frame	justify	refer to
assert	defend	evaluate	identify	narrate	report
assume	define	emphasize	illustrate	persuade	review
claim	demonstrate	examine	imply	propose	suggest

Process – refining techniques

Writing the review

First, correctly reference the article.

Second, write general comments, in sentences.

Third, select important comments and highlight them.

Voskoglou, M & Buckley, S 2012, 'Problem solving and computers in a learning environment', *Egyptian Computer Science Journal*, ECS, vol. 36, no. 4, pp. 28–46, Sept

This article explores the relationship between computation and critic solving technological problems.

The research evidence strongly suggests that using computers to sol abilities in solving real-world problems involving mathematical mode

The authors explore the meaning of problem-solving, critical thinking a and the relationship between them.

The authors contend that while there is no universally accepted definition of **critical thinking** there is a general consensus that it involves the skills of making judgements, analysis and synthesis, generalisations and drawing conclusions. Critical thinking is needed to solve problems, and when this process involves the use of computers, it also draws on computational thinking skills. Levels of automation afforded by digital devices frees up memory to focus more on the nature of problems and possible solutions.

V & B define critical thinking as the ability to rationally arrive at a con substantiated using valid information.

V & B define **problem-solving** as an 'activity that makes use of cognit means to overcome obstacles (problem) and develop a better idea o (page 30) PS is at the heart of mathematics.

The authors explain that critical thinking is a high-order level of thinking—it is and involves analysis, synthesis and evaluation. This is a precursor to problem-solving that involves estimating, predicting, generalizing and creative thinking.

But when we are solving technical problems we need to also employ a pragmatic or practical way of thinking. This way of thinking is referred to as computational thinking, which combines mathematical and engineering knowledge and skills to understand and solve complex problems. The authors contend that CT has a strong analytical focus, though acknowledge it is a hybrid of other modes of thinking: abstraction, logical thinking, modelling and constructive thinking.

CT involves being able to formulate a problem and express a solution that can be carried out by a digital system. According to the authors computational thinking needs to be taught early and often as we need to skill students who are not only good at using digital tools but also at creating digital tools/solutions. (page 33)

Modelling thinking involves using equations/symbols/structures to represent real-world situations.

CT the use of critical thinking using computer science concepts and techniques so CT is a prerequisite to problem solving. However the authors argue th applied depend on the problem, however, they

- Critical thinking and CT
- Problem-solving

Key elements of CT are abstraction and PS. Abst The authors define a problem as having three st obstacles to get from the starting point to the g

CT develops skills in logic, reasoning, creativity a thinking. CT has 'created a way of thinking that is only ju g to generate enormous change and benefits' (Einhorn, S., "Micro-Worlds, Computational Thinking, and 21st Century Learning", *Logo Computer Systems Inc, White Paper*, 2012. 'CT is a learned approach and there's no better way to learn it explicitly than through programming.' (page 34)

Importantly the authors contend that CT is 'an important, essential and very truly 21st century skill … that is best learned through experience, interactions and actively doing'. (page 35) **the authors also contend that CT is now an intrinsic part of our lives as a world without computers in unthinkable.**

Opinion
The Digital Technologies curriculum requires students to apply computational, design and systems thinking when defining a problem: what are the elements of the situation (starting state), what is needed to solve the problem (goal state) and what are the constraints on achieving the solution (obstacles).

DRAFT

Process – refining techniques

Writing the review

...e concepts and techniques so CT is a prerequisite
...order in which these types of thinking are
...develop and then applied to solve a problem.:

Problem solving

Key elements of CT are abstraction and PS. Abstraction involves
The authors define a problem as having three states: a starting state; the goal state and the obstacles to get from the starting point to the goal state.

CT develops skills in logic, reasoning, creativity and helps develop inventiveness and innovative thinking. CT has 'created a way of thinking that is only just beginning to generate enormous changes and benefits' (Einhorn, S., "Micro-Worlds, Computational Thinking, and 21st Century Learning", *Logo Computer Systems Inc, White Paper*, 2012. 'CT is a learned approach and there's no better way to learn it explicitly than through programmi...

Importantly the authors contend that CT is 'an im... kill ... that is best learned through experience, intera... s also contend that CT is now an intrinsic part of ou... unthinkable.

Key finding

- Use of computers as a tool for problem-so... world problems involving mathematical m...
- Technological problems require a different ... ake the computer think like them – this involves comp... inking – the application of computer science concepts.

Reread your review and list key findings, taking into account any new comments.

