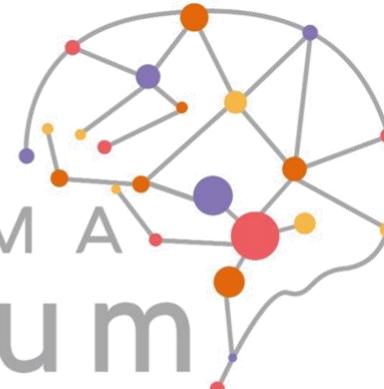
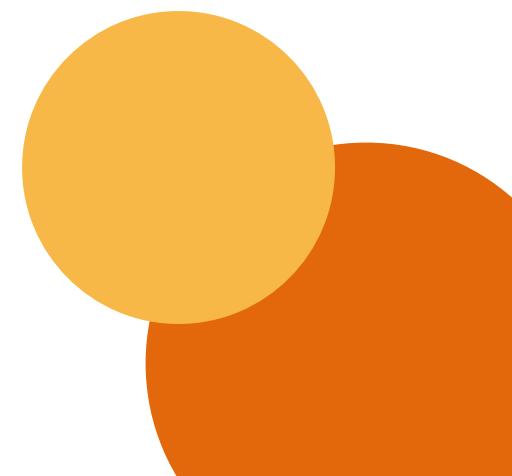


PROGRAMA cerebrum

Para Professores



EF3 – Como o cérebro aprende?



Currículo Cognitivo Comportamental



Para Aprendizagem

Agenda



Atividade semanal EF1

Bases da aprendizagem

**Sentidos, percepção e
memória**

Carga Cognitiva

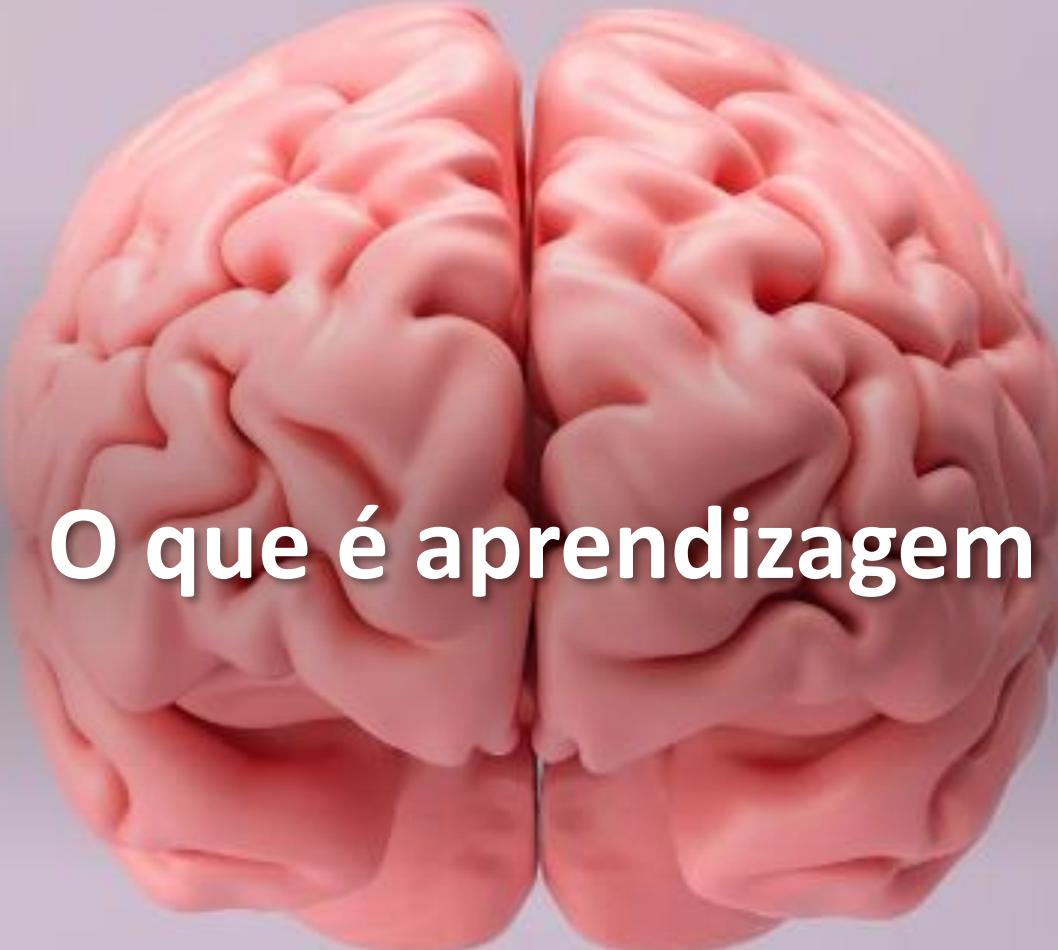
Atividade semanal EF3



Checagem

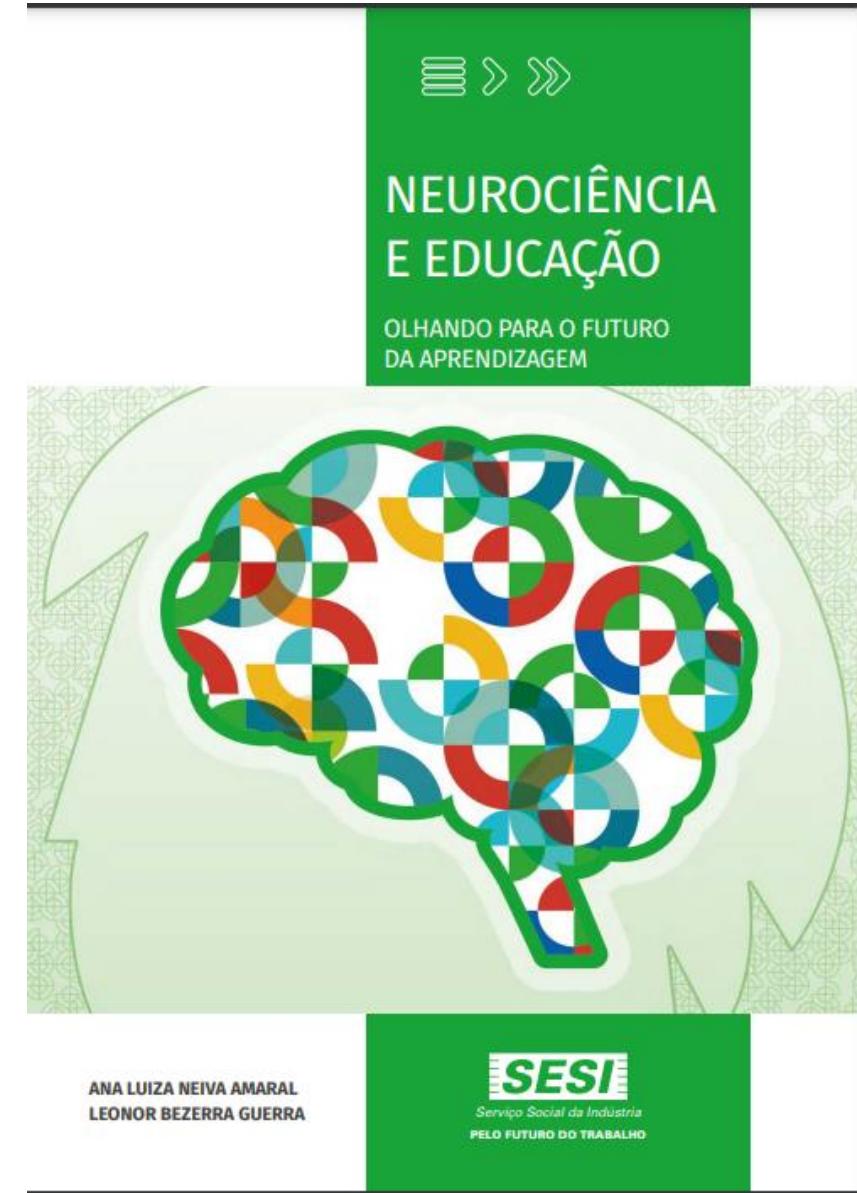
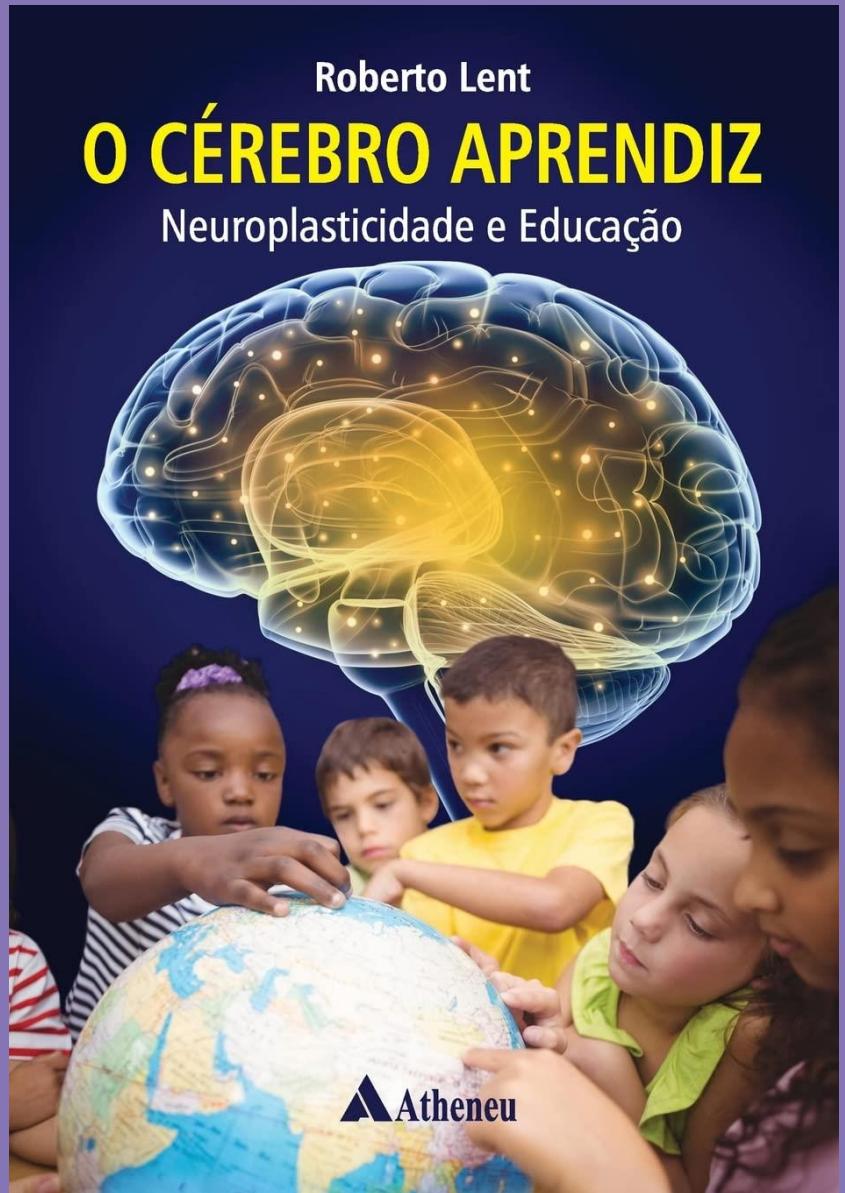


Prática de bem-estar

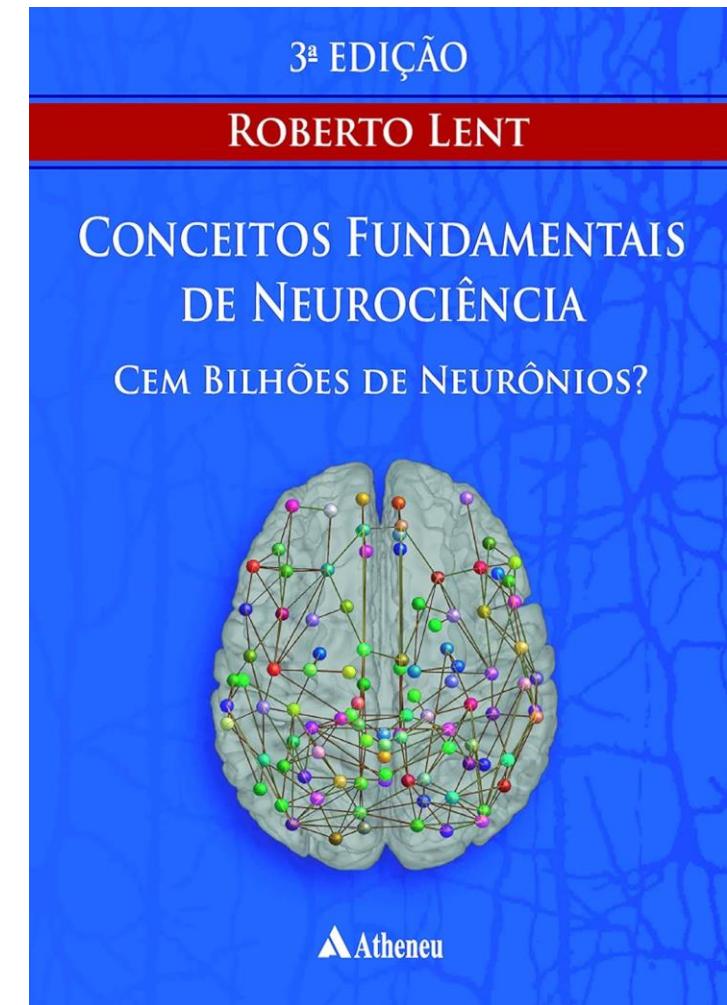
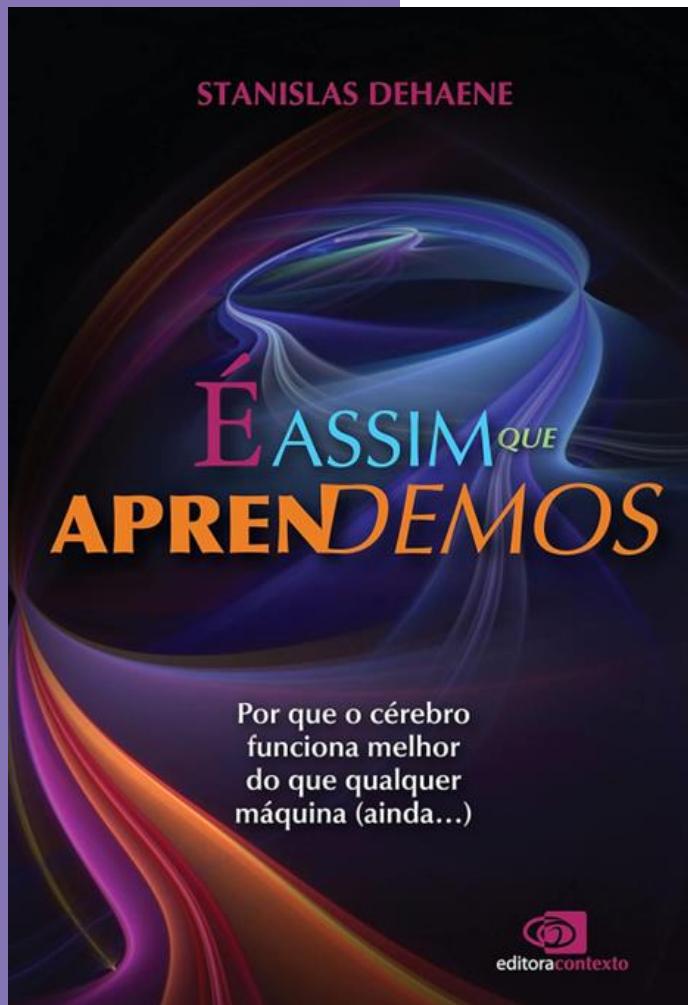


