2.16

Information Literacy

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The growing complexity of engineering problems means that engineers spend an increasing amount of time working with information from multiple disciplines, making information literacy (IL) a critical skill. Despite this, there is evidence to suggest that engineering students lack confidence and ability to select, evaluate, and use different sources, which is likely to hinder engineering practice and raises ethical concerns in both education (e.g., academic misconduct) and the workplace (e.g., professional responsibility). In this chapter, we first define IL in relation to associated concepts. This is followed by an introduction to key frameworks and standards that outline essential competencies and skills. We then examine the growing importance of IL in the context of technological advances, including the exponential rise in available information and the increasing use of generative artificial intelligence (GenAI). Finally, we explore practical strategies for embedding IL into engineering education, highlighting collaborative approaches that involve specialists such as subject librarians to support effective scaffolding of IL competencies and skills.

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1 Definition

Developing information literacy (IL) in engineering students involves agreeing upon a shared understanding of what IL means within the context of engineering education, as well as the competencies and skills involved. Establishing this consensus first requires differentiating information from related concepts including knowledge and data, as well as understanding the hierarchical relationship between them (Ackoff, 1989).

In the context of engineering, data includes "*measurements, surveys and observations*", which are unusable and "*need to be processed in some way to yield information*" to assist engineers in performing their role (Brodie & Brodie, 2009, p. 138). Knowledge is treated as a special form of information, recalled from memory and "*frequently applied in the day-to-day role of an engineer*" (Brodie & Brodie, 2009, p. 139). New knowledge is thus created when "*we interpret information in light of our prior knowledge*" (Trevelyan, 2014, p. 103). The hierarchical nature of this relationship means that each level can be seen as a precursor to the next and thus data literacy can be viewed as a sub-competence of IL (Schield, 2005).

Although several IL competency standards and frameworks exist across higher education (e.g., ALA, 2000; Bent & Stubbings, 2011), here we draw upon that which the Association of College and Research Libraries (ACRL) provide specifically for science, engineering and technology disciplines. The ACRL defines IL as "*a set of abilities to identify the need for information, procure the information, evaluate the information and subsequently revise the strategy for obtaining the information, to use the information and to use it in an ethical and legal manner, and to engage in lifelong learning*" (ACRL, 2006). It provides five information literacy standards which we will use to inform the definition of IL used in this chapter:

1. Determining the information needed to answer a question or solve a problem.
2. Obtaining the information effectively and efficiently.
3. Critically evaluating the information and its sources and deciding whether to seek additional sources or modify the search process.
4. Using information ethically and legally to complete the given task.
5. Understanding IL as an ongoing process and recognising the need to keep abreast of new developments in the field.

This definition highlights the way that IL intersects with other competencies and skills including lifelong learning, for which it "*forms the basis*" (ALA, 2000, p. 207). Within engineering education research specifically, IL has been identified as one of six major clusters of lifelong learning competencies (Van den Broeck et al., 2024). Furthermore, access to information is increasingly via technology, thus requiring a need to be digitally literate, with Fan and Wang (2022) including information skills as one of five key aspects of digital skills. Bruce (1997) introduces information technology literacy (ITL) as a concept which influences and coexists with IL, and which is defined as "*the knowledge which allows an individual to function efficiently and effectively in whatever circumstance one finds him/herself in a technologically oriented society*".

IL competencies therefore allow engineering students to engage with a broad spectrum of information in an ethical and efficient manner.

2 Why teach information literacy

Although IL "*is a concern to all sectors of society*" and "*a prerequisite for participating effectively in the information society*" (Information Literacy Meeting of Experts, 2003, p. 1), it is particularly important within the field of engineering for several reasons. Firstly, studies focused on engineering work have highlighted the importance of IL in engineering practice, with Robinson (2010) finding that over 55% of the engineer's workday was spent on the acquisition and provision of knowledge, and Allard et al. (2009) determining that engineers spend one quarter of their time on information-related tasks. Furthermore, the accurate extraction and use of information is considered as fundamental to ethical and responsible practice (Faber et al., 2022), with Messer et al. (2005, p. 4) claiming it allows engineers "*to use the appropriate information, sustainably, ethically and professionally*". The ACRL (2006) refers to "*unique challenges*" faced by engineering and science disciplines because of their interdisciplinary nature, requiring "*students demonstrate competency …in unique areas such as experimentation, laboratory research, and mechanical drawing*". They also claim that it is "*highly important for students in science and engineering/technology disciplines*" which are "*rapidly changing*", with the curriculum of technical degrees being estimated to have a half-life of less than five years (National Academy of Engineering, 2004). IL is thus a key competency for lifelong learning (Tuyaerts et al., 2025; Van Den Broeck et al., 2024; Wertz et al., 2013), and enables engineers to "*to keep up with new developments and new sources of experimental/research data*" (ACRL, 2006) and adapt to the changing needs of society and technological innovations (Faber et al., 2022).