Critical thinking plays a central role in knowledge acquisition and creation, in computational thinking and thus in real complex technological problems (page 41)
Opinion
The Digital Technologies curriculum requires students to apply computational, design and systems thinking when defining a problem: what are the elements of the situation (starting state), what is needed to solve the problem (goal state) and what are the constraints on achieving the solution (obstacles).

Voskoglou, M & Buckley, S 2012, 'Problem solving and computers in a learning environment', *Egyptian Computer Science Journal*, ECS, vol. 36, no. 4, pp. 28–46, September

Summary
This article explores the relationship between comp... solving technological problems. Research evidence ... suggests that using computers to solve problems e... problems involving mathematical modelling.

Structure your review (summary, analysis, reflection elements) and check for coherence between the elements, and accuracy.

Analysis
The authors contend that while there is no univers... a general consensus that it involves the skills of ma... generalisations and drawing conclusions—thinking ... substantiated using valid information.

However, the authors argue that when solving technological pr...ms, this requires a combination of critical thinking and **computational thinking**. This is because technical problems require a more pragmatic or practical way of thinking, drawing on mathematical, engineering and computer science concepts and techniques. At its broadest definition, the article defines computational thinking as the ability of formulate a problem and express a solution that can be carried out by a digital system.

The authors (page 35) argue that CT is 'an important, essential and very 21st century skill' and that the best way of teaching this is through active and regular learning. Together, computational thinking and critical thinking support the solving of technical problems, and in today's world a life without computers is unthinkable.

According to the authors, computational thinking needs to be taught early and often as we need to skill students who are not only good at using digital tools but also at creating digital tools/solutions.

Reflection
The conclusions drawn by the article show that critical thinking plays an active role in knowledge creation and combined with computational thinking they support the solving of real complex technological problems, which is at the core of the Digital Technologies curriculum. Together the Critical Thinking General Capability and Digital Technologies in the Australian Curriculum support knowledge creation and problem-solving in a contemporary, technological world.

Easterbrook – the review

Harvard referencing system

Easterbrook, S 2014, ‘From computational thinking to systems thinking’, *Proceedings of the 2nd International Conference on Information and Communication Technologies for Sustainability (ICT4S2014), 24–27 August 2014*

Summary

This article explores how the relationship between systems thinking and com
would provide a conceptual basis for transformational change–change that
environmental impact of technology. The article contends that supplementi
thinking with systems thinking will minimise the weakness of computational t
reductionist in its focus (technological solutionism), to encourage the solving of ‘wi s or
dilemmas that consider social and environmental sustainability. The focus on the opt sation and
automation of existing ways of doing things associated with computational thinking should be
counter-balanced by systems thinking that takes into account the dynamics of society and is future-oriented.

Key ideas/contentions are stated – detail is hidden. No evaluation.

Easterbrook – the review

Analysis

The author challenges the rise of computational thinking in educational programs because it assumes that complex problems can be solved through algorithmic means, which provides a 'selective view through which to view the world'. He contends that this eliminates ethical dilemmas, such as sustainability, because they have no computational solution. Easterbrook argues that computational thinking is often applied with limited consideration of the context within which solutions will apply.

Easterbrook challenges why there has been limited critical thinking about computational thinking, given its reductionist approach. He argues that computational thinking only considers how problems can be formulated in a way that enables us to use a computer to solve them; meaning that little thought is given to the ongoing relationships between the stakeholders who will be affected by the solutions. This he asserts means that reducing problems to their computational components leads to practices that undermine sustainability.

The author posits that 'wicked' (or dilemma) problems, namely ones that don't have clear problem definitions and objectively correct solutions, should feature more prominently in our teaching and learning programs, such as sustainability. He contends that systems thinking provides students with a toolkit for reasoning about how change happens in complex systems. Systems thinking brings a critical approach to solving wicked problems because it encourages exploring the interdependencies between components and systems, hence fostering a greater appreciation of the systemic effects of solutions.

Appropriate language

Selection of ideas relevant to Digital Technologies (ways of thinking, ethics, sustainability, stakeholders [interactions and impact])

Synthesis of key ideas/concepts and presentation of arguments

Easterbrook – the review

Reflection

This article supports the inclusion of the three ways of thinking in the Digital Technologies curriculum (computational, design and systems thinking) and the focus on preferred futures. It provides a strong reminder of the complexity of some problems and how we should scaffold the types of problems solved by students through their learning journey (simple problems, simple solutions, complex problems). Posing some problems as dilemmas (or wicked problems) could encourage teachers and students to take a multifaceted approach to problem-solving.

Connects key ideas/concepts to Digital Technologies curriculum

Makes connections between key findings and teaching and learning

Evaluates the usefulness of the article to Digital Technologies

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