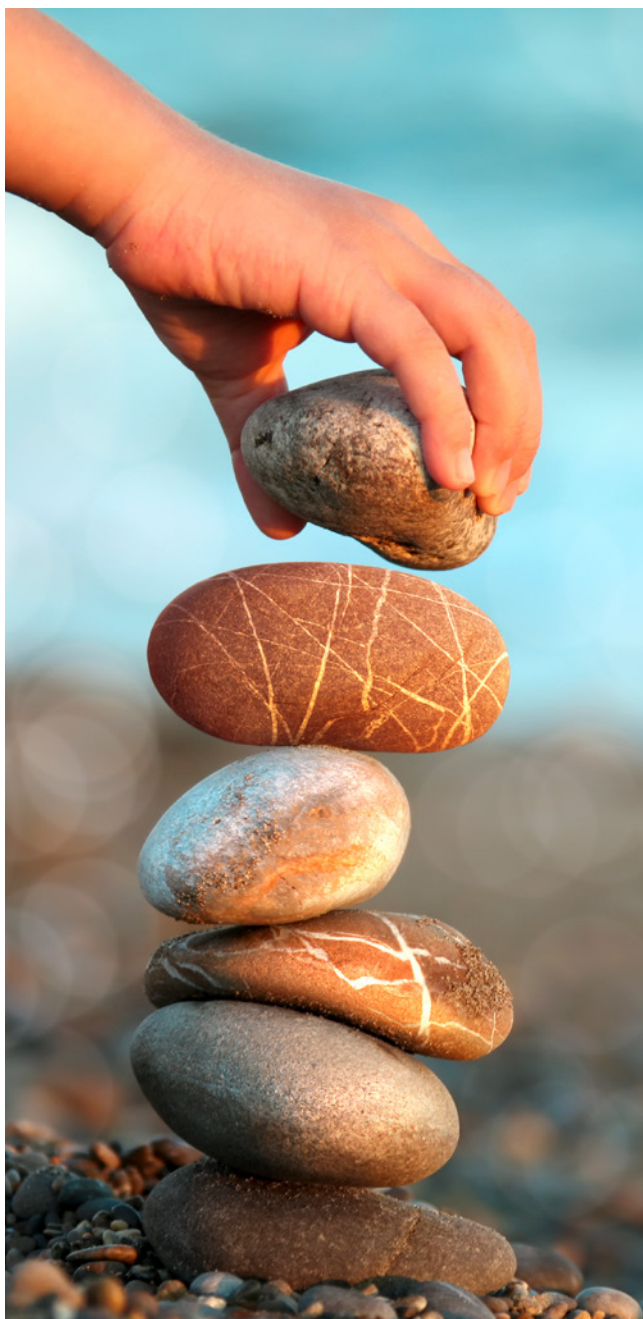


Integrating explicit instruction with independent learning: Load Reduction Instruction (LRI)

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How can we harness the best of explicit instruction and discovery learning? How do we ease the burden on learners in the early stages of learning and then work towards more challenging schoolwork? How do we move from group instruction to independent learning? What are the differences between 'novice' (and at-risk) and 'expert' learners and what does this mean for teaching?

Load Reduction Instruction (LRI) (Martin 2016; Martin & Evans 2018) has recently been proposed as an instructional strategy aimed at answering these questions. LRI is an approach to teaching that reduces the cognitive load on students in order to optimise their learning and achievement. LRI initially involves explicit instruction. Then, at the appropriate point in learning, LRI also involves less structured approaches such as guided discovery-, problem-, and inquiry-based learning.

In this article, learning and instruction are considered from educational and cognitive psychological perspectives. Because educational leaders play an important part in supporting and guiding the instructional approaches teachers within their schools adopt, it is suggested that latest research findings in this area are critical to success in this influential role.

The five principles of LRI

Over the past few decades, there has been an ongoing tussle between constructivist (and post-modernist) approaches to instruction and more positivist (or post-positivist) explicit and direct approaches to instruction. The former tends to focus on student-centred learning, discovery and inquiry-based approaches, with the teacher seen more as a facilitator of learning. The latter (explicit) tends to focus on more teacher-centred, explicit, and structured instruction. Each has its strengths.

LRI brings both together through the following five principles at key points in the learning process:

- (1) Reducing the difficulty of a task during initial learning
- (2) Instructional support and scaffolding through the task
- (3) Ample structured practice
- (4) Appropriate provision of instructional feedback
- (5) Independent practice, supported autonomy, and guided discovery learning.

These key principles are shown in Figure 1 on the next page.