This need for engineers and students to adapt has become increasingly important in recent decades as digitalisation and widespread use of generative artificial intelligence (GenAI) have led to the spread of deliberately misinterpreted or misleadingly prepared information (Schüller, 2020). Large language models (LLMs) are associated with several limitations in that they can provide incomplete, inconsistent, incoherent, illogical, and indulgent information, meaning that "*AI may promote confirmation bias or path dependency by only telling you what it thinks you want to hear*" (Carroll & Borycz, 2024, p.6) and tend to hallucinate scholarly citations and false information (Chaudhuri & Terrones, 2025).

These trends have resulted in an increased focus on the development of IL competencies and skills, particularly those related to critical evaluation. This growing emphasis on IL is evident by its inclusion within various nationally and globally recognised engineering accreditation criteria (e.g., ABET, 2025; ENAEE, 2021), with Riley et al. (2009, p. 2) claiming that "*students cannot achieve many of the ABET outcomes without developing information literacy skills*".

Despite recognition of the growing importance of IL, evidence from the engineering education literature suggests that students are not adequately equipped with IL competencies and skills. For example, both Douglas et al. (2014) and Ross et al. (2011) found first-year engineering students to be overconfident in their ability in IL, with other work finding that first-year students struggle with applying and documenting information during design work (Wertz et al., 2013). Other studies have found that students have trouble differentiating between different types of sources, spend little time gathering information, make little use of references, have issues with citation styles and have a lack of ability to assess the quality of information, evaluate web resources, and use technical papers (Ekwaro-Osire et al., 2008; Tsai & Janssen, 2018). There is also reason to believe that IL education may not sufficiently prepare students with the competencies and skills needed for work as engineers, suggesting the need for authentic interventions, by which we mean those which include the use of sources typically used by engineers within their work (e.g., patents, standards, test data), to address realistic engineering problems. For example, engineers have been found to rely on knowledge of contacts and have less access to knowledge behind a paywall (e.g., Manuel et al., 2005; Paretti & Asaro, 2008), with Phillips et al. (2019) finding that although engineering students and professionals regularly make use of search engines such as Google, practicing engineers lack sufficient access to resources; instead, they tend to consult with peers and make use of propriety information.

3 Forms of implementation

3.1 Integration of IL within individual modules and entire programmes

You can incorporate IL into teaching in a variety of ways at module and programme level, the latter allowing for scaffolding and progressive development of IL based competencies and skills. For example, undergraduate instruction may focus on identification and selection of credible sources and citation practices. At graduate level, students are more concerned with developing as independent researchers and therefore need to be able to evaluate information and identify limitations and gaps in literature to inform future research topics (Smyser & Bolognese, 2023).

At a module level, you can incorporate IL into general engineering classes (e.g., searching for books in the library and practicing citation) or by demonstrating engineering- focused databases and technical standards (Phillips et al., 2018). For example, in the case of the former, IL could be considered as integral to first-year engineering modules, in which students are taught foundational skills necessary to be successful in disciplinary study and the engineering profession (Faber et al., 2022). In comparison, interventions with a technical or subject focus can be included within design modules at different levels (e.g., introductory to capstone) (Phillips et al., 2018). To this end, Fosmire (2012, p. 47) claims that "*engineering design problems provide a real-world context for the underlying skills and techniques that students learn during their coursework*", and Atman et al. (1999) describe a relationship between design quality and breadth and depth of information obtained.

While individual modules play a vital role in reinforcing IL skills, the lack of scaffolding and inconsistency in approaches used (Ford-Baxter et al., 2022; McAdams &

Glauberman, 2017) suggests the need for programme-wide integration, which helps ensure consistency and progressive development. Williamson et al. (2019) describe a strategic, top-down approach to the incorporation of IL within engineering, involving building relationships with academic stakeholders and the use of hands-on modules and specific instruction throughout a degree. One way in which you could integrate IL at a programme level is by using a curriculum mapping process. For example, within engineering, McAdams and Glauberman (2017) describe making use of the ACRL framework in conjunction with a curriculum map of ten undergraduate programmes to plan and design scaffolded and sequenced opportunities for students to engage in IL at strategic points in their degree.

3.2 Teaching methods

A range of approaches can be used when teaching IL skills, with the ACRL (2011) advising that "*multiple modes should be incorporated whenever possible*". Your selection will depend on several factors including cohort size, availability of technology, and session learning outcomes. For example, traditional lecture style sessions may be used when delivering basic core concepts, with active learning approaches (e.g., problem-based learning) being utilised when guided assistance is beneficial, e.g., when providing students with opportunities to practice use of databases and other tools. The use of active approaches such as problem-based (PBL) and project-based learning (PjBL), which engage students with open-ended, authentic scenarios, has been shown to help engineering students to connect IL theory and practice. This resulted in increased levels of interest and engagement when compared to traditional lecture-based learning (Hsieh & Knight, 2008), as well as improvements in technical knowledge in addition to IL-based skills and competencies. Although the ACRL (2011) recommends that "*instruction should employ active learning strategies and techniques*", the adoption of such pedagogies may be limited by cohort size (Cioc et al., 2022).

Equally, assuming the availability of appropriate technological resources, you may choose to adopt a blended or hybrid approach involving the use of computer-assisted instruction (e.g., web tutorials or web-based instruction) and self-directed independent learning.

3.3 Practical examples

In this section we include examples of activities which could be integrated into engineering modules. In so doing, we make use of the ACRL (2016) IL competency standards for higher education and therefore group activities into those focused on: recognising the need for information; locating information; evaluating information; ethical and legal use of information; and lifelong learning. To some extent, the groupings are sequential, and it is likely that you begin by familiarising new undergraduates with different types of sources and information and how to access them, before focusing on evaluation and synthesis. For each grouping we reflect on ways that the design of interventions can allow you to support the progressive development of students' IL competencies and skills.

Examples are provided for select competency standards, followed by a longer exemplar which incorporates some of these examples into one complete task covering all five competency standards (Example 5).

Identify the information needed for a problem or question

- Break authentic, open-ended problems into sub-problems (if necessary, this can be done using AI).
- Identify knowledge gaps and develop precise research questions.
- List potential sources of different types of information needed to contribute towards a given problem.
- Develop a search strategy (with justification for decisions made) by identifying appropriate investigative methods; different sources and formats of relevant information; and key terms and synonyms. Compare strategies with peers to determine how differences in approach result in different outcomes.

Progression: as students develop, they will become more confident and efficient in identifying the necessary information and you could therefore increase the complexity of problems, necessitating input from a wider variety of disciplines and/or types of sources, which, at times, may bring conflicting insight.

Locating information

- Use engineering databases to find a set number of high-quality sources relevant to a given question within a set time.
- Compare results from searches using keywords and those using controlled vocabulary, classification schemes, or subject headings.
- Obtain further sources of information by using the reference list and citation tracking of one provided article.
- Compare the efficiency and reliability of results from a general web search and a technical or scholarly source.
- Obtain and extract information from standards and specifications to complete a specific design task.
- Iteratively improve AI prompts to promote precise information seeking.

Progression: as students develop, you should notice them becoming more confident in searching for data and information and make use of more sophisticated techniques to optimise searches. You can thus provide them with problems or questions which require them to locate information from a wider range of (unprescribed) sources from the university library and external digital resources.

Evaluating information

- Identify the information relevant to a given problem (from an extended text or a limited number of prescribed, high-quality resources) through a range of reading and search techniques.
- Produce an annotated bibliography which summarises and evaluates the differences between sources and explains their relevance to a specific (design) problem.

- Revise a query based on critical evaluation of initial sources.

