ADAPTIVE LEARNING

- BENEFITS AND HOW IT WORKS

RelyOn Nutec
360° Safety

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For years, e-learning has been a go-to tool for companies and organisations that need an efficient way to educate or update competences for their workforce. However, traditional e-learning is in itself not harvesting the true power of learning on a digital platform. But infusing e-learning with computing power and modern tech algorithms, adaptive learning unlocks the real potential for learners in the 21st century.

Adaptive learning is a technology-based approach to learning. It combines theories of optimal learning with the capabilities of algorithms and computers. The study material simply adapts to the learner, ensuring that time is spent on the subjects that need the most attention. This significantly boosts the efficiency of the learning process. At the same time, the process reveals blind spots, perhaps unknown for the learner, that are important to address – e.g. safety protocol and response.

In this White Paper, we highlight some of the many advantages of adaptive learning and offer a brief look into the theory behind the technology.

WHAT IS ADAPTIVE LEARNING TECHNOLOGY?

Adaptive learning technology is an advanced type of e-learning. The term adaptive learning refers to a technology capable of evaluating the student's skills, knowledge, and confidence levels. The technology constantly assesses how the student responds to the material. That way, the student's learning material becomes much more targeted since subjects are filtered out that do not require more attention, leaving more time to focus on weaker areas.

The personalised course is a much more tailor-made learning experience compared to traditional e-learning, which, in the end, will enable students to achieve the desired goals faster and more efficiently.

BENEFITS OF ADAPTIVE LEARNING

Before diving into basic concepts around adaptive learning, here is a quick overview of the key benefits compared to traditional e-learning or classroom training:

- It cuts training time in half
  - Provides higher proficiency
  - Provides higher retention due to intelligently spaced repetitions
  - Uncovers and fixes unconscious incompetence
- Improves engagement and reduces frustration
- Rich learning analytics
  - Supports instructor with data to focus efforts – ideal for blended programmes
  - It helps guide learners' learning.

HOW DOES IT WORK?

Adaptive Learning offers an entirely new approach to learning. It utilises insights from biology as well as computer science. The learner's study material will be tailored to each person's specific needs and competences based on data. In this section, we take a look at how that is possible.

THE ADAPTIVE ALGORITHM LEARNS LIKE A VIRUS

Adaptive learning uses biological models that mimic the way viruses behave in nature, evolving moment-by-moment using trial and error as their environment changes. Relationships between individual learning objectives are not exact in terms of order and semantic connections. In other words, there are many pathways to the same learning objective. This has a profound impact on how the content should be made.

Biological models are designed to be able to cope with flexibility and messiness by accommodating "noise". This could be fluctuations in a learner's understanding from day to day, ambiguity in how a question is phrased—and other uncertainty, such as answers that are mostly but not entirely correct, into their systems.

Biological adaptive models are multidimensional and have subcomponents that each "acts" continuously. Some of the key concepts and challenges that the models are trying to address are:

Measurement of knowledge
- Self-evaluation
- Modelling knowledge completion
- Time and knowledge decay
- Competences
- Predicting the "next optimal task"
- Motivation
- Spaced repetition
- Noise
- Chunking
- Interleaving

Multiple interdependent biological models gather data from learner interactions moment-by-moment and evolve to meet the unique needs of each learner.

These models allow the learner to make mistakes and pursue misconceptions, closely mimicking real-world-cognitive situations and providing the optimal experience for the learner.

UNCONSCIOUSLY INCOMPETENT - BELIEVING YOU KNOW WHEN YOU DON'T

Learning is not simply about adding missing knowledge or skills. For any given element of knowledge or skill, a learner will be objectively competent or incompetent but may be subjectively unaware of their level of competence. When learners are unconsciously incompetent, they believe they possess knowledge or skill when they do not.

Together with other cognitive biases, this is likely to play a significant role as a source of errors on the job – especially critical when safety is at stake – and this is most likely to occur when people think they know what to do, when in fact they don't.

THE IMPORTANCE OF ACTING WITHOUT THINKING

Automaticity is the ability to do things without occupying the mind with the low-level details required, becoming an automatic response pattern or habit. It is usually the result of learning, repetition, and practice.

When faced with stress, the human brain falls back on things that are "second nature." Those fallbacks must generate the correct response. We do not need to achieve automaticity in every skill or piece of knowledge. However, automaticity is a requirement in areas such as core skills and safety-critical behaviour. Adaptive learning helps the learners achieve automaticity when relevant by facilitating the practice and re-practice on specific topics.

DATA IS ACTIONABLE INSIGHTS FOR BOTH LEARNERS AND INSTRUCTORS

One of the significant strengths of adaptive learning is the highly granular data collected by the system. This data provides actionable insights for both learners and instructors.

For learners, access to their learning performance data is a huge step forward from simple, limited information like a single completion figure or even information on which questions were incorrect. With learning analytics, learners can gain insights that can guide their learning. They can see which sections they struggled with, where they struggled to self-assess their knowledge, and what content they should review to improve.