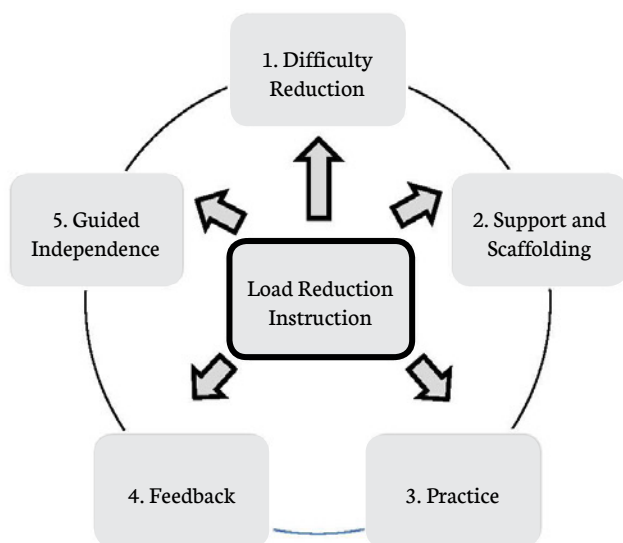


Figure 1. Load Reduction Instruction (LRI) Framework - adapted from Martin (2016).

Because students are novices at many points in their learning, it is important to reduce the cognitive burden on them in the initial stages of the learning process. As articulated by its five principles, LRI helps build the core knowledge and skills that students need to progress from novice to expert. As core skill and knowledge develop, LRI then emphasises the role of guided discovery-, problem-, and inquiry-based learning.

Therefore, a fundamental idea of LRI is that once learners progress beyond novice status and have sufficiently automated core skills and knowledge, they are ready to engage in meaningful discovery and exploratory learning.

What has memory got to do with LRI?

There are two key parts of the human memory system: working memory and long-term memory. They are both critical for learning. LRI has been developed to optimise both of them.

Working memory refers to the conscious component of memory that is responsible for receiving and processing information, performing tasks and solving problems, particularly new information, new tasks, and novel problems. Long-term memory refers to the vast storage component of the human memory system.

Learning occurs when information is successfully moved from working memory and stored in long-term memory (Mayer & Moreno 2010; Sweller 2012). When students do schoolwork, they constantly retrieve information from long-term memory into their working memory, for example, to perform a task or answer a question.

Working memory is very limited. Some researchers (Atkinson & Shiffrin 1971; Baddeley 1994; Miller 1956) have estimated it holds information for only about 15-20 seconds. Fortunately, long-term memory does not have the same limits. In fact, long-term memory has vast capacity.

The severe limit of working memory is a substantial challenge to teachers when teaching new material and presenting novel subject matter. If working memory is overly burdened or overloaded then there is a significant risk that learning content is not understood, information is misinterpreted or confused, information is not effectively encoded in long-term memory, and learning is markedly slowed down.

To overcome this, it is critical that teachers deliver information so it can be effectively and accurately stored in long-term memory (Mayer & Moreno 2010; Sweller 2012). Then, students retrieve this information from long-term memory into working memory to do their schoolwork.

Therefore, there is a clear necessity to deliver instruction and develop instructional material that optimally assists the processing of information to long-term memory from working memory and that frees working memory from unnecessary burden or load. This is the primary aim of LRI (Martin 2016; Martin & Evans 2018).

Also, academic life becomes increasingly demanding as students progress from primary to high school. There is an escalation in homework, frequency and difficulty of assessment, content to be covered, subject difficulty, and competing deadlines. This places significant cognitive demands on students. It is therefore important to teach in ways that ease the cognitive load on students as they learn. Load Reduction Instruction (LRI) is an approach to teaching that reduces the cognitive load on students in order to optimise their learning and achievement (Martin 2016; Martin & Evans 2018).

Strategies for implementing the five LRI principles

As described, LRI comprises five key principles, from (1) Reducing the difficulty of a task during initial learning through to (5) Independent practice, supported autonomy, and guided discovery learning. LRI also articulates many specific strategies that teachers can use to integrate the five LRI principles into their teaching. Following are some quick tips for each of the five LRI principles - all of these are fully described in Martin (2016):

1. Reducing the difficulty of a task during initial learning

- Pre-training (or revision) of key ideas
- Teacher modelling important processes
- Breaking work into 'bite-size' segments
- Regular checking of early learning.

2. Instructional support and scaffolding through the task

- Ensuring learners' attention to central information is not diverted (e.g. to irrelevant information on a page)
- Integrating important information (e.g. integrate instruction on punctuation into a student's own essay)
- Ensuring logical sequencing of information delivery
- Supporting information appropriately (e.g. present an image with an accompanying narrative)
- Avoiding redundancy (e.g. present information only once if learner has understood)
- Signalling (e.g. ask students to listen out for a specific key idea coming up in the lesson)
- Organising information under themes or 'big ideas'
- Allowing enough instructional time to master a task
- Checking for understanding through the lesson
- Providing worked examples that show what a completed task looks like
- Providing templates to guide students through the task
- Prompting (e.g. students asked to identify the 'what', 'who', 'why', and/or 'when' in a text or narrative)
- Adjusting a task to personalise (e.g. 'Your goal in this task is to...' rather than 'The goal for this task is to...').



3. Ample structured practice

- Deliberate practice, where the student rehearses a specific skill until mastered
- Mental practice, where the student studies an example, then turns away and rehearses the example in his/her mind
- Guided practice, where the student is guided through the learning steps (e.g., prompting responses through a task).

4. Appropriate provision of instructional feedback

- Showcasing, where the teacher shares examples of good work if students get stuck or cannot complete a task
- Feedback that is concrete and specific information on the correctness of an answer
- Feedforward that provides feedback *and* specific ideas for future improvement.

5. Independent practice, supported autonomy, and guided discovery learning

- Independent practice (when skills and knowledge are automated and fluent), where the learner attempts similar problem tasks independently
- Guided discovery learning (after independent practice), where the learner undertakes new tasks or applies learning to ‘real-world’ or ‘ill-defined’ problems that further enrich learning.

Student-centred or teacher-centred learning?

LRI’s emphasis on explicit instruction in the early stages of learning may lead some to conclude it is a teacher-centred approach. In some ways it is. However, at all times, the student is front and centre in pedagogical decision-making and instructional delivery. Martin (2016) has thus made clear that LRI is very much a student-centred instructional approach, whilst also recognising the centrality of the teacher in this. LRI thus comprises three student-centred approaches that are substantially supported by the teacher:

Student-centred Instruction:

- The teacher is responsible for the organisation and presentation of instructional material with a clear and present focus on students’ needs, including their cognitive needs.

Student-centred Exchange:

- Guided practice, questioning, worked examples, and checking for understanding, and feedforward take place following the teacher’s initial instruction.

Student-centred Learning:

- With appropriate monitoring by the teacher (as needed and appropriate), the student is responsible for independent practice, checking and reviewing his/her own work, and engaging in further discovery or exploration.

This student-centred process is shown in Figure 2. At different stages of the educational process, teacher and student will play different roles, moving from (a) student instructional salience to (b) more distributed teacher-student interaction to (c) student learning salience. This pattern of instruction plays out at each point the student encounters new and/or challenging skill and content.

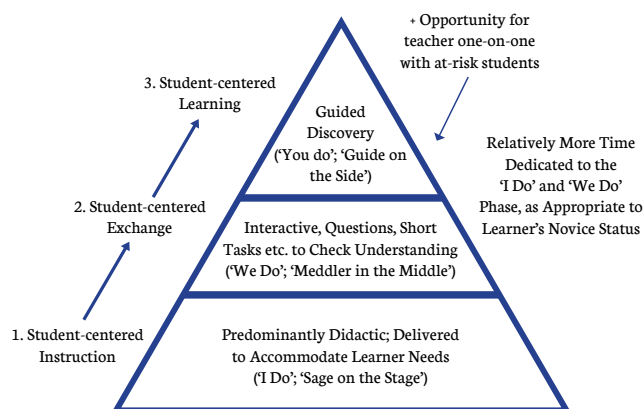


Figure 2. Role of Student and Teacher in Load Reduction Instruction: Student-centered Instruction (‘I Do’; ‘Sage on the Stage’); Student-centered Exchange (‘We Do’; ‘Meddler in the Middle’), and Student-centered Learning (‘You Do’; ‘Guide on the Side’) - adapted with permission from A. J. Martin (2016)

These ideas are also aligned with the recent ‘I Do’ (sometimes also referred to as ‘Sage on the Stage’), ‘We Do’ (or, ‘Meddler in the Middle’), and ‘You Do’ (or, ‘Guide on the Side’) approach to instruction (Archer & Hughes 2011; McWilliam 2009). First, learners require sufficient time, attention, and resources directed at the student-centred instruction (‘I Do’) phase. After the teacher has provided this initial instruction, he/she aims to get a sense of students’ understanding and learning at the student-centred exchange (‘We Do’) phase. Once the teacher is satisfied with students’ understanding and learning at this stage, there is an opportunity for student-centred learning (‘You Do’).

Importantly, high ability students also need time, attention, and resources directed at the initial student-centred instruction (‘I Do’) phase. But they do not spend so much time in this phase. After the teacher ensures they have the required skill and knowledge mastered, they are able to move to the later phases more quickly.

Indeed, these ideas follow a long line of research and theory such as that by Pearson and Gallagher (1983) and Fisher and Frey (2008) in the past few decades – who built on seminal research such as Piaget’s (1951) work on cognitive structures and schema, Vygotsky’s (1978) work on zones of proximal development, Bandura’s (1965) work on attention, retention, reproduction, and motivation, and Wood, Bruner and Ross’s (1976) work on scaffolded instruction. These ideas also harness latest developments in cognitive and instructional psychology (Mayer & Moreno 2010; Sweller 2012). Taken together, these theories suggest that learning occurs through effective scaffolding and interactions with others, and when these interactions are intentional, specific learning occurs.

Conclusion

LRI reduces the cognitive burden on students to help their learning and achievement. In the early phases of learning, a structured and somewhat directional approach to instruction that reduces cognitive load is important. This helps build the core knowledge and skills that students need to progress in their learning. As their core knowledge and skills grow, LRI emphasises the important role of guided discovery-, problem-, and inquiry-based learning. In these ways, students benefit from the best of both explicit and discovery-oriented approaches to instruction. Educational leaders play a vital role in communicating, guiding, and supporting the instructional approaches adopted within their schools. To the extent this is the case, LRI principles and strategies are relevant to educational decision making and have potential to optimise the learning and instruction that takes place in the school.

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