Example 1. Use of frameworks to evaluate sources

Apply frameworks such as the CRAAP test, this referring to Currency (how recent is the information), Relevance (does the information directly answer the research question?), Authority (who is the author or publisher?), Accuracy (where does the information come from and how is it supported?), Purpose (why was the information created?).

Level/context. *You could integrate this within introductory modules which focus on development of professional skills, or in discipline-specific modules in which information is required, for example to inform design.*

Time needed. *The duration of the activity can be varied (e.g., from 1 to 2 hours) depending on the number and length of sources provided and whether students work in teams or individually.*

Resources. *Curated pack of sources (it is beneficial to include a range of sources which are likely to result in different evaluations) relevant to module content; activity sheets (see Faber et al. (2022) for activity sheets which support students in assessing information by utilising the CRAAP test).*

Output. *A short list of suitable sources to address a problem or question, or a ranking of sources on the same topic according to their relevance.*

Assessment and marking. *Award marks for correct application of frameworks.*

Example 2. Evaluating contradictory sources of information

Provide students with different (contrasting) sources about the same technology (e.g., a government report, a trade body report, a corporate white paper, an environmental NGO blog, and a peer-reviewed article about carbon capture). Ask them to evaluate and synthesise sources in relation to a given problem or question.

Level/context. *You could include this in more advanced modules which consider the need for responsible and ethical engineering or modules, where students need to consider a wide range of information to inform decisions, e.g., a design module.*

Time needed. *The duration can be varied (e.g., 1-2 hours) depending on the complexity and length of the sources and whether students work in teams or as individuals.*

Resources. *Contrasting sources; guidance identifying and evaluating arguments.*

Output. *An argument map illustrating the logical structure of arguments made in the sources, presenting assumptions and evaluating the support an argument offers for a conclusion. Alternatively, use role-play exercises and debates whereby students adopt opposing viewpoints.*

Assessment and marking. *Award marks for correct identification of arguments, sources of bias, assumptions, and inferences, and for the justification as to the degree to which the arguments offer support for the conclusion.*

Example 3. Critical use of GenAI

Ask students to evaluate a GenAI output which focuses on a specific research topic. They should fact-check and validate claims using real sources, analyse how well the output captures key points, and identify gaps and errors.

Level/context. *You could include this example at a variety of levels where research is required (e.g., design modules, final-year research projects).*

Time needed. *The duration of the activity can be varied (e.g., from 1-2 hours).*

Resources. *Sources to aid in validation and evaluation of outputs, research questions for students to answer by iteratively improving GenAI prompts to promote precise information seeking.*

Output. *An annotated copy of the GenAI output which indicates errors; a paragraph summarising how well the output captures the key points.*

Assessment and marking. *Award marks for sourcing evidence to support the correct identification of errors and omissions in the output.*

To support student development and progression in the area of evaluating information, you may initially provide students with curated source packs to evaluate. As they develop, they should become increasingly independent in their ability to obtain, evaluate, and use sources. You could provide them with problems or questions which require them to locate and evaluate (complex and contradictory) information from a wider range of sources.

Ethical and legal use of information

- Read short excerpts from engineering reports with different citation practices (some plagiarised, some paraphrased, and some correctly cited). Identify examples of ethical attribution (giving proper credit to original authors through accurate citation and referencing) and correct examples of improper attribution.
- Determine whether it is more appropriate to paraphrase or quote extracts provided.
- Provide a reference for a given source using a variety of referencing styles.
- Consider the ethical use of information by analysing a case involving intellectual property in engineering, such as patent infringement or copyright violation (e.g., software code copied without permission, or copyrighted 3D-printing designs reproduced unlawfully). Discuss how ethical engineering practice requires respecting intellectual property rights by obtaining permission where necessary, complying with licensing agreements, and giving appropriate credit to creators.

- Identify, discuss, and debate ethical issues around the use of information (e.g., open access to information in the context of a specific engineering problem, and the use of AI-generated content in engineering decision making).

To support student development and progression in the area of ethical and legal use of information, realise that as students develop, you should find that they become more confident in paraphrasing and make use of quotations in a limited, purposeful manner. Their arguments around ethical use of information will become stronger and more nuanced as they become more confident in obtaining, evaluating, and synthesising information from a wider range of perspectives.

Example 4. Engineering failures

Present an engineering failure and ask students to identify which information gaps, ignored data, or misinterpreted sources contributed to the failure.

Level/context. *You could include this example within introductory modules which consider the need for responsible and ethical engineering and acts to demonstrate the importance of IL to students.*

Time needed. *The duration of the activity can be varied (e.g., from 15 mins to up to an hour) depending on the complexity and length of the case study and whether students work in teams or as individuals.*

Resources. *Case studies of engineering failures.*

Output. *A list of information gaps or examples of misinterpretation.*

Assessment and marking. *Award marks for identification of sources contributing to failure along with an explanation of the role each played.*

Extension task. *Students could propose methods to ensure the absence of information gaps or misinterpretation of sources in future.*

Lifelong learning

IL and lifelong learning are complementary, as a commitment to lifelong learning supports the development of IL competencies, while IL itself is a key lifelong learning skill that enables engineers to keep pace with new developments in a rapidly evolving field. Development of the aforementioned IL competencies (see the associated five standards listed in Section 1) can be supported by the use of self-evaluation tasks (see Phillips and Zwicky (2018) and Ross et al. (2011) for an example task) and reflective journals (see Davidson Squibb & Mikkelsen (2016), who provide example tasks and reflection as well as accompanying marking rubrics). Such tasks serve as tools for prompting metacognitive thinking, encouraging students to reflect on challenges faced during research, how they adapted, lessons learned, and how information needs evolved during the project. Prompts can encourage the documentation of evolving strategies, databases utilised, search terms and query refinement, and replacement of sources based on evaluation or the limitations of information retrieval systems.

Activities which promote IL as the basis of lifelong learning are provided below.

- Explore a cutting-edge technology (e.g., hydrogen fuel cells, AI-driven structural monitoring, quantum materials) and summarise the current state of research and future directions by making use of a number of sources.
- Search relevant job postings and identify skills and knowledge areas in demand; then find scholarly or industry sources or identify professional organisations and conferences to learn more about them.
- Determine IL (and general development) needs, for example competency in use of new technologies and approaches to accessing and managing information, as well as emerging and advancements in the field.
- Produce a journal which includes reflections on learning, feedback, gaps in knowledge and future aims.

Supporting student development and progression in the area of lifelong learning : as students develop, they may become more autonomous in their reflection and learning, and you can provide them with fewer prompts and guidance.

Example 5. A scaffolded approach to embedding IL competency standards within a research/design module.

Task

Provide an authentic, open-ended (design) problem or research question which requires students to address environmental, economic, and social perspectives within a defined context. In some cases, you may choose to select specific design tasks which require students to obtain and extract information from exact standards and specifications.

Outputs

Output 1:

- *Ask students to break down the problem or research question into sub-problems (with help using GenAI), identifying a variety of types and formats of potential sources for information, with a realistic search strategy and timeline to acquire the information.*
- *Award marks for inclusion of appropriate investigative methods; a list of possible sources of relevant information which takes account of the value of different resources and formats relevant within the field; key terms and synonyms; and justification for decisions made.*

Output 2:

- *Ask students to produce an annotated bibliography, summarising differences between key sources and explaining their relevance to the problem or question.*
- *Award marks for the ability to question sources of information and the reasonableness of conclusions, for example by evaluating differences in reliability, validity, accuracy, authority, timeliness, quality, currency, and relevance of sources.*

Output 3:

- *Ask students to produce a portfolio demonstrating their growing research skills and metacognitive awareness of information-seeking processes. This could include (1) a search strategy reflection log which includes databases, search terms, and filters used, revisions to their strategy based on evaluation of search results, and the limitations of the information retrieval systems; and (2) reflective pieces focusing on their information gathering process, the relevance of the search results, and the limitations of the information.*
- *Award marks for the ability to describe and reflect upon the approaches taken, justification for the need to change the approach, and the inclusion of clear adaptations.*
- *Extension task: you may also wish to ask students to reflect on how the skills developed prepare them for ongoing learning in engineering.*

Output 4:

- *Ask students to produce a design or research report.*
- *Award marks for synthesis of relevant information, critical engagement with the literature, ability to justify decisions and draw conclusions based on information, and thorough and accurate citation (in text and in bibliography).*

Additional considerations

Teamwork and peer feedback can be utilised for large cohorts.

Librarians could provide sessions focused on locating relevant resources and search strategies (e.g., use of controlled vocabulary, classification schemes, or subject headings), as well as methods by which to manage and organise sources of information (e.g., citation management software).

4 Recommendations for implementation and learning

In this section we conclude with practical insights and guidance and discuss some of the challenges involved in implementation, as well as considerations to be made with respect to transferability.

4.1 General recommendations

Scaffold the development of IL skills across the programme levels

Reinforce IL at multiple points across the programme to ensure systematic exposure and ongoing practice. Introducing basic IL skills and gradually increasing their complexity provides scaffolding and enables cumulative learning, allowing students to develop mastery over time.

Such an approach is less likely to lead to the superficial understanding, minimal long-term retention, or lack of transferability that are often associated with single one-shot library sessions which suffer from a lack of time to cover discipline-specific resources, recap on difficult topics, and engage with students (Williamson et al., 2019).

Furthermore, scaffolding helps ensure that the number and variety of (digital) tools and information sources do not overwhelm students and increase the cognitive burden, especially when introduced in tandem with technical content.

Ensure that IL content is embedded within the discipline and relevant to engineering practice

Ensure that IL is embedded into core engineering modules (such as those discussed in 3.1), that it is contextually relevant, that it is not treated as an isolated skill, and that students do not confuse technical adeptness with IL (Wilkes et al., 2015). Retention and application of IL concepts have been shown to be more efficient when taught within students' discipline (Ragains, 2013), and you should therefore focus on providing point-of-need instruction and structured assignments which require students to research specific, manageable, and useful topics (Feldmann & Feldmann, 2000), and to reflect on the way that IL-based competencies are applied in practice. This involves spending more time focusing on accessing and evaluating a variety of information types (Phillips et al., 2019) and the inclusion of real-world tasks that involve using technical standards, patents (Phillips & Zwicky, 2018), and discussion of ethical use of intellectual property.

Focusing primarily on textbooks and limiting access to discipline-specific resources (e.g., technical standards) may hamper skill acquisition and undermine students' readiness for engineering practice (Phillips et al., 2024; Tuyaerts et al., 2025), with findings from a three-round Delphi with 15 engineering industrialists showing that participants believed that higher education focuses too much on the theoretical aspects of IL and that it is best developed through practice, for example through the use of PBL.

Collaborate with librarians

As information professionals, academic librarians are well-positioned to support your teaching, and there is evidence to suggest that engineering students are generally complimentary of librarians' knowledge and teaching ability (Bakermans & Ziino Plotke, 2018; Omarsaib, 2023).

Librarians can contribute to the delivery of one-shot sessions, or partner with you to identify knowledge gaps, develop approaches, and co-deliver content. While you may understand cohort characteristics and bring expertise in curriculum design, assessment, and disciplinary content, librarians contribute expertise in identifying the research topics, information resources, databases, and search strategies that best support module learning outcomes, as well as in organising, evaluating, and locating relevant resources (Wilkes et al., 2015). Together, you provide complementary skills which can be utilised through the development of trusting, open relationships in which you understand and respect what each party brings to the team.

Ensure IL competencies are assessed and rewarded

IL competencies should be incorporated into marking criteria for summative assessment of project deliverables, thus making the value of IL explicit to your students (Smith Macklin, 2001). Without regular assessment, you may lack the ability to identify students' skill gaps or evaluate the effectiveness of instruction. Assessing the varying IL ability of first-year students can be used to inform the development of subsequent curriculum (Bakermans & Ziino Plotke, 2018). If you have scaffolded the development of IL-based competencies and skills over time, you should also ensure that the assessment is designed to assess that progression. When designing an assessment, it is important to take into account the context in which competencies will be applied; you should therefore focus on developing marking criteria which align with the application of identified IL competencies in authentic tasks (for an example see Smyser and Bolognese (2023), who provide an assessment brief and adapted rubric for team-based student research and capstone projects).

4.2 Adaptability and challenges

Implementing IL instruction in engineering education requires thoughtful adaptation to varying institutional and contextual factors and challenges.

Institutional culture and support

Institutional culture around the value of IL impacts upon its integration within engineering curricula, with engineering librarians reporting difficulties in gaining buy-in from academic staff to integrate IL learning into their coursework (Wilkes et al., 2015). Institutionalising IL requires targeted development opportunities and appropriate resource allocation, allowing for sustainable and systematic development of IL skills (ACRL, 2016). In the absence of institutional support, initiatives tend to rely heavily on individual academic champions (Manuel et al., 2005) and pilot projects, making them vulnerable to staff turnover and shifting priorities. In the case of the one-shot approaches typically used in these instances, it is advised *"to best use the limited time available for instruction"* by focusing *"less on tools, such as specific databases, and more on transferable skills"* (Waters et al., 2012, p. 131).

Technological resources and infrastructure

Technology can be used to enhance IL education in a variety of different ways. Firstly, when teaching large student cohorts, it is advantageous to adopt blended learning approaches which include online content, digital modules, and automated assessment. This approach offers several benefits, allowing students to learn at their own pace whilst also reducing the workload of librarians (Zhang et al., 2015). It has been shown to improve information seeking self-efficacy, as well as performance (Tang et al., 2022). Secondly, digital tools such as citation managers and collaborative platforms can be used to streamline research processes and promote better organisation. Finally, a wealth of opportunities emerges as the use of GenAI continues to become more widespread. For example, LLMs can assist in generating relevant keywords and develop search strings, as well as formatting references. It can also support the development of a concept map and research questions when planning research projects or learning about complex topics (Carroll & Borycz, 2024; Chaudhuri & Terrones, 2025). Students may also hone their ability to critically evaluate information by making use of outputs of GenAI (Lo, 2023) before comparing them with peer-reviewed publications on the same topic.

However, a critical approach should guide the integration of technology into IL-based teaching. The advent of GenAI means there is also an increasing need for us to focus on introducing the technical, operational, pedagogical, and ethical aspects of AI, and ensure that students are aware of how the technologies work to support IL, as well as the implications for academic integrity. Your instruction should focus on providing students with fact-checking techniques and critical thinking strategies that can be employed when making use of AI outputs. At the same time, it is important to help students determine instances when it is appropriate to use this technology (taking account of local academic standards). There is also a need to consider issues such as digital poverty; face-to-face workshops and printed guides remain essential to ensure equitable access to IL, particularly in contexts where technology is limited. Institutions with limited access to discipline-specific databases or technical standards may place greater emphasis on open access resources (Phillips et al., 2024).

Student resistance

Very little work investigates students' perception of IL instruction. As discussed in Section 2, the existing literature tends to focus on students' overly optimistic perceptions of their own ability, which has been framed as a challenge to equipping students with IL (Douglas et al., 2014). As educators, we therefore face the challenge of demonstrating the need for its inclusion within modules and programmes, which can be facilitated by the use of authentic tasks which bear relevance to engineering practice. Despite students tending to underestimate the need for instruction in IL, we should not overestimate their baseline IL competency. This is particularly important in the case of diverse student cohorts, who may have varying experience in IL training.

4.3 Resources and further reading

Finally, in addition to the literature cited in this chapter, we also want to recommend the following resources to deepen your knowledge: *Information literacy for science and engineering students* by DeJong (2024) and *The information literacy framework* by Julien et al. (2020).

5 Concluding thoughts

In this chapter we have highlighted the growing need for IL skills, driven by the increase in information availability, the variety of information types utilised by engineers, the reported lack of competency by students, and a misalignment between teaching and workplace practice. We subsequently provided a summary of the key IL competencies and skills relevant to engineering students and guidance to support their intentional and scaffolded integration within engineering education programmes.

Importantly, IL should be understood as a continually developing competency rather than a fixed body of knowledge. While this chapter offers guidance for developing students' ability to locate, evaluate, and apply information, the rapid expansion of scholarly and technical resources, together with the growing influence of GenAI, requires ongoing review and adaptation of instructional approaches. As engineering educators, we should thus cultivate a reflective and critical approach to information practices, ensuring their methods remain effective and relevant in a rapidly changing professional and technological environment.

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AI statement

During the preparation of this work, the authors did not make use of any AI tools.

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