Instructors can get a much broader and more granular review of their students' performance, not just a simple matter of questions right and wrong. Such as whether students understand their lack of knowledge, whether they are motivated and engaged, and whether certain sections are particularly problematic.

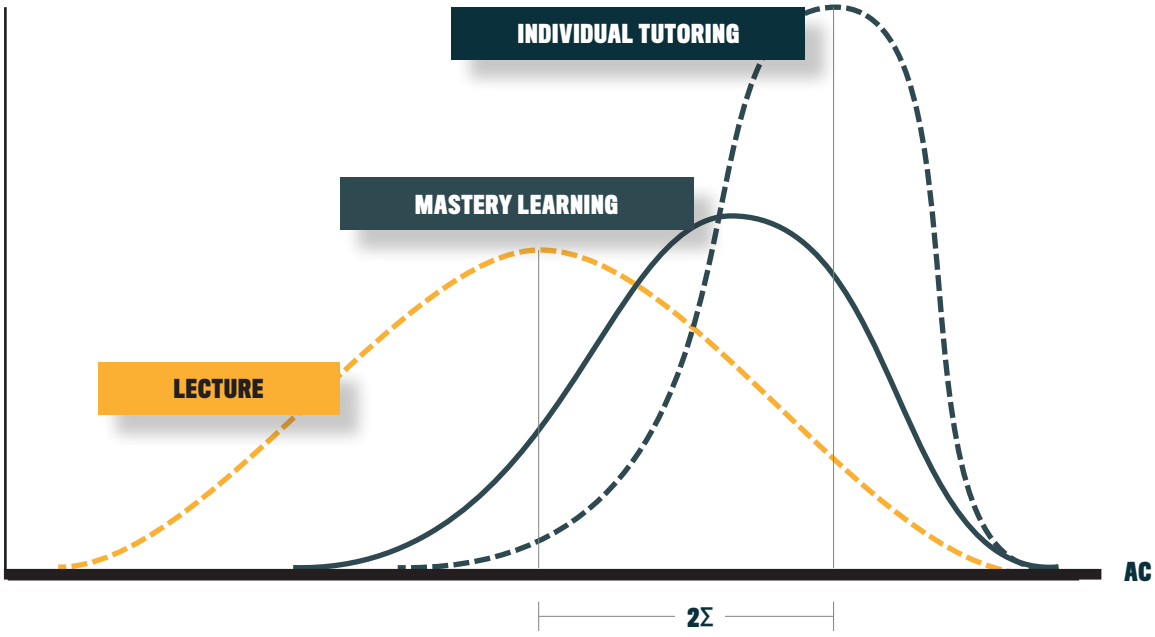
Data analytics is also used to gain insights into the course content itself. It allows continuous and iterative improvements based on learners' feedback and data usage at a very granular level.

THE SCIENCE BEHIND ADAPTIVE LEARNING

The adaptive learning approach relies on other well-established concepts in educational psychology and cognitive science – augmented by usage and data points from real learners using the platform. Following are some of these key concepts:

BLOOM'S 2-SIGMA PROBLEM: HOW TO LEARN THE BEST

The "2 Sigma problem" refers to a paper published by **Benjamin Bloom** – the educational researcher best known for Bloom's Taxonomy – in 1984. In his research, Bloom divided students into three groups. The first group, the control group **[Lecture Group]**, received conventional class-based instruction and periodic assessments to track how much they had learned. The second group received traditional class-based instruction but was given formative assessment tasks throughout the course, designed to help them learn the material and establish when they had mastered a topic and were ready to progress **[Mastery Learning].** The third group received the same formative, mastery-based feedback as group 2, along with one-on-one tutoring **[Individual Tutoring]**.



Bloom's results were clear-cut. Students who had received individualised tutoring showed improvement over the control class by two standard deviations (or grades), with the performance of the tutored students surpassing 98% of students in the controlled group. Mastery learning, meanwhile, boosted results one standard deviation above the control group. The mastery students also outperformed 84% of the students in the control group. Furthermore, there was less variation between grades in the test groups, i.e. students' results had a much lower spread around the average.

The results suggest that a combination of mastery learning and personalised tutoring allows learners to achieve their potential. In 1984, at Bloom's time, this was a challenge. While mastery learning and personal tutoring were effective for learning outcomes, they were too labour-intensive to achieve daily.

In the 21st century, technology offers a solution to that problem. By combining the power of digital delivery with skilled educators' human insights and judgments, adaptive learning technology can provide mastery learning and individualised programmes for learners at scale. This technology allows instructors to use their resources and time more effectively, stimulating learner engagement and results.