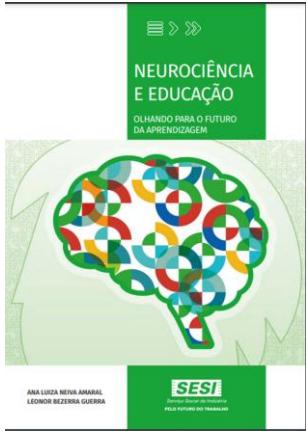
O que é aprendizagem

Sugestão de leituras



Sugestão de leituras



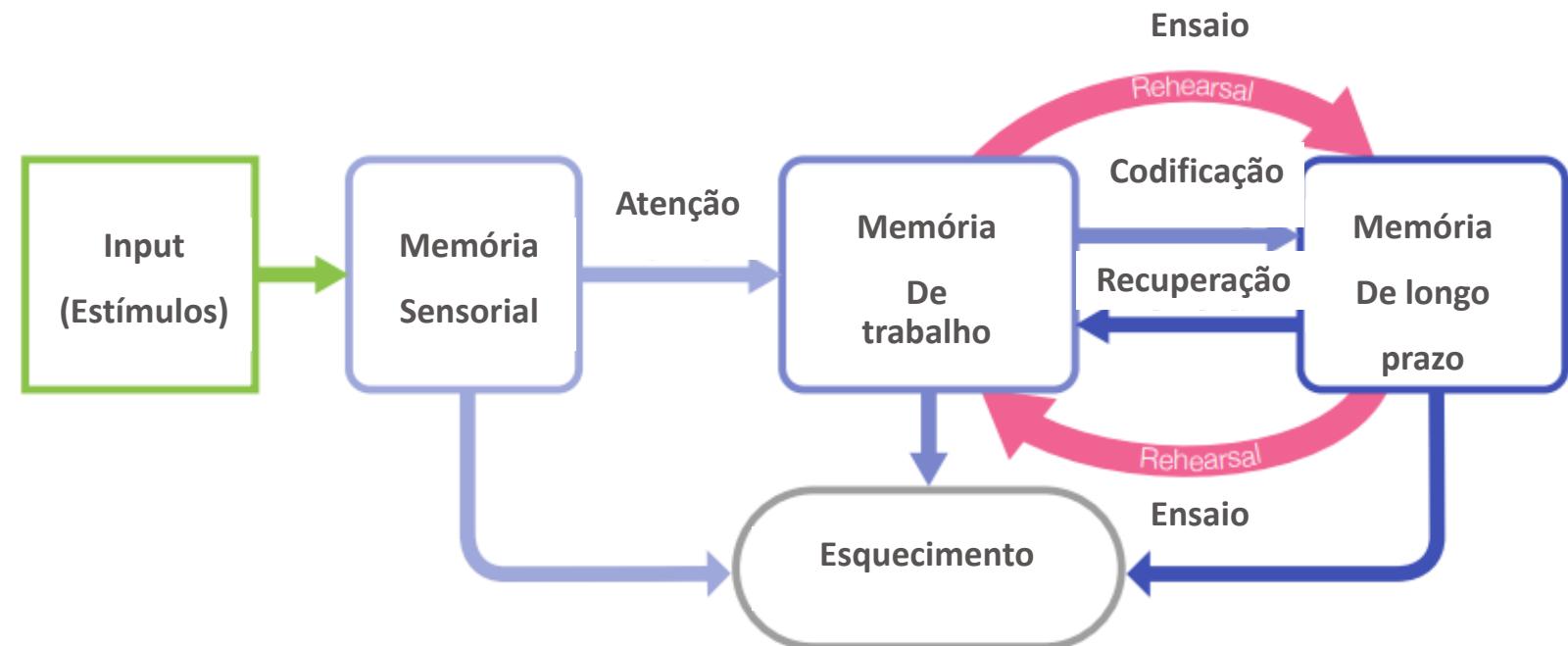


Aprendizagem é a **aquisição de novas competências (C,H,A)**, relacionadas às modificações cerebrais desencadeadas pelas **interações do aprendiz com o ambiente**. É um processo que se traduz pela **formação e consolidação das ligações entre neurônios**, e resulta de **modificações químicas e estruturais no sistema nervoso**, o que exige tempo e energia para se manifestar.

Portanto, a aprendizagem corresponde à modificação do cérebro por meio da experiência.

Serviço Social da Indústria. Departamento Nacional. Neurociência e educação : olhando para o futuro da aprendizagem / Serviço Social da Indústria, Ana Luiza Neiva Amaral, Leonor Bezerra Guerra. Brasília : SESI/DN, 2020.

Aprendizagem – princípios básicos da ciência cognitiva



Adapted from Atkinson, R.C. and Shiffrin, R.M. (1968). 'Human memory: A Proposed System and its Control Processes'. In Spence, K.W. and Spence, J.T. *The psychology of learning and motivation*, (Volume 2). New York: Academic Press. pp. 89–195.

Principais pontos a considerar...

Para ocorrer aprendizagem a informação precisa se consolidar em memória de longo prazo

Informação será processada através da memória de trabalho

A memória de trabalho tem capacidade limitada e pode ser sobre carregada.

Beneath the surface of cognitive science

Defining key concepts that underpin how we learn



To make purposeful use of cognitive science practices, teachers and school leaders need to know the core concepts that underpin them.

If we look below the surface, strategies such as interleaving and retrieval practice are based on key memory processes as well as Cognitive Load Theory.

This poster defines some of the key terminology to support teachers and school leaders in building a shared understanding of these concepts in their school.



Estratégias pedagógicas

	Working memory This is where new information is processed. It has a limited capacity and may vary from person to person. Working memory can be overloaded, inhibiting learning.
	Long term memory This is where previous learnt information is stored. It has a potentially unlimited capacity.
	Encoding This is how information from the working memory is transferred to the long term memory. Information not encoded can be forgotten.
	Retrieval This is when information from the long term memory is brought back into the working memory. Retrieval can strengthen memory.

Memória
+
Teoria da Carga Cognitiva

	Cognitive Load This is the amount of working memory being used when asked to process information or a task.
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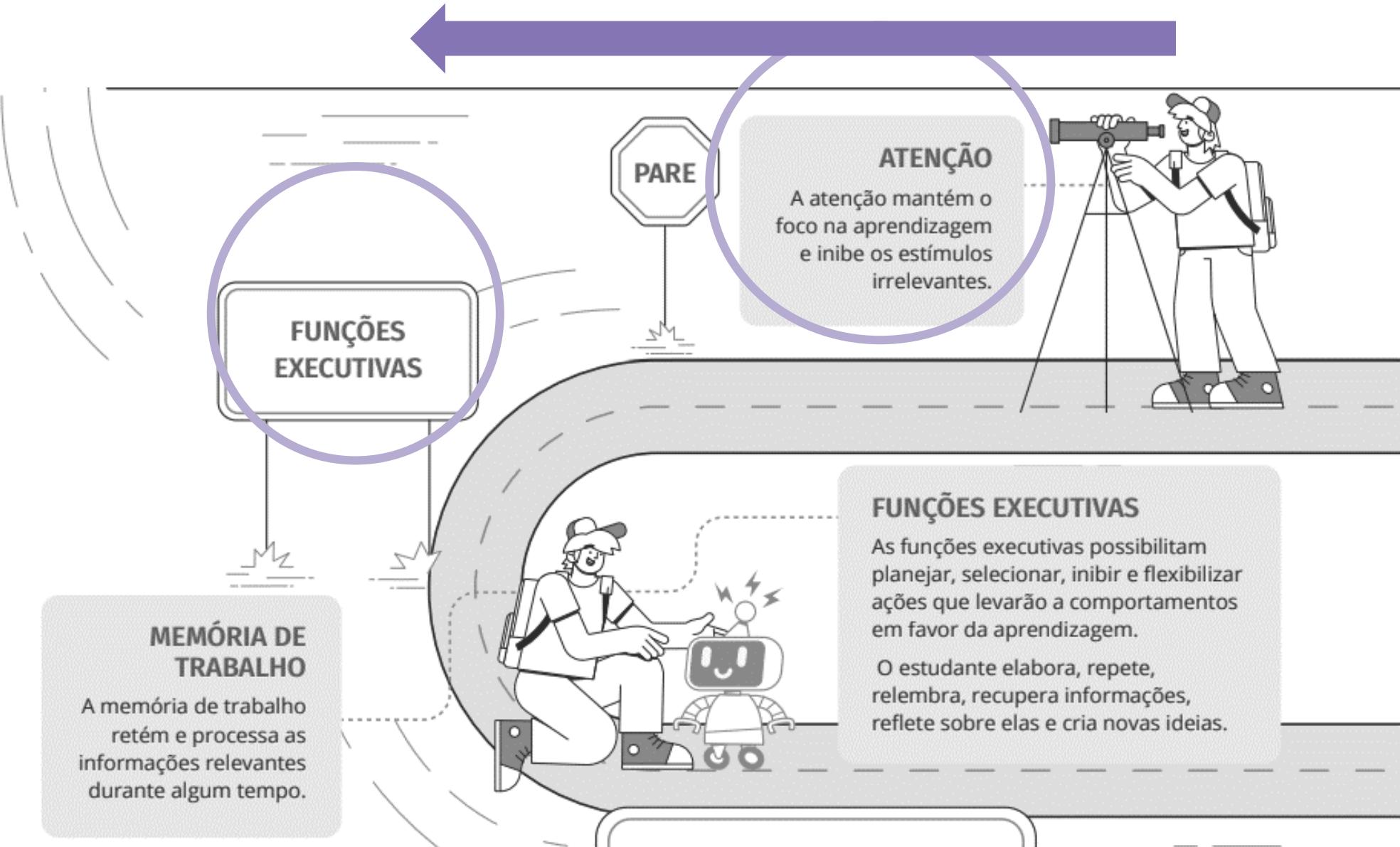


Further information and guidance can be found in the EEF's evidence review
'Cognitive science approaches in the classroom: a review of the evidence'

Caminhos da aprendizagem

1



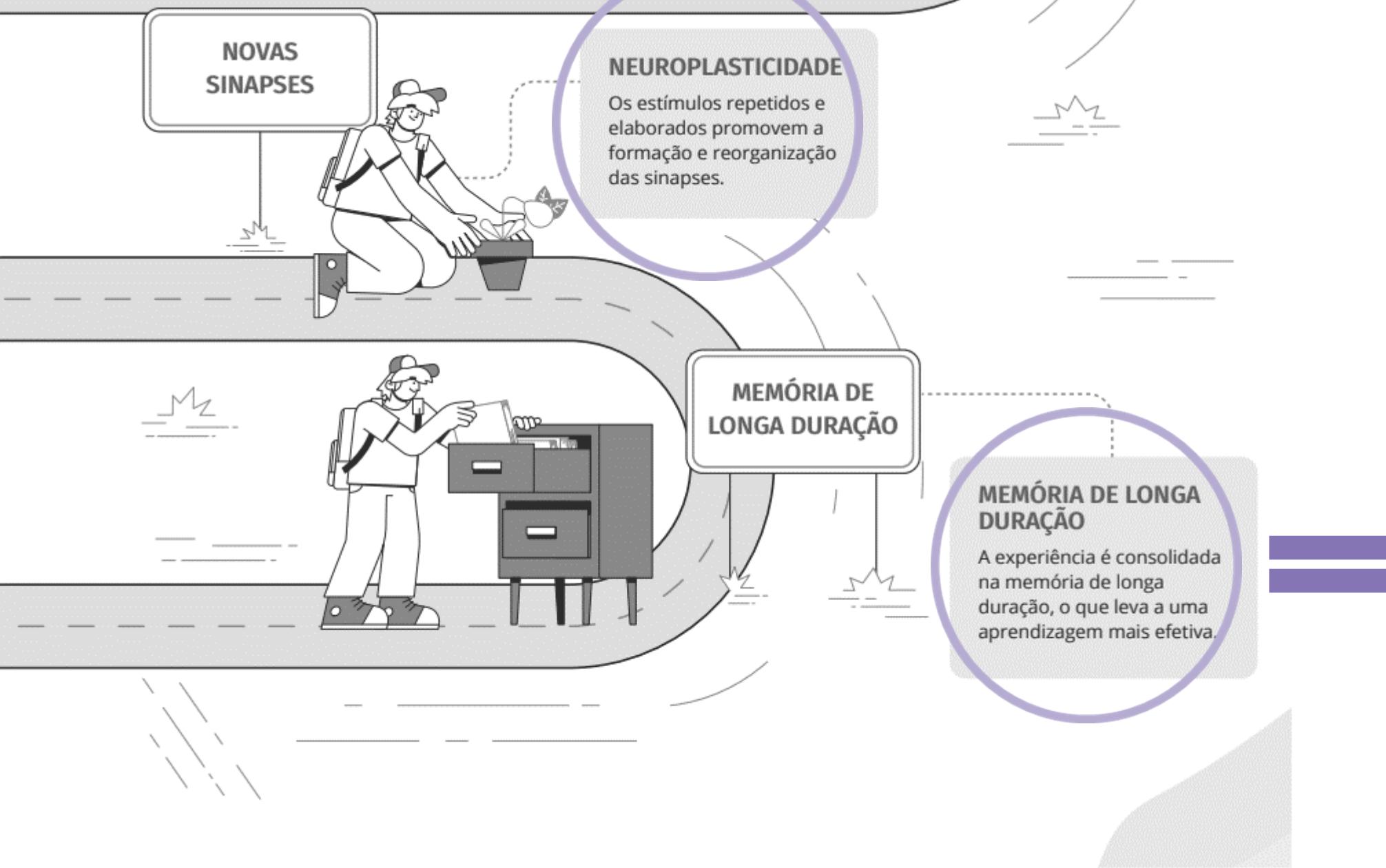


Aquisição de informações
ou experiências

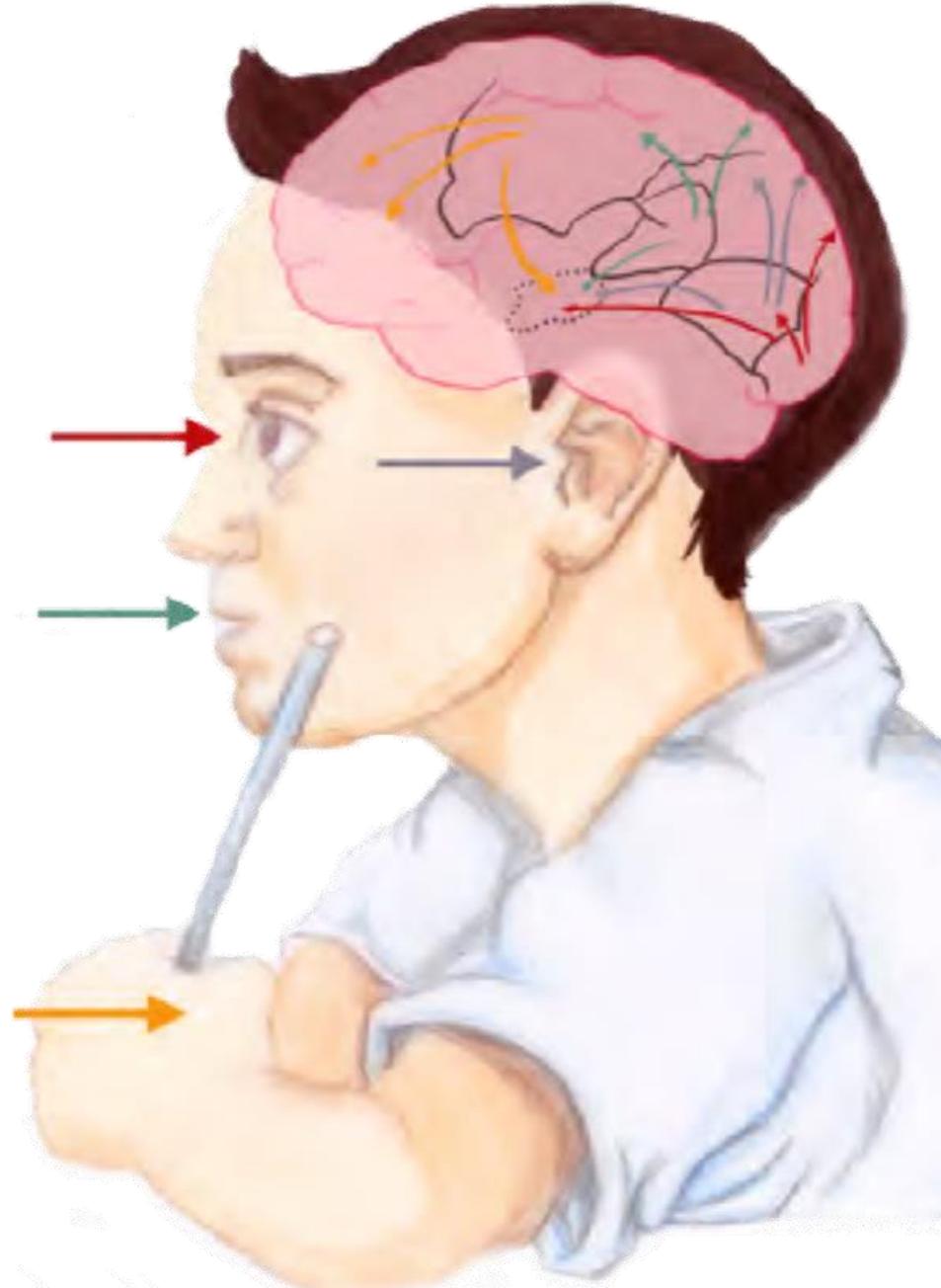


2





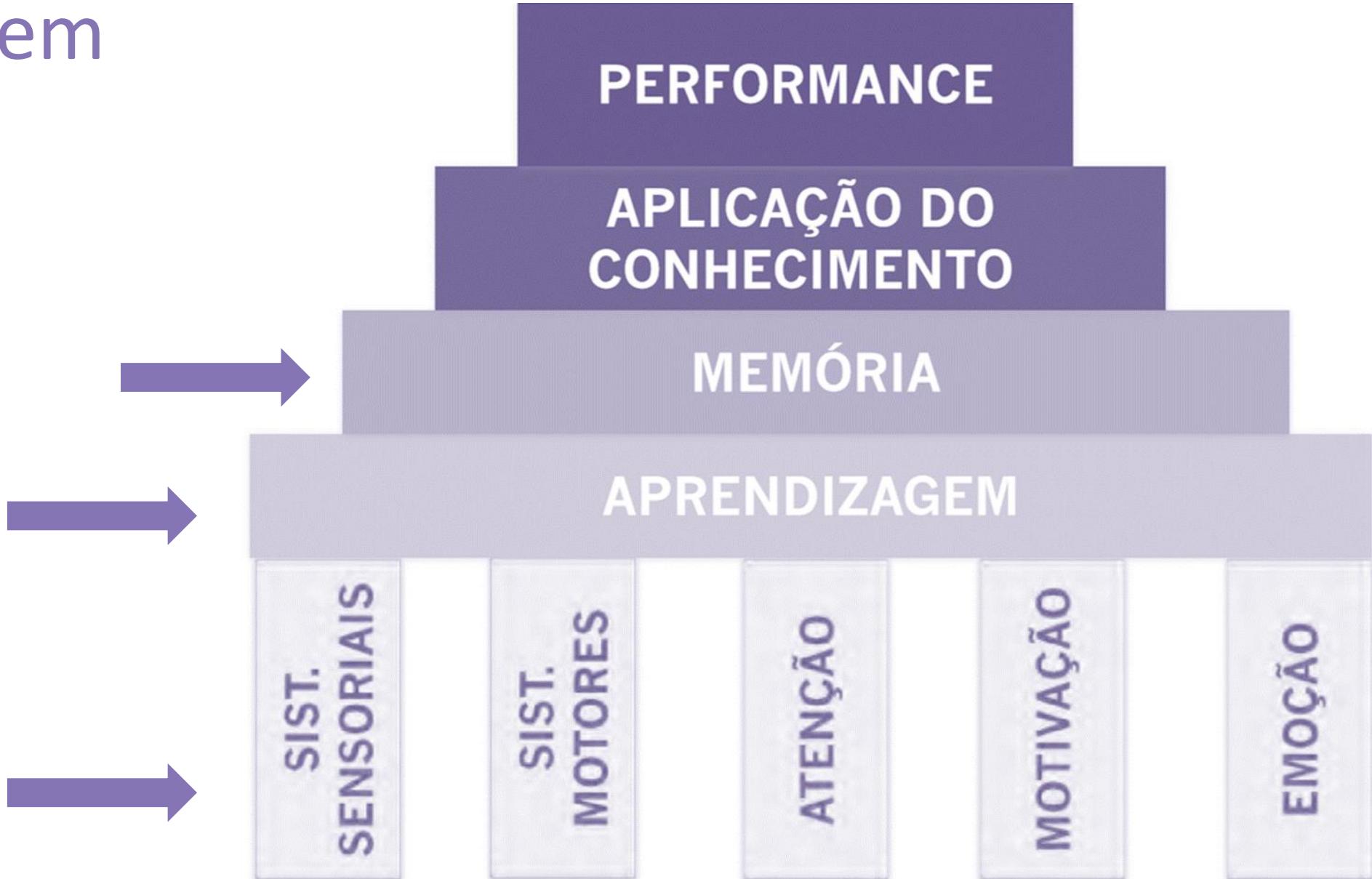
O aprendizado não é
apenas um
comportamento, mas
uma alteração.



Bases da aprendizagem

Funções Executivas

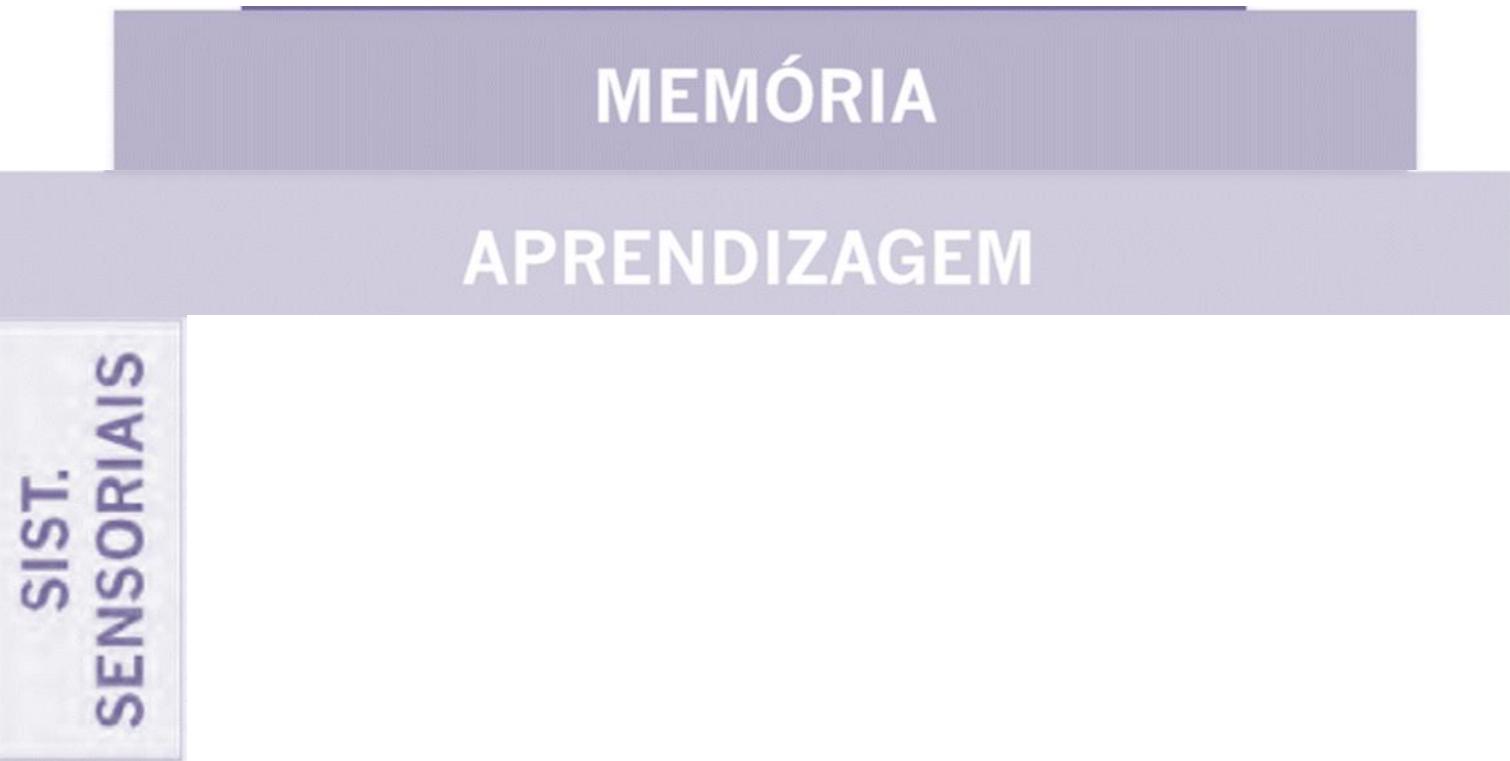
Neuroplasticidade



Bases da aprendizagem

Funções Executivas

Neuroplasticidade



Bases da aprendizagem

SIST.
SENSORIAIS

Neuroplasticidade

MEMÓRIA

APRENDIZAGEM

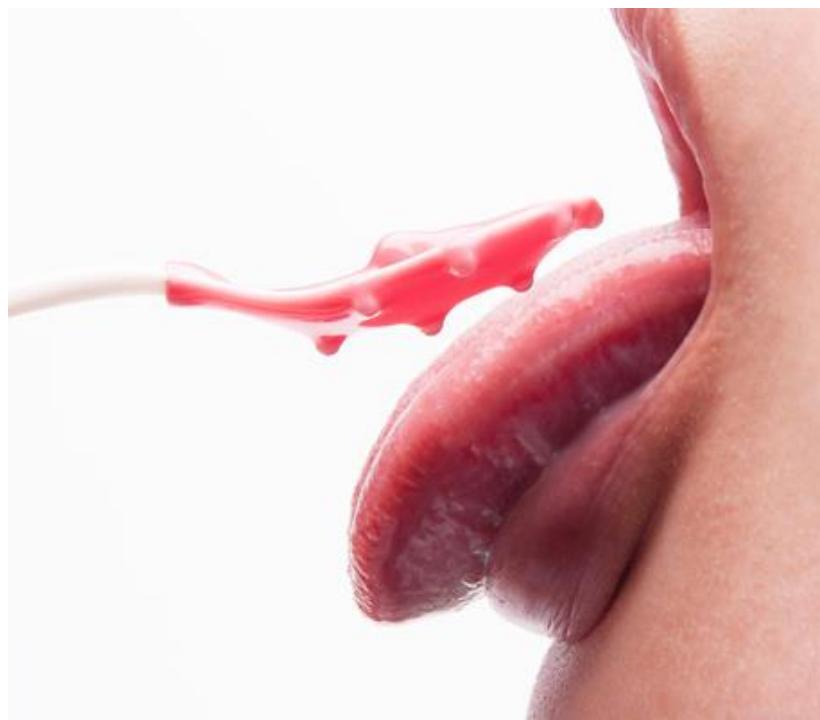
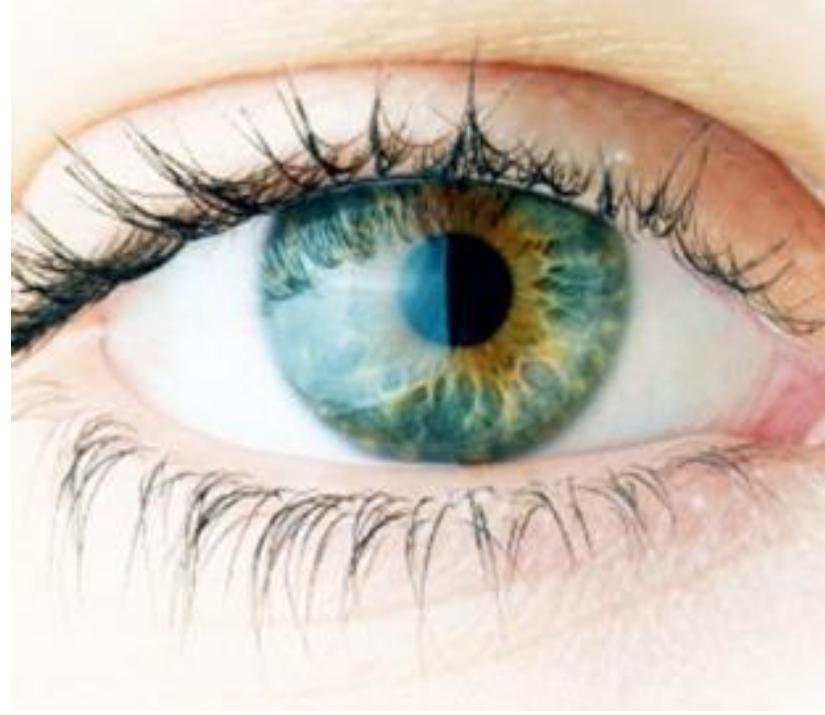
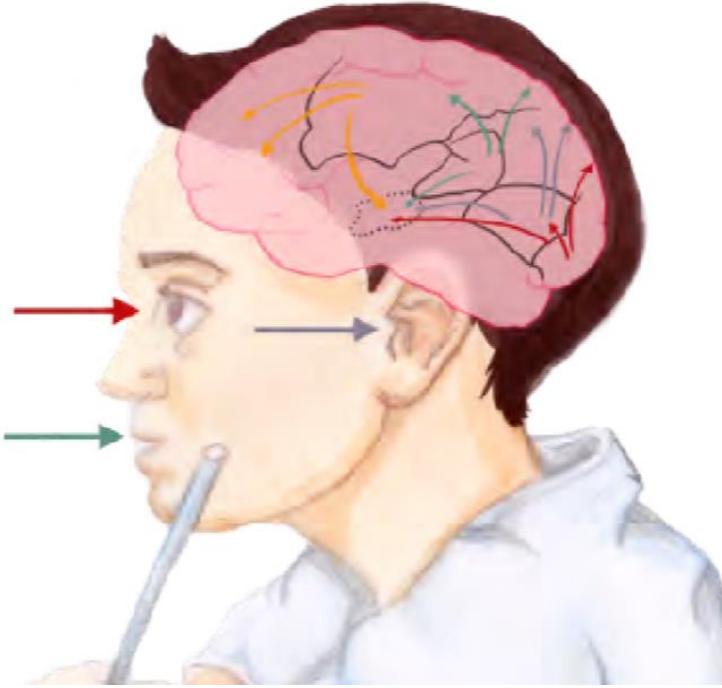
Estratégias cognitivas

Consolidando...

Aprendizagem, em neurociência significa aquisição de informações, conhecimentos ou experiências	Para ocorrer aprendizagem são necessários sistemas sensoriais, atenção, sistemas motores, atenção, motivação e emoção.	Aspectos de controle executivo são essenciais: memória de trabalho, planejamento, dentre outros.
Para que efetivamente ocorra aprendizagem, o conhecimento ou experiência precisa ser armazenado na memória de longo prazo.	As emoções serão cruciais para o processo de consolidação da memória.	Aprender não é apenas um comportamento, mas sim, uma alteração do nosso sistema.



Sentidos



Sentidos – porta de
entrada para o mundo

Exercício sensorial



**Informações
multissensoriais
favorecem a
memorização**



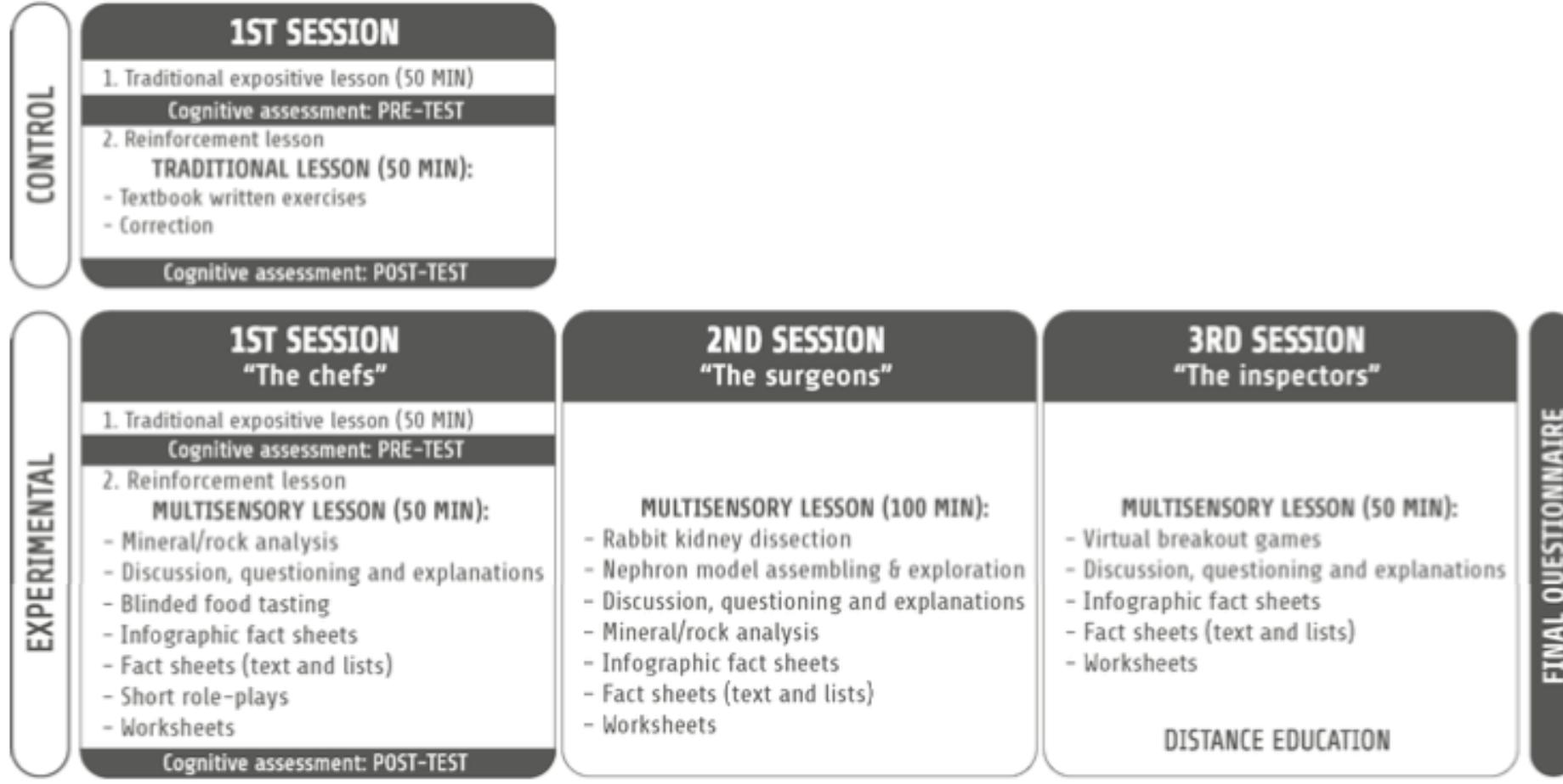


Figure 1. Workflow with the control group and the experimental group, including all strategies/activities selected for each session and the instruments of assessment applied.

Ferreira, Fábio Miguel, and Clara Vasconcelos. "The Impact of Multisensory Instruction on Geosciences Learning and Students' Motivation." *Geosciences* 10.11 (2020): 467.

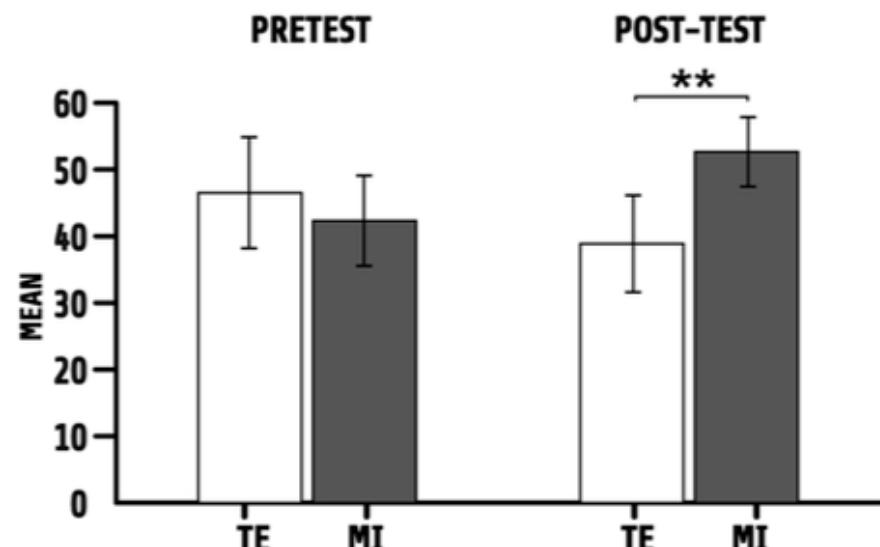
Mais
motivação

Mais interativo
e facilita
aprendizagem
na prática

Facilita a
memorização

Facilita a
aprendizagem

Mais atenção
e
concentração

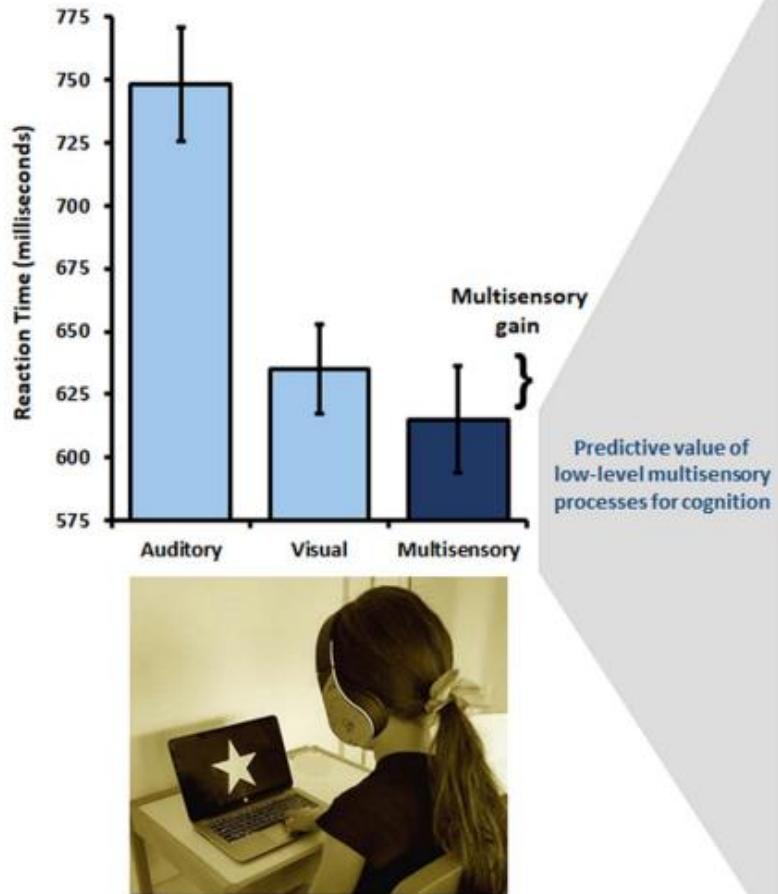


Ferreira, Fábio Miguel, and Clara Vasconcelos. "The Impact of Multisensory Instruction on Geosciences Learning and Students' Motivation." *Geosciences* 10.11 (2020): 467.

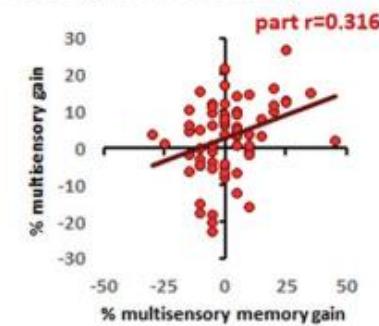
Informações multissensoriais favorecem a memorização



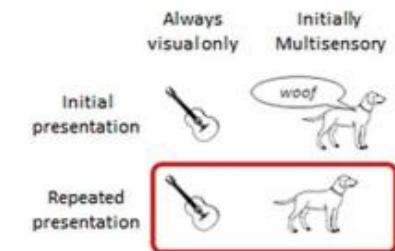
A. Simple Detection Task



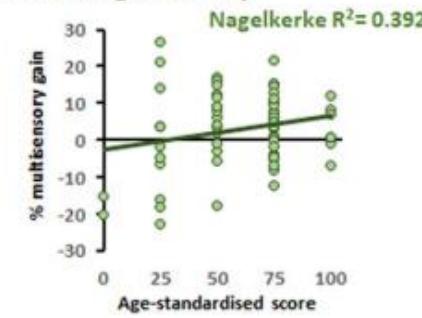
B. Recognition Memory



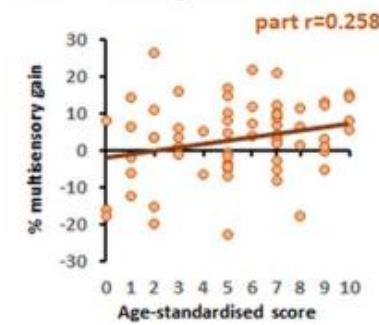
% benefit of multisensory learning



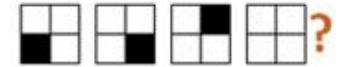
C. Working Memory

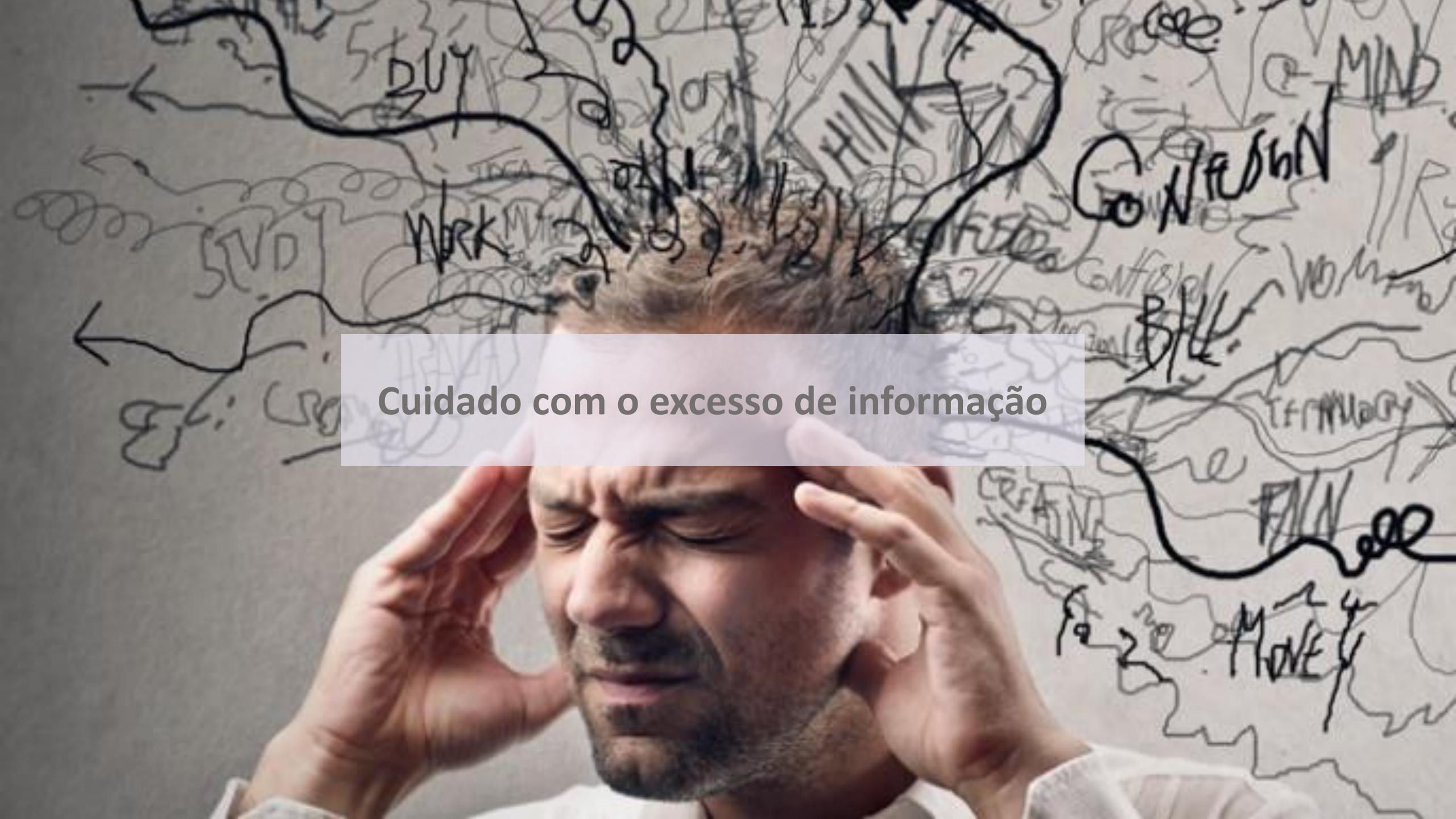


D. Fluid Intelligence



Raven's Progressive Matrices





Cuidado com o excesso de informação



Providing Instruction Based on Students' Learning Style Preferences Does Not Improve Learning

Beth A. Rogowsky^{1*}, Barbara M. Calhoun² and Paula Tallal^{3,4}

¹Department of Teaching and Learning, Bloomsburg University of Pennsylvania, Bloomsburg, PA, United States,

²Independent Researcher, Nashville, TN, United States, ³Center for Molecular and Behavioral Neuroscience, Rutgers University, Newark, NJ, United States, ⁴Center for Human Development, University of California, San Diego, San Diego, CA, United States

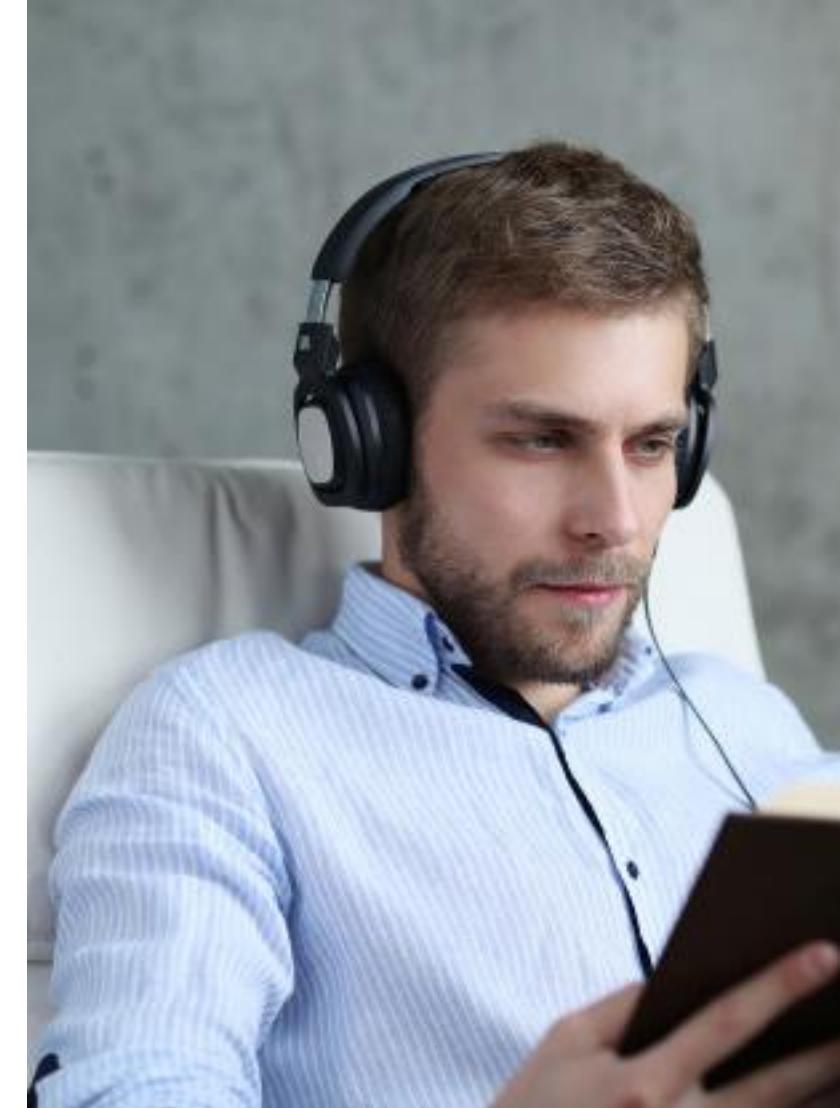
ATENÇÃO!!!

Estilos de Aprendizagem é NEUROMITO.

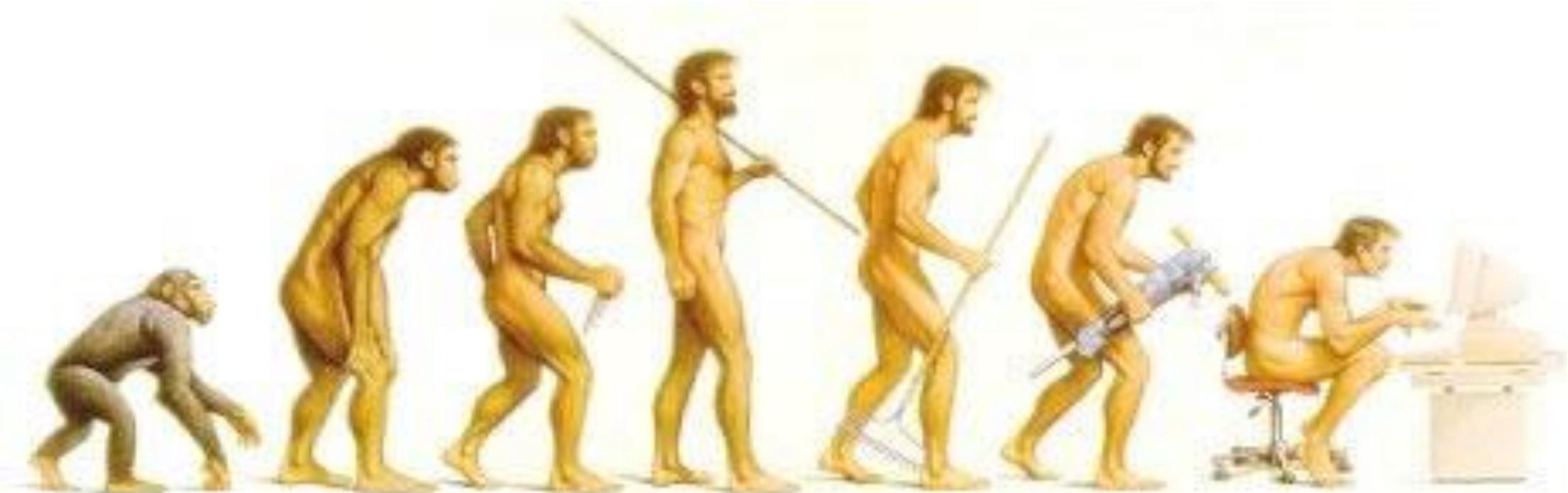
Aprendizagem para adultos...



Preferências já
foram
estabelecidas ao
longo da vida



Nosso cérebro não evoluiu a tempo de lidar com telas e monitores



Consolidando...

Os sentidos são nossa porta de entrada para o mundo.

É a partir dos estímulos sensoriais que entendemos o mundo ao redor e o mundo interno.

Estímulos multissensoriais impactam positivamente a formação de memória

O excesso de estímulos sensoriais, por sua vez, pode gerar sobrecarga cognitiva.

Estilos de aprendizagem são neuromitos.

Preferências de aprendizagem são corretas e ocorrem por repetição ao longo da vida acadêmica.



Percepção

É a forma como interpretamos o mundo!

E pode variar de acordo com experiências prévias!



Sensação

Processo de receber
informação através dos
sentidos

Sensações resultam em informação crua
a partir dos sentidos

Sensação é um processo biológico



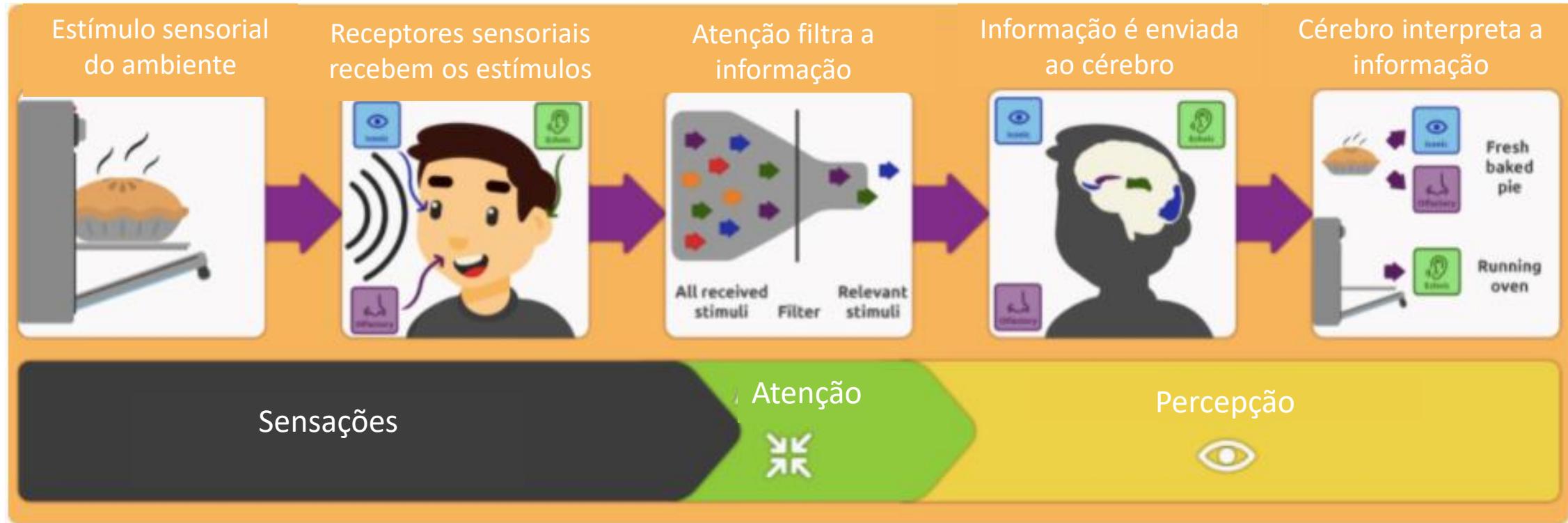
Percepção

Maneira como o cérebro
interpreta as sensações

Percepção resulta em significado das
informações

Percepção é mais um processo
psicológico uma vez que informações
armazenadas no cérebro afetam o
resultado

Como percepções são criadas

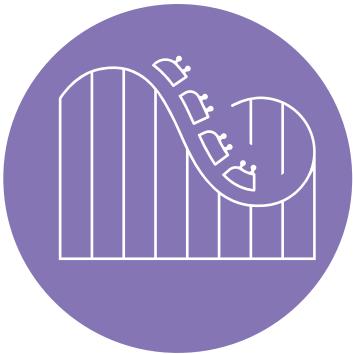


<https://www.braingymmer.com/en/blog/perception/>

Que fatores afetam a percepção?



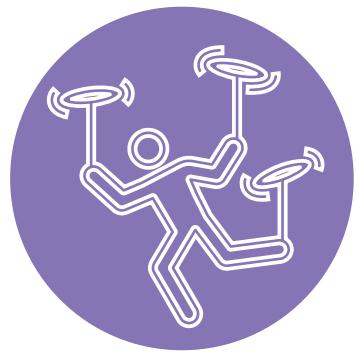
Memória



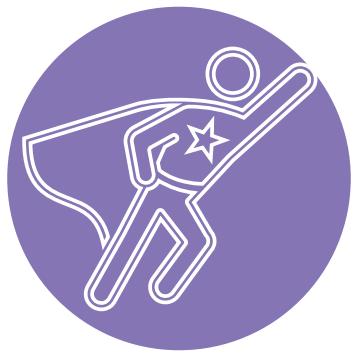
Expectativas



Atenção



Personalidade



Motivação



Interesses

Que fatores afetam a percepção?



Memória



Expectativas



Atenção



Personalidade



Motivação



Interesses

CONHECIMENTOS PRÉVIOS

A

S

I

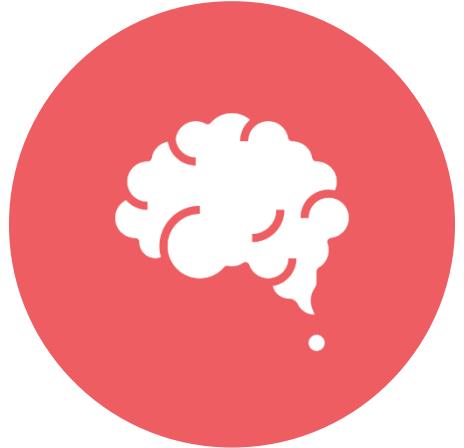
FAZER PARTE DA ESTRATEGIA

DE APRENDIZAGEM DAS

AULAS!



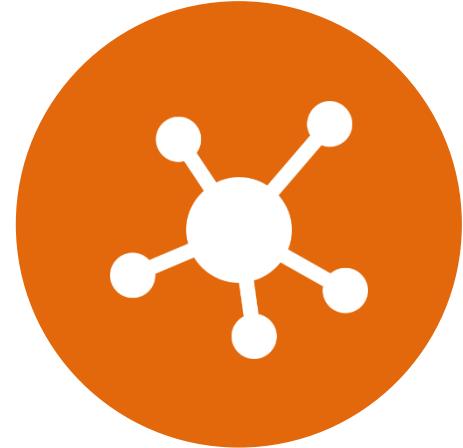
Sala de aula invertida



Atividades de sondagem

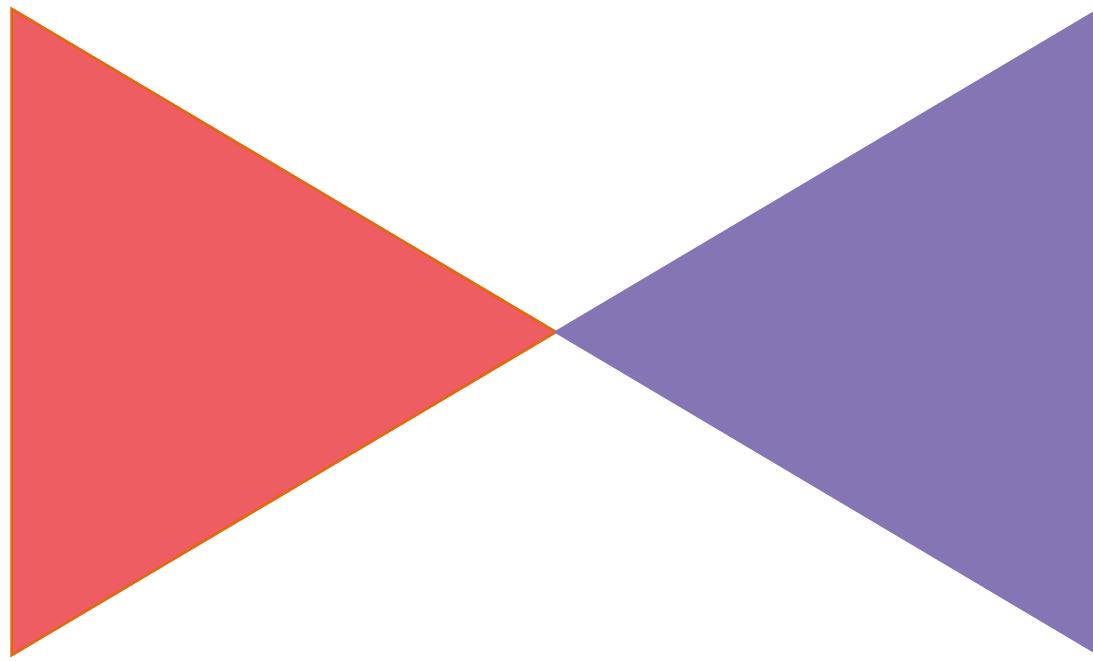


Debates

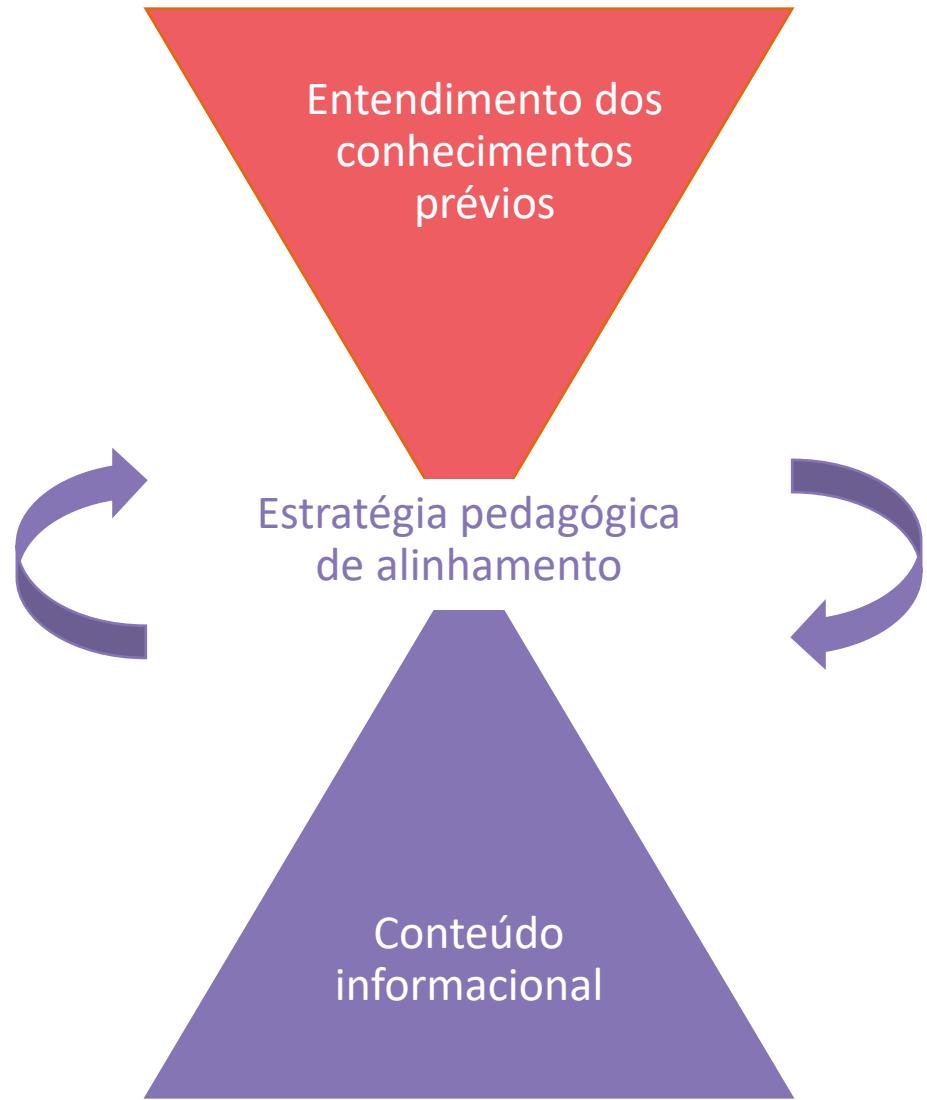


Apresentações

Como fazer isso?



Como fazer isso?



Consolidando...

Percepção é como interpretamos o que os sentidos captam

A percepção pode ser afetada por informações pré-existentes

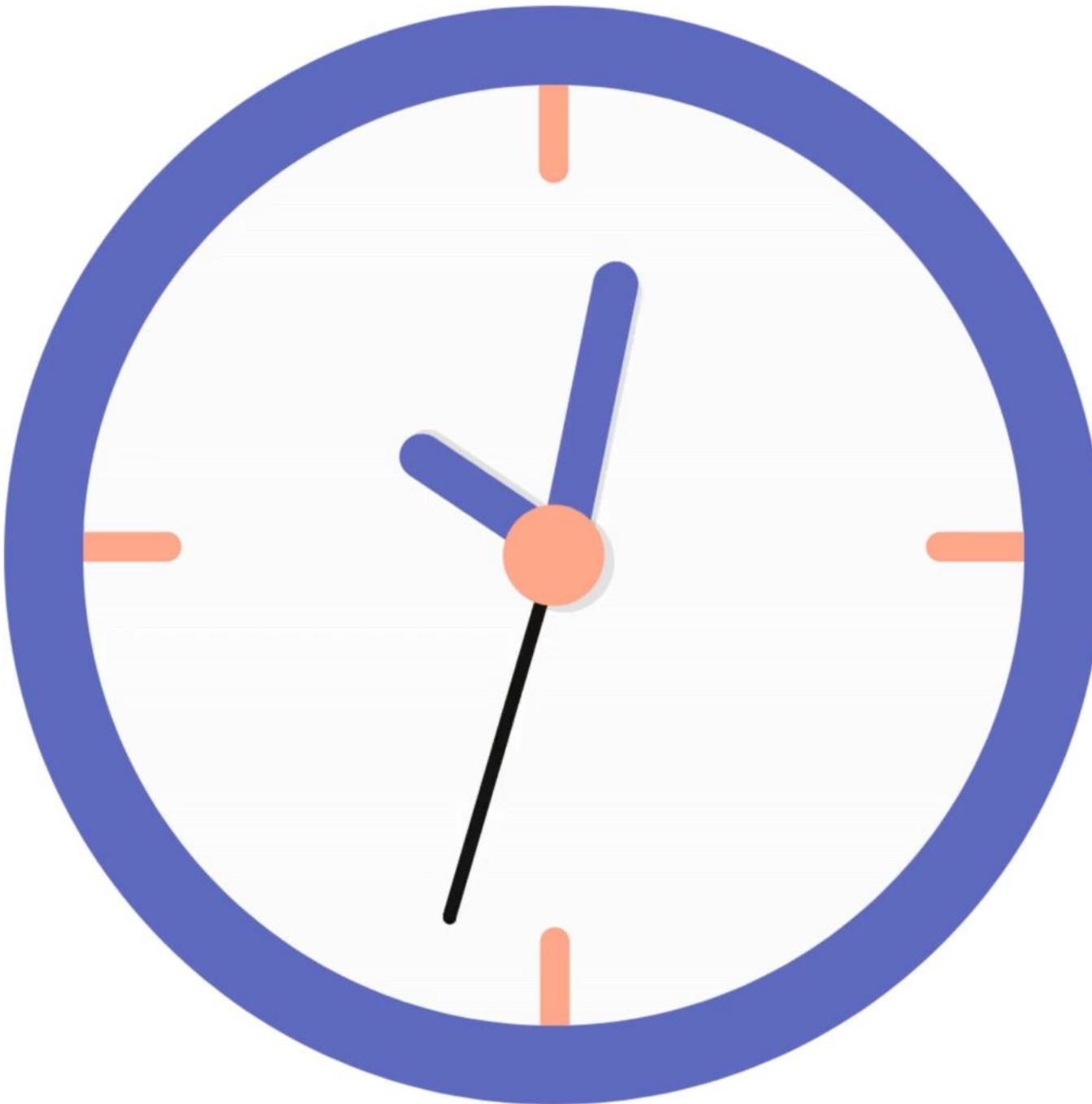
Fatores como atenção, expectativas, interesse, dentre outros podem afetar a apercepção

Os processos de sondagem pelo professor são essenciais para levar em consideração os conhecimentos prévios

Conteúdo informational não chega igualmente para todos se não for contextualizado

Sem atenção não há percepção

Hora da
pausa!

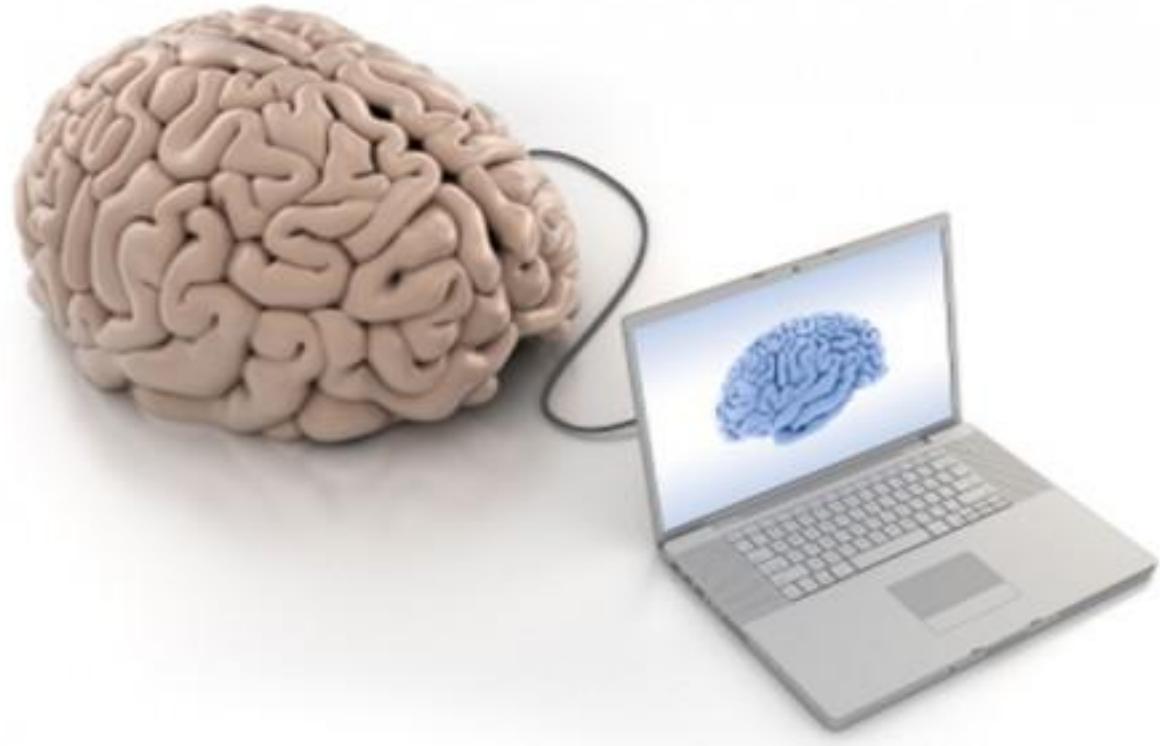




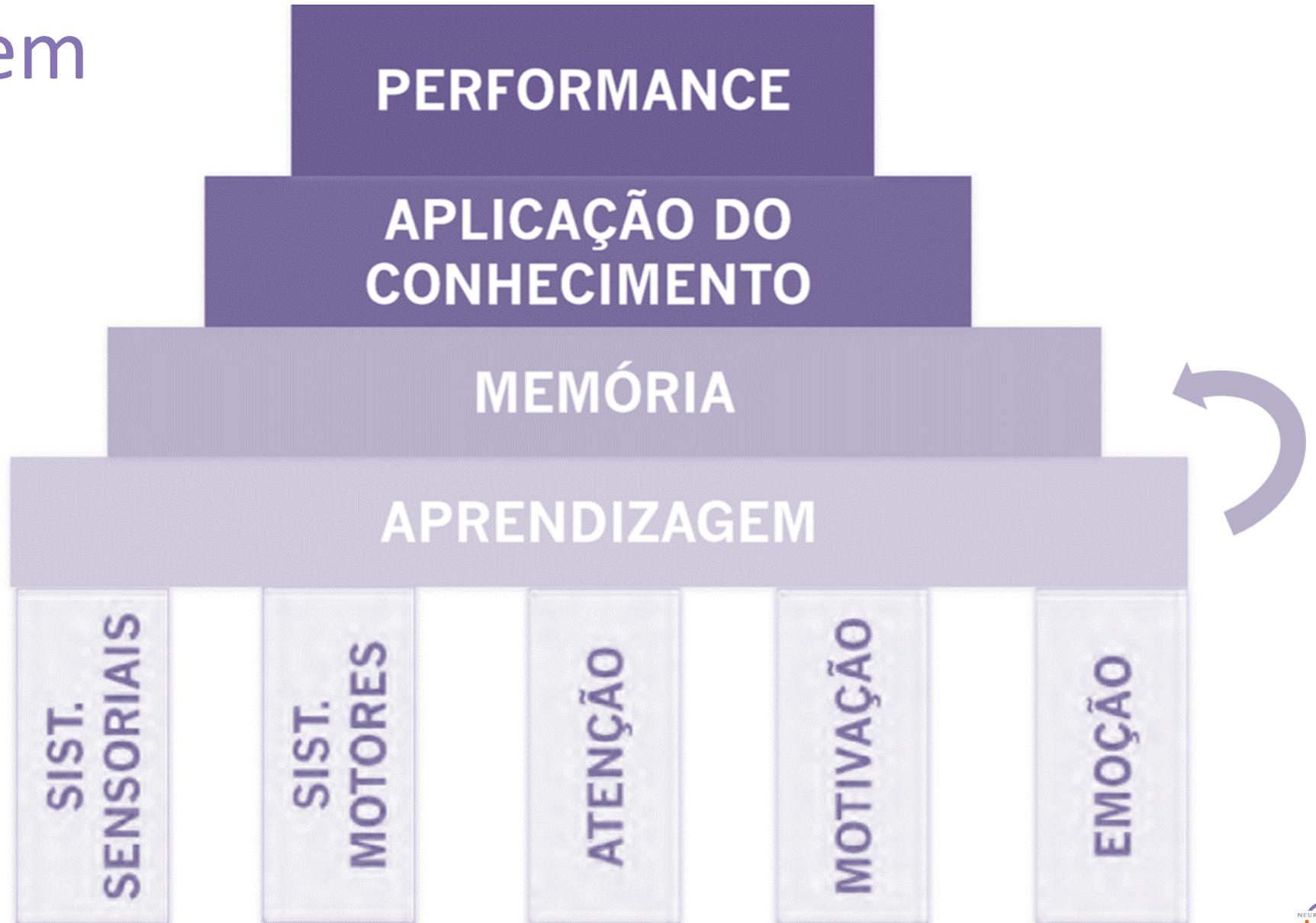
Memória

A memória é a capacidade de **adquirir** (aquisição), **armazenar** (consolidação) e **recuperar** (evocar) informações disponíveis, seja internamente, no **cérebro** (memória biológica), seja externamente, em dispositivos artificiais (memória artificial).

MEMÓRIA



Bases da aprendizagem





APRENDER + EVOCAR = MEMÓRIA

Aprendizado



Aprendizado
Aquisição de
conhecimento ou
habilidade

X

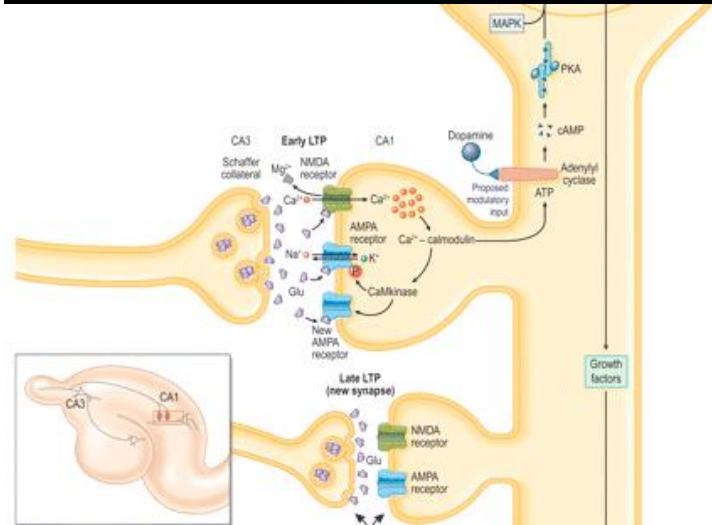
Memória



Memória
Retenção do conhecimento
ou habilidade, para que
possa ser posteriormente
evocado.

Eric Kandell e os estudos com Aplisia.

A memória é formada pela **criação de conexões entre os neurônios**, formando circuitos no nosso cérebro.



Duração da memória



Memória de TRABALHO...

Segundos – Minutos



... de CURTO PRAZO...

Horas - Dias



... de LONGO PRAZO.

Dias – Meses - Anos

Duração da memória



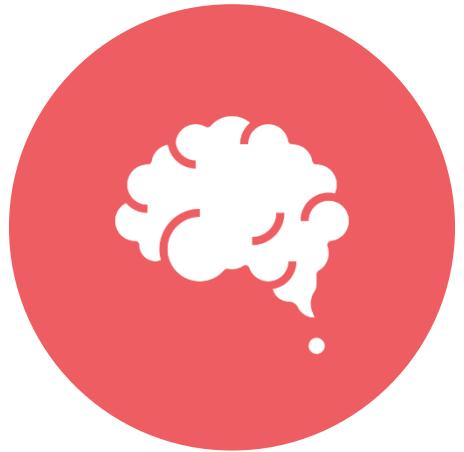
Memória de TRABALHO...

Segundos – Minutos

“Armazenamento
temporário de
informação com
capacidade limitada.”



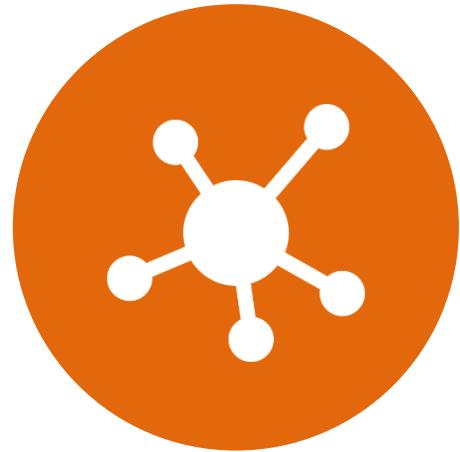
Memória de trabalho



Iniciação de tarefas



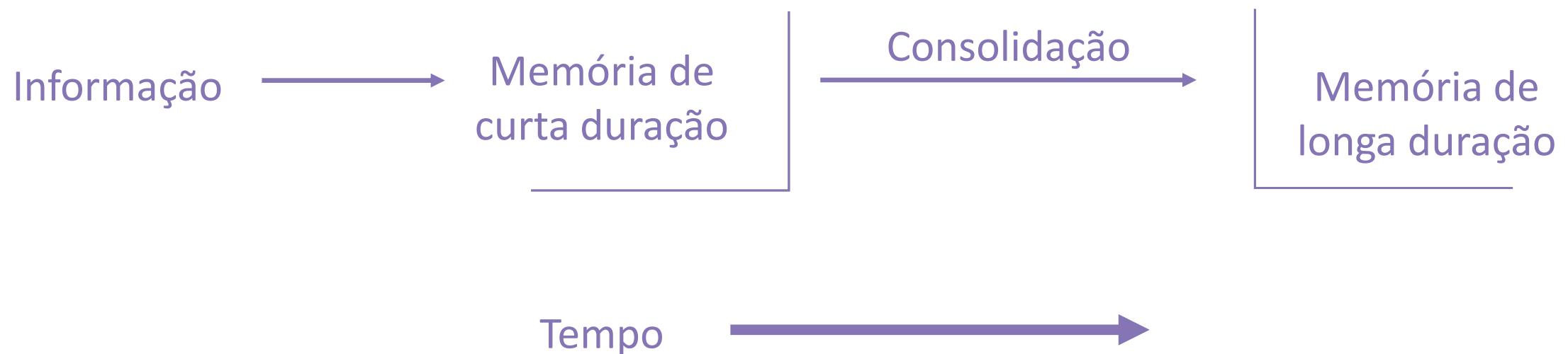
Planejamento



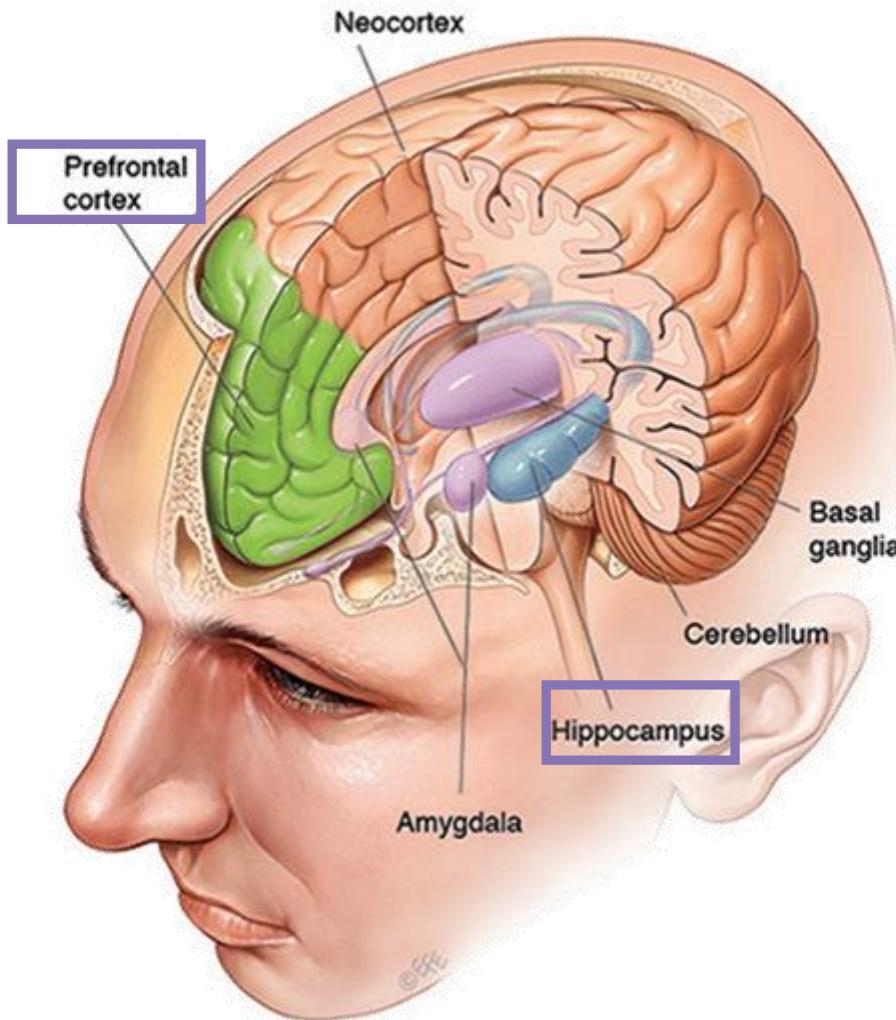
Priorização

FUNÇÕES EXECUTIVAS

Como as memórias são formadas?



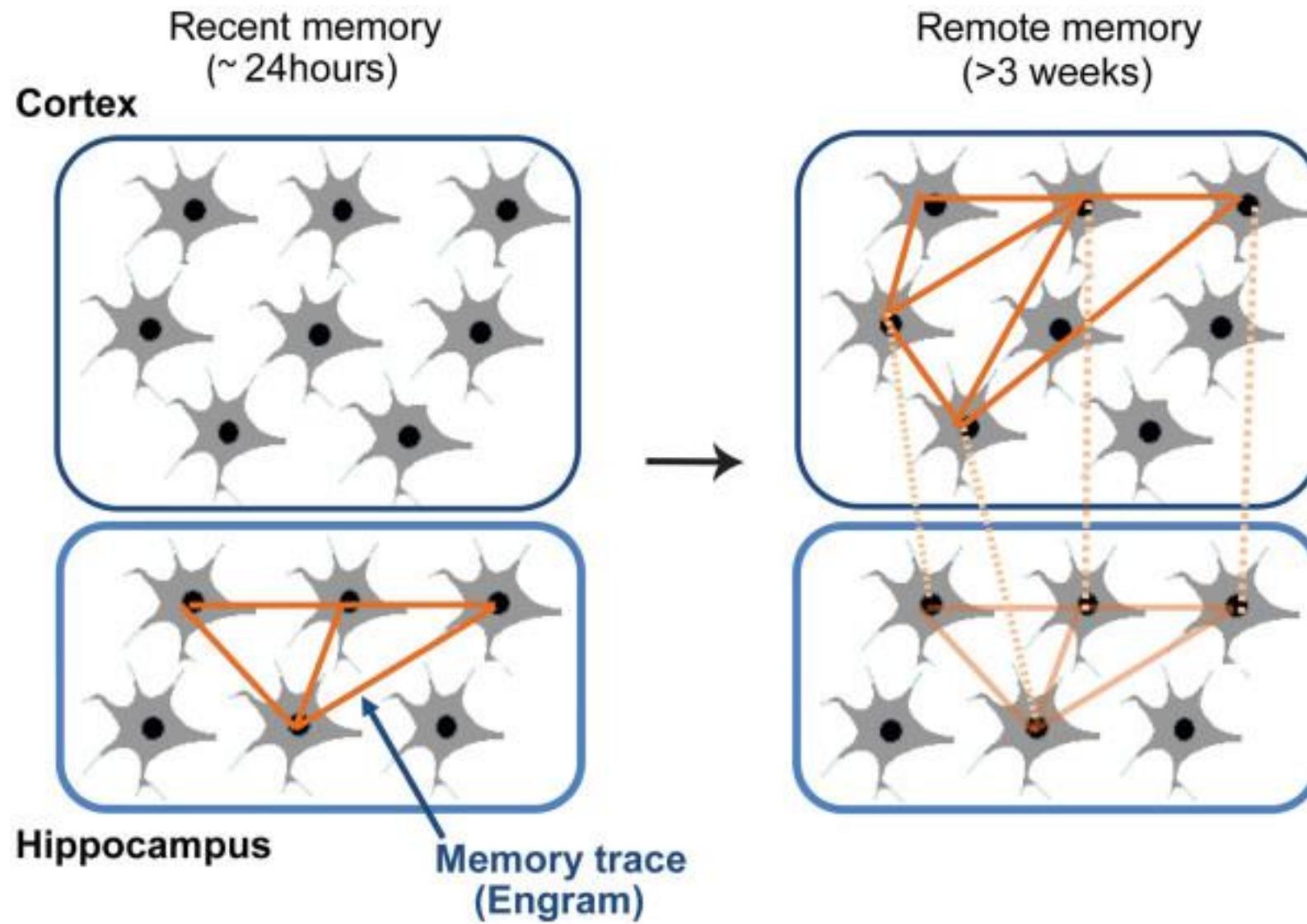
Como as memórias são formadas?





Desuso

Esquecimento...

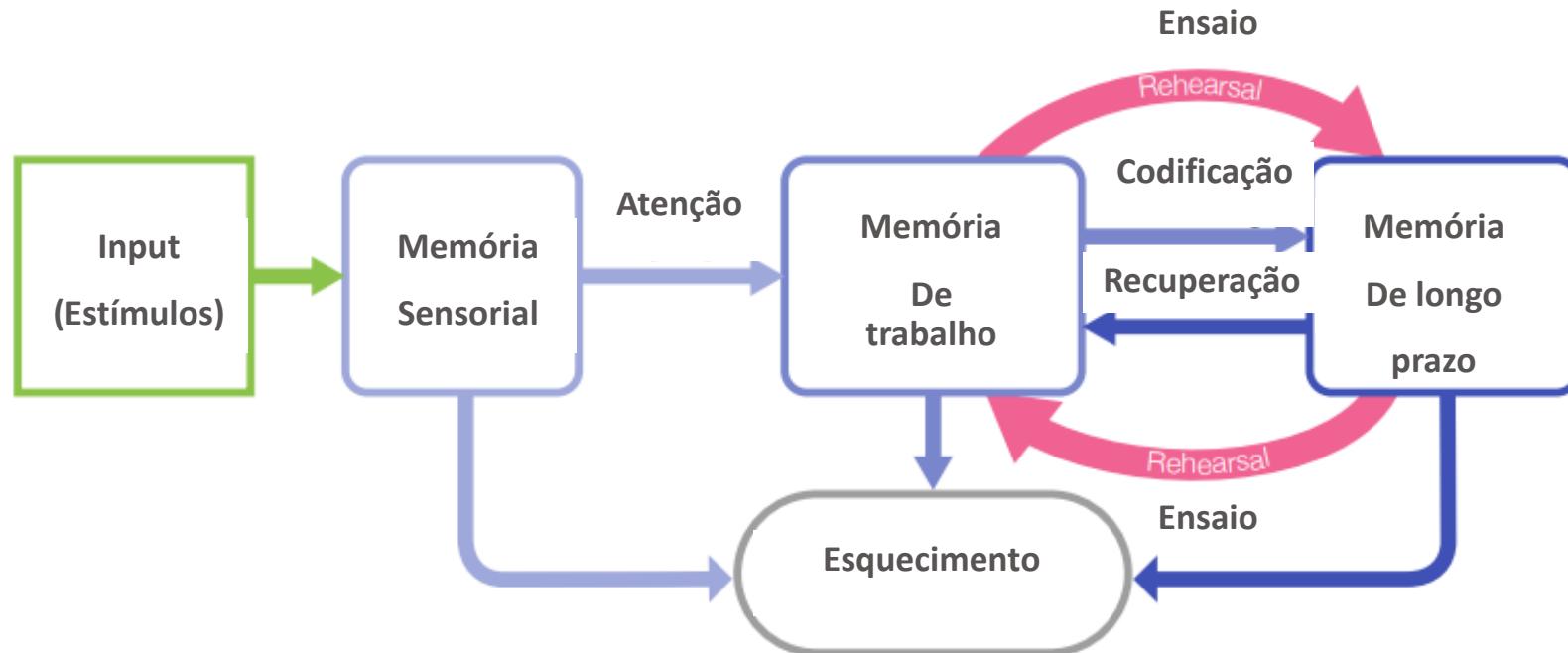




Esquecimento...

Desuso
Fadiga mental

Teoria da Carga Cognitiva



Adapted from Atkinson, R.C. and Shiffrin, R.M. (1968). 'Human memory: A Proposed System and its Control Processes'. In Spence, K.W. and Spence, J.T. *The psychology of learning and motivation*, (Volume 2). New York: Academic Press. pp. 89–195.



Esquecimento...

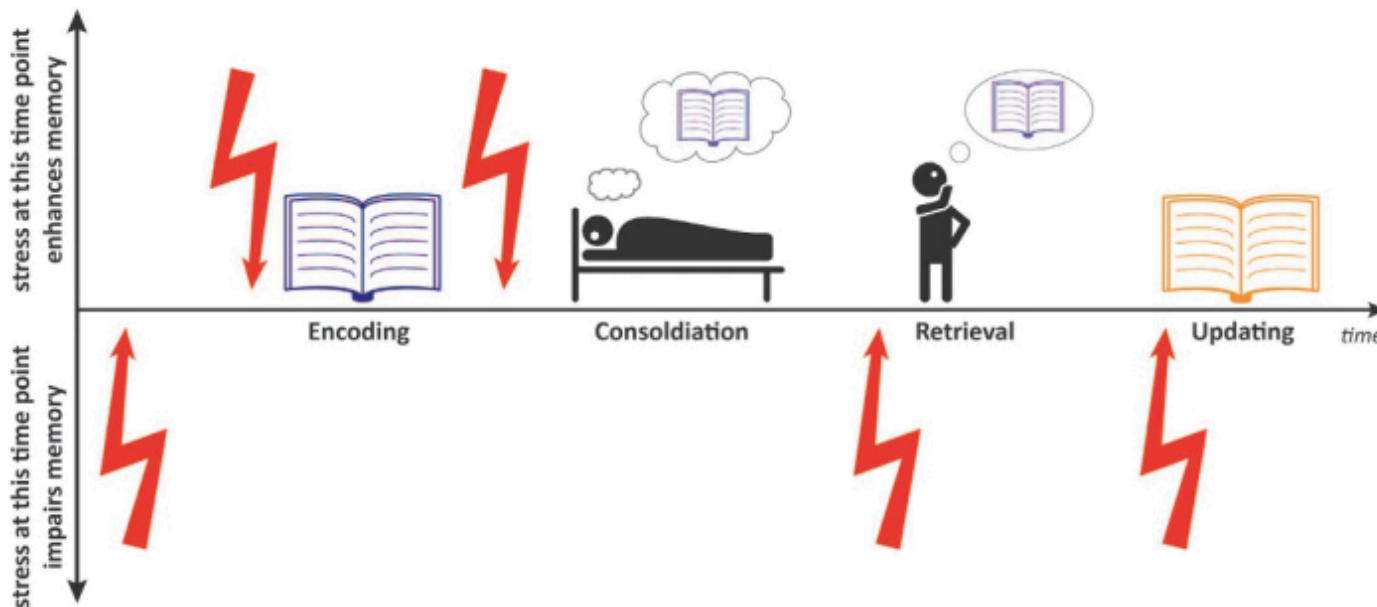
Desuso
Fadiga mental
Estresse
Ansiedade

REVIEW ARTICLE

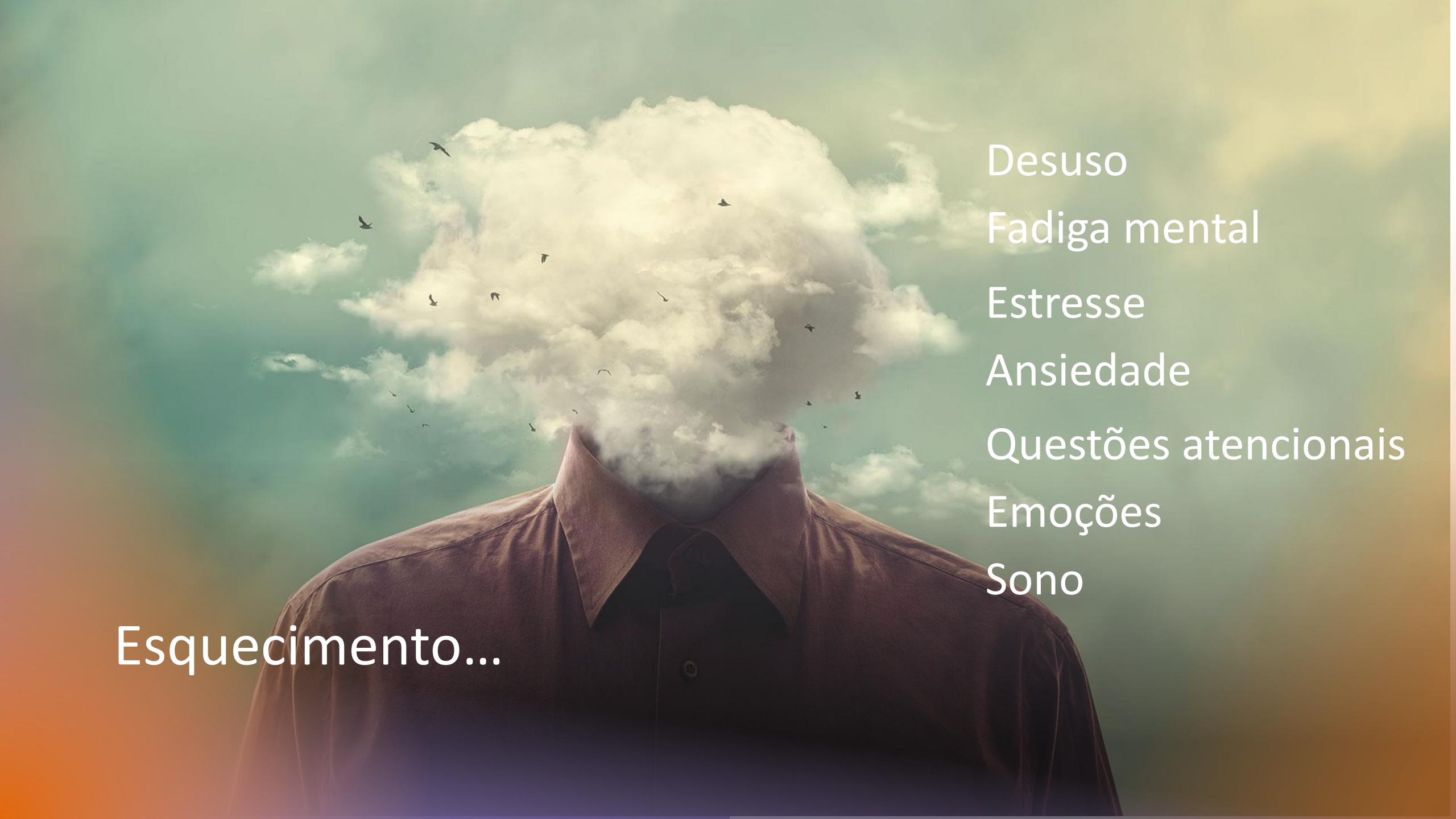
OPEN

Learning and memory under stress: implications for the classroom

Susanne Vogel¹ and Lars Schwabe¹



O estresse pode afetar a formação de memória e a aprendizagem dependendo do momento e da intensidade.

A surreal image of a man from the chest up. His head has been replaced by a massive, billowing white cloud. Several small black birds are scattered around the cloud. The background is a vibrant, multi-colored sky transitioning from green to yellow and orange. The man is wearing a dark brown button-down shirt.

Esquecimento...

Desuso

Fadiga mental

Estresse

Ansiedade

Questões atencionais

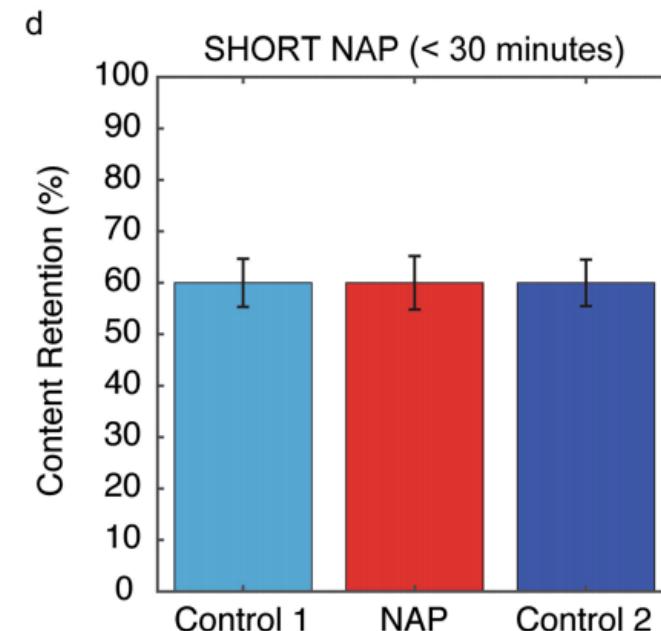
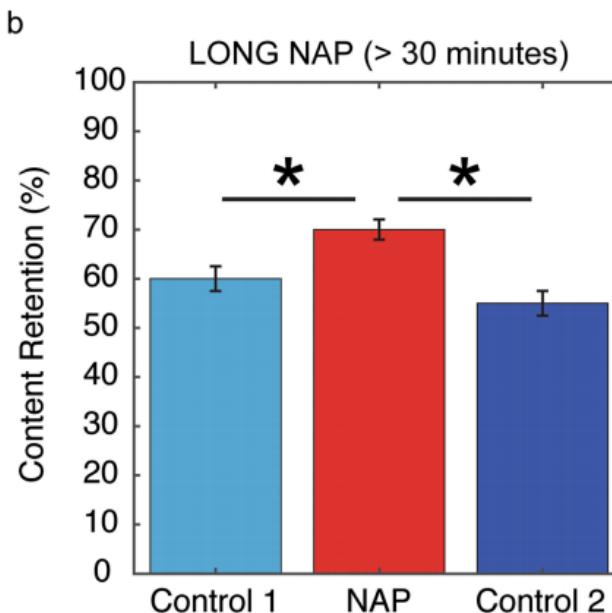
Emoções

Sono

Post-class naps boost declarative learning in a naturalistic school setting

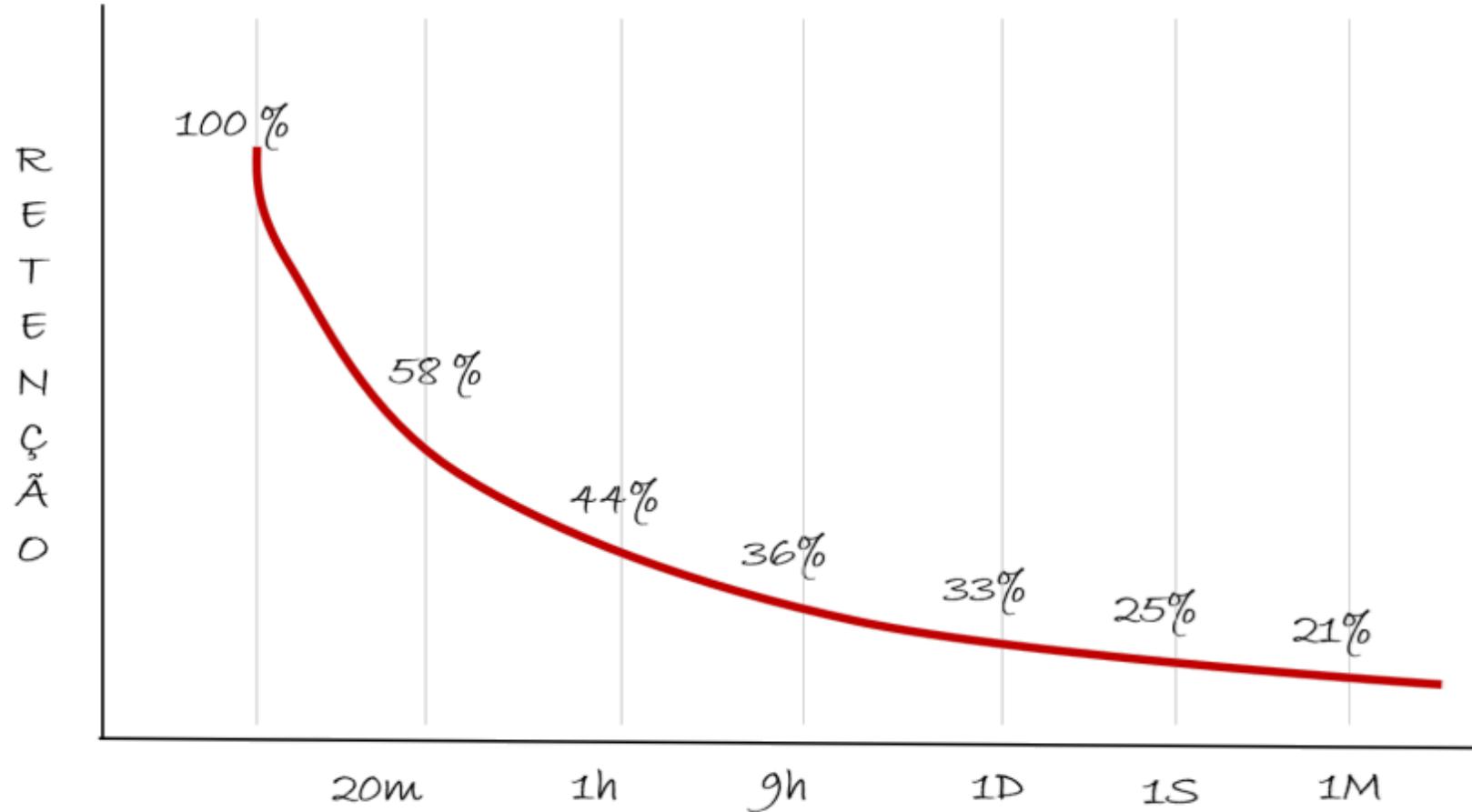
Thiago Cabral¹, Natália B. Mota^{1,2}, Lucia Fraga³, Mauro Copelli², Mark A. McDaniel⁴ and Sidarta Ribeiro¹ 

Cochilos de 30 a 60 minutos após as aulas melhoram a retenção de conteúdo em estudantes.



Sono e memória

Curva do esquecimento de Ebbinghauss



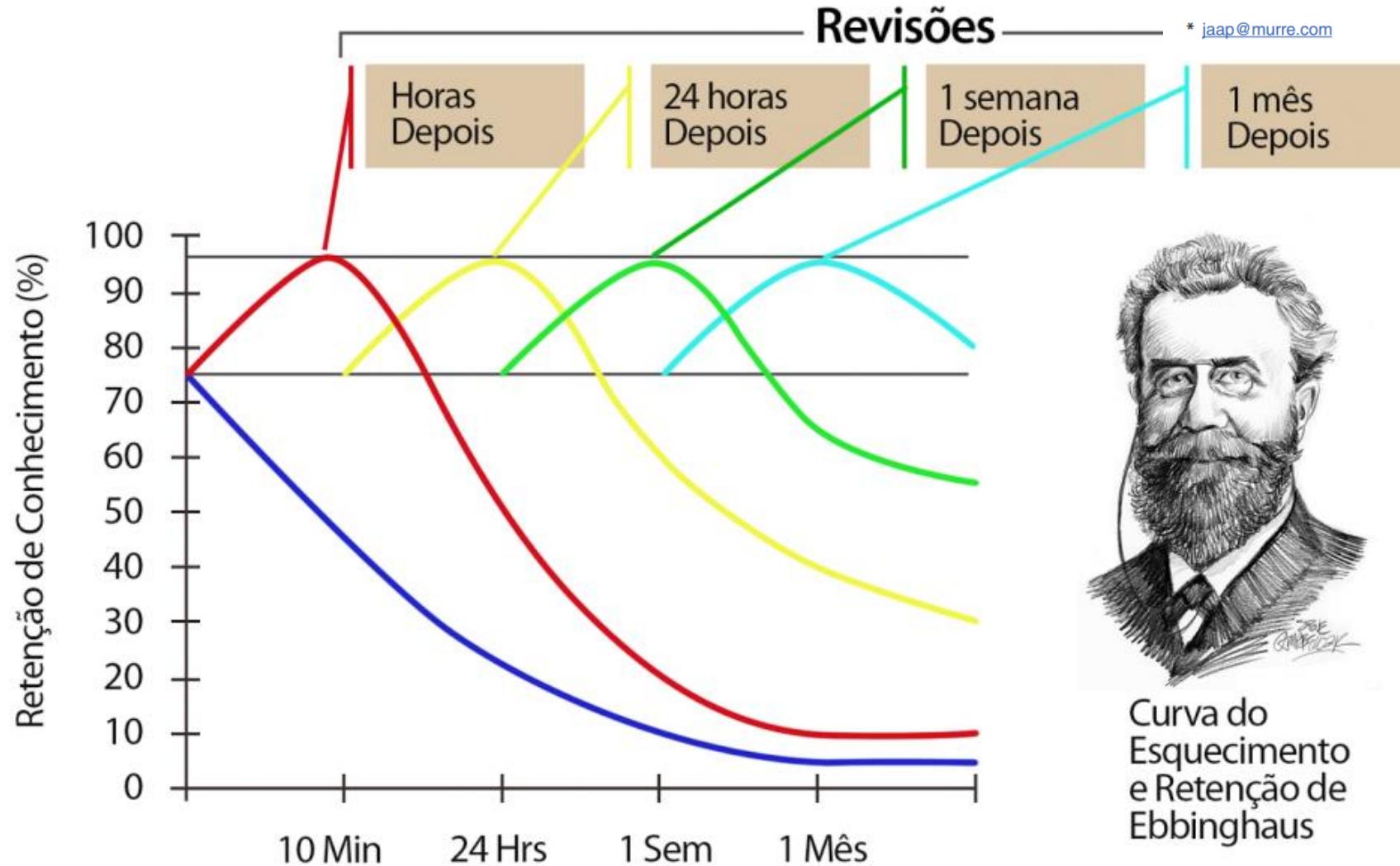
Espaçamento

Replication and Analysis of Ebbinghaus' Forgetting Curve

Jaap M. J. Murre*, Joeri Dros

University of Amsterdam, Amsterdam, The Netherlands

* jaap@murre.com



Beneath the surface of cognitive science

Defining key concepts that underpin how we learn



To make purposeful use of cognitive science practices, teachers and school leaders need to know the core concepts that underpin them.

If we look below the surface, strategies such as interleaving and retrieval practice are based on key memory processes as well as Cognitive Load Theory.

This poster defines some of the key terminology to support teachers and school leaders in building a shared understanding of these concepts in their school.



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Memória

Teoria da Carga Cognitiva

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Further information and guidance can be found in the EEF's evidence review 'Cognitive science approaches in the classroom: a review of the evidence'

Teoria da carga Cognitiva



Consolidando...

Memórias são conexões cerebrais que podem se formar, fortalecer ou desfazer

As memórias têm tempo de duração diferentes variando de pouco tempo a muito

As memórias de curta duração são armazenadas no hipocampo, enquanto que as de longa duração se situam no córtex

Aprender significa mobilizar informações e comportamentos da memória de trabalho para a memória de longo prazo

A teoria da carga cognitiva fiz que a memória de trabalho é limitada

Sem atenção não há percepção



Carga Cognitiva

CARGA COGNITIVA

Educational Psychology Review
<https://doi.org/10.1007/s10648-019-09464-6>

REVIEW ARTICLE



Cognitive Load as Motivational Cost

David F. Feldon¹ · