

WHAT IS  
ADAPTIVE  
LEARNING?

THE BENEFITS

HOW SMART  
SPARROW DOES  
IT

# Let's Talk About Adaptive Learning

## What is Adaptive Learning?

## Definition of Adaptive Learning

Adaptive learning — or adaptive teaching — is the delivery of custom learning experiences that address the unique needs of an individual through just-in-time feedback, pathways, and resources (rather than providing a one-size-fits-all learning experience).

When you think about adaptive learning, do you think about this?



Here, an instructor is tutoring a student to help them understand a difficult concept. Almost inevitably this instructor will alter their hints and advice in response to

lesson how to accommodate questions and mitigate confusion, referencing current events or known student passions and preferences, changing activities in the moment (e.g. the student is having trouble, so walking them through the assignment instead of asking them to work alone).

The instructor in the above example is adapting to the learner and therefore we call tutoring an adaptive learning experience. But responding to the exact needs of one or two learners at a time is the most a single instructor can be expected to effectively manage at once. The more students, the less an instructor is able to flex their teaching prowess to ensure every individual is progressing.

## Enter adaptive learning technology

Adaptive learning technology aims to emulate and support (not replace!) the talents of great educators to provide the best possible learning experience for every single student. It helps scale the benefits of adaptive learning to tens, hundreds, or thousands of students at a time.

The mechanisms of “how” technology adapts to students has several variations:



## Designed Adaptivity

A method of adaptivity in which an educator designs the expert teaching sequence to guide their learners toward content mastery. They drive how the lessons adapts feedback and content sequences in the lesson. Adaptations can occur based on a variety of factors called *adaptivity factors*.

This expert-model approach to adaptivity tells the technology how to react in unique situations — an "If THIS, then THAT" approach. It can be used to provide needed remediation, share advanced content with excelling learners, encourage people racing through screens to slow down, and more.

This gives the educator more agency and control over what the learner experiences.



## Algorithmic Adaptivity

A method of adaptivity in which one or more algorithms answer the following two questions:

1. What does the learner 'know'?

Based on those answers, the algorithm can select “the right item at the right time” for students as they learn.

A common algorithm is [Bayesian Knowledge Tracing \(BKT\)](#) which estimates the rate at which learning occurs. Another known framework is [Item Response Theory \(IRT\)](#), developed in the field of psychometrics to model the interaction of a learner with discrete items.

By using preset rules or algorithms to shape content to the needs of an individual student — just as an instructor does with students in one-to-one conversations — technology can provide necessary remediation, extra content, words of encouragement, and more.

If you’re interested in reading an in-depth history of Smart Sparrow’s approach to adaptivity, we invite you to read the original dissertation research paper on intelligent tutoring systems by Dror Ben-Naim, founder and CEO of Smart Sparrow.

## Different adaptivity types and adaptivity factors

The screenshot shows a dark-themed adaptive learning interface. At the top left is the title "Searching for Signatures". To the right is a large number "6". Below the title, a question "How could we test for life beyond Earth?" is displayed, followed by a unit score of "110 / 1483". A descriptive text block follows, starting with "What are the signs of life? How could you test for life in a returned sample? The answer lies in the living cell. The cell is a fascinating, living machine filled with complex interaction. various chemical processes found inside every". On the right side of the screen, there are two yellow circular icons with white letters: "Chemical Basis of Life" and "Gathering Energy". At the bottom left is a "Home" button, and at the bottom right is a navigation bar with several dots.

There are many ways to review learner behaviors and performance in order to personalize courseware appropriately. These are called *adaptivity factors* — which include performance (what the student is doing, what they've done in the past), level of knowledge (prior or gained), content preferences, misconceptions, demographics, or other data sources. Education technology can adapt learning experiences for the individual based on any combination of factors.

Adaptivity factors can trigger unique responses, using *adaptivity types*. Based on what has happened in the student's learning journey, do you move them along as planned, provide hints, or reroute their learning pathway entirely? There are many ways to create a great adaptive learning experience.

types.



## Adaptivity factors

Learner information/profile, behaviors, and performance benchmarks that can be used adapt a learning experience, e.g.

**Performance:** Was the correct or incorrect answer was provided? How has the learner done across a series of tasks/lessons?

**Behaviors:** How long did the learner take to complete the task?

**Information:** Learners can share how confident they feel in material, content type preferences, or personal data to alter what happens next.



## Adaptables

The ways the lesson can adapt based on the learner's performance. For example:

**Real-time Feedback:** Offer appropriate help when it is

misconceptions (as if students are being guided by a tutor looking over their shoulder).

**Differentiated Pathways:** Offer varying sequences of content to each student, e.g. provide extra help to a student for a particular concept before continuing to the next topic, fast-track advanced learners, or allow learners to decide what they'll learn next.

## Varied market definitions of adaptive learning

Many companies and educators use the term 'adaptive learning' to describe their product or process, but sometimes — frustratingly — they have very different implications. Since there are many ways to change how we teach to meet learner needs, it has become an umbrella term.

In one [framework developed by EdSurge](#) in order to address this challenge, they define what they see as the most common different types of adaptive learning. They split the field into adaptive content, adaptive sequence, and adaptive assessment:



## Adaptive Content

When a student answers a question, responding with feedback based on their specific response (e.g. hints, review materials on the relevant skill, further scaffolding) without changing the overall sequence of skills. This is an upgrade to marking questions correct or incorrect without explaining why.



## Adaptive Sequence

Continuously collecting and analyzing student data to automatically change what a student sees next; from the order of skills a student works on to the type of content received.



~~Challenging the questions a student sees based on his/her response to the previous question.~~

response to the previous question. The difficulty of questions will increase as a student answers them accurately, while if the student struggles the questions get easier. This method is often used to benchmark student understanding or progress.

Another common framework used by educators and practitioners in the field is described in the white paper [Learning to Adapt 2.0](#). This study published by Tyton Partners dissects adaptive learning technology by their capabilities, such as:

Communication and collaboration features between students and instructors

Content model and customization features (e.g. faculty can set or override the technology's grading scale or scores)

Sources of content (e.g. OER, publisher content, customer-generated content)

These taxonomies are useful to understand the different ways technology can gather data and trigger adaptivity — and they are most effective when brought together in one tool.

# The state of edtech and adaptive learning platforms

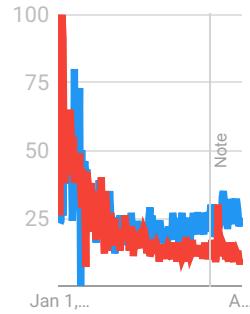
Education institutions have been historically slow to adopt new technology — but we think that's a good thing. Universities are not organizations that can afford to take on the Silicon Valley “move fast and break things” mindset, because that could mean failing students in how we shepherd them through some of the most formative years of their education.

## **Interest in adaptive learning over time**

To get some data on this popularity contest, we ran a Google Trends analysis on the terms ‘adaptive learning’ and ‘adaptive technology’ (as well as other terms yielding less popular results) as far back as Google would go: 2004.

Adaptive learning and adaptive technology have had a predictable relationship with the world — intense puppy love followed by calmer but steady interest.

adaptive learning  
adaptive technology



Worldwide 1/1/04 - 8/2/18 Web Search

Numbers represent search interest relative to the highest point on the chart for the given region and time. A value of 100 is the peak popularity for the term. A value of 50 means that the term is half as popular. A score of 0 means there was not enough data for this term.

Why is this interesting? For us, it shows a fairly typical **hype cycle**, starting with a spike of what was perhaps superficial interest followed by steady discussion and incorporation of adaptivity into student learning experiences. Though for some it may feel as though we've been talking about adaptive learning forever, we still see a lot of open opportunities to think about how to improve the ways in which adaptive technology is used to engage learners, **spark passions**, encourage persistence, and support content mastery.

### Adaptive learning in the global market

In the **2017 Digital Learning Report**, which surveyed university educators across Australia, less than 1/3 of instructors and

~~Currently use adaptive learning technology.~~

In the United States, the Department of Education created the [National Education Technology Plan \(NETP\)](#), a plan articulates a vision of equity, active use, and collaborative leadership to make everywhere, all-the-time learning possible. They also shared a [Higher Education supplement](#) to examine learning, teaching, leadership, assessment, and infrastructure in the context of higher education. Within these plans, they address the benefits of adaptive learning across the full spectrum of education:

*Design Principles for a Student-Centered Higher Education Ecosystem — #3*

Prepare students for postsecondary-level work. Institutions should employ technology enabled approaches to meet students where they are through redesigned diagnostic tools and **adaptive, targeted remediation for students in need of additional preparation to succeed in college-level courses.**

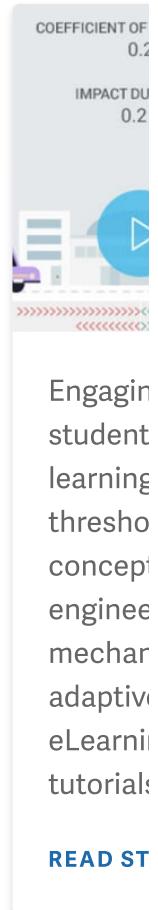
elements of an effective and engaging digital learning experience.

## The Benefits of Adaptive Learning

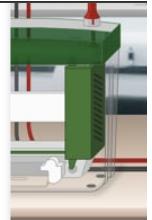
### How adaptive technology elevates the teaching experience

It's unlikely that class sizes are getting smaller, and equally unlikely that instructors will be able to guide every struggling student through each challenging lesson — which is where adaptive technology comes to assist.

Instructors and learning designers can create engaging, personalized learning experiences that are more inclusive of different learning needs, so at risk and advanced students both get the attention they need at all times. It can be used to share introductory materials, classroom pre-work, remedial lessons, case studies, and explorations of new and old concepts.



care, expands an instructor's capacity to improve learning outcomes for every single student.



**TEACH TO THE STUDENT, NOT TO THE CLASS**



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disease

[READ ST](#)

## How adaptive technology expands opportunities to learn



Education has become a lifelong pursuit, both formally and informally. It comprises diverse learning experiences, including institution-based learning, online coursework, continuing education, workforce training, and personal pursuits.

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[READ ST](#)

Designing adaptive learning experiences enables learners to continue their studies, receive feedback, and navigate difficult content even without direct or immediate access to an instructor. Furthermore, students are given an opportunity to own their learning process, explore unique learning sequences, and study at a comfortable pace.





## Research into adaptive learning

Multiple studies have shown that student performance improves when they're engaging with adaptive learning experiences.

Here are some studies that may interest you:

How  
Explorat  
and Ada  
Learnin  
Changin  
Biology  
Classes

[READ ST](#)

## How Smart Sparrow Empowers Adaptive Learning

Putting power in the hands of instructors

~~Ensuring instructors have a high degree of ownership~~

and agency in their teaching, including what, how, and when students learn — even in digital learning environments.

Why? Instructors and learning designers know what has worked best for students — how to sequence, scaffold, and chunk information to improve learner comprehension; where students often stumble; which hints and remediation work best; what struggling learners need vs what advanced learners need to stay engaged; and how to encourage students to stay motivated.

When you put the power of designing adaptive learning in the hands of educators, students have better experiences — and we don't mean that instructors need be the sole designers of such courseware, but we do mean they must be able to influence the material "to make it their own" (hence pedagogical ownership).

## Designed adaptivity

Smart Sparrow adaptivity begins at the most granular level – concepts and questions – where learning actually happens and where misconceptions occur. Adaptivity and personalization is therefore experienced by the student within a lesson, on every screen.

process and enables instant customization by instructors. Our platform encourages the use of expert models of adaptivity, also discussed above and thought about in "If THIS, then THAT" statements.

Some examples with multiple scenarios to adapt to different performances:



If the learner selects **Answer A**, then send them to **Screen 2**.

If the learner selects **Answer B**, then send them to **Screen 3**.



If the learner spends **less than 5 seconds** on the screen before trying to move on, then **stop them and provide feedback** that reads, "This information is important; make sure you understand it before moving on!"

If the learner spends **more than 10 seconds** on the screen before trying to move on, then **provide feedback** that

and let them keep going.



If the learner **does not complete** the simulation activity on screen, then stop them and **give feedback** that reads, "Wait, there's more to do here! Don't give up yet!" If the learner **completes** the simulation activity with the incorrect answer of X, then **stop them and give them feedback** that reads, "Hmm, something isn't quite right. Have you tried Y?"

There are just a few of the many, many ways you can design adaptivity to give learners more personalized experiences based on their exact actions.

## Learning analytics, data, and reports to improve adaptive teaching

Using Smart Sparrow's learning analytics, instructors know exactly how students are performing, where they're getting

A data-informed approach to digital learning means instructors can intervene before it's too late, assess the efficacy of their teaching methods, and update or adapt content to help students achieve the best outcomes possible.

Through a continuous improvement mindset, instructors can use Smart Sparrow to create adaptive learning experiences that improve for every new cohort of learners and never feel outdated.

## Play with real-world examples of adaptive learning experiences

SCIENCE



Introductory Chemistry

## WORKPLACE LEARNING

**Financial Services**

One of Australia's major banks leveraged adaptive learning technology to deli...

## MATHEMATICS

**Liberal Arts Math**

Professor created an original, fully-interactive digital textbook for 100-lev...



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Infiniscope

Biomedical Education Skills and Training (BEST) Network

Adaptive Mechanics Network