DELIBERATE PRACTICE - MAKING AN EFFORT PAYS OFF

Another fundamental concept within adaptive learning is that the most prepared learners to put in the effort are the most likely to reap the benefits. In other words: practising something difficult will eventually lead to success in that arena. Optimally, the practice needs to be mindful, supported by continuous feedback from a coach, and planned to challenge the learners' limits. Adaptive technologies are designed to make this practice efficient, constructive, and rewarding through intelligent and targeted repetitions and self-assessment acting as formative assessment.

METACOGNITION - A REALISTIC LOOK AT CAPABILITIES

Metacognition is another central concept. This is the ability to think about one's thinking or observe one's learning. Enhanced metacognition has been found to improve students' understanding of various disciplines, also helping to transfer skills to new settings. Adaptive learning can help learners develop their metacognition by breaking down each skill into its components. Hence, monitoring their progress towards learning goals, repeating questions where they showed lower confidence, and indicating discrepancies between self-assessed certainty and actual performance on a task.

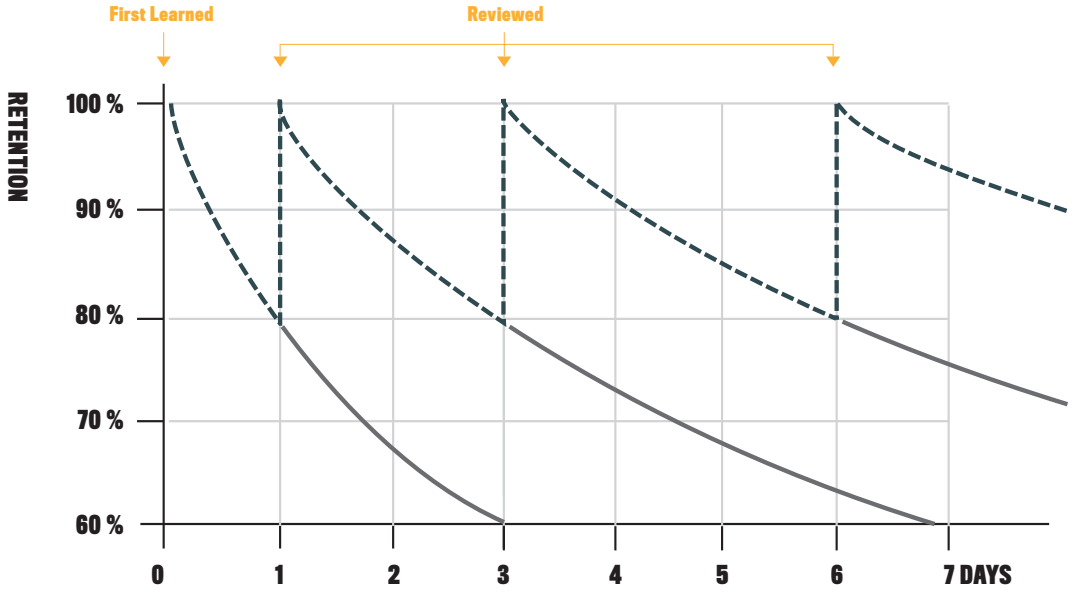
Highlighting these discrepancies can boost low confidence, moderate unduly high confidence, and determine when repetition is necessary – even with a correct but guessed answer. These strategies combine to give learners a realistic view of their performance and help them better understand their areas of improvement.

RETAINING NEW KNOWLEDGE

Adaptive learning technology is more than an efficient learning tool. It also helps students retain new knowledge, a key component in learning theory.

Theoretical work like the Ebbinghaus forgetting curve mathematically models the rate at which people lose information after first learning it.

This is used as the foundation to model the knowledge decay and establish the best time for learners to review information they have already learned, contributing to the long-term retention of information.



A layperson's understanding of the cognitive science involved is using spaced repetition to build neural connections in the brain, similar to how "reps" of an exercise build muscle. When learners have an opportunity to put something they've learned into practice, there is a much greater chance that the information is retained.

Without that opportunity to put knowledge into practice, there's a risk that the brain may view the information as expendable because exposure only happened once. That problem becomes severe when rarely used information is critical – e.g. safety protocols in an emergency. Without reinforcement, the information supposedly "learned" at the safety course is not accessible when needed most. Now, reinforcement in the form of personalised refreshers can become part of the learning experience through adaptive learning platforms.

SUMMARY

Adaptive learning is a unique learning tool. The technology's ability to discover blind spots in vital areas such as safety makes the learning platform ideal for companies and organisations which operate in high-risk scenarios. Based on educational psychology and cognitive science, the approach to adaptive learning is founded deeply in science and theory. At the same time, the outcome is very understandable: Ensuring that learners focus on the right tasks.

RELYON NUTEC PLATFORM

RelyOn Nutec digital learning solutions are powered by Area9 Rhapsode™, a state-of-the-art technology developed by our partner Area9 Lyceum. The globally leading Area9 Rhapsode™ learning platform uses artificial intelligence to deliver a customised, personalised, and efficient approach driven by an individual's specific knowledge level and unique needs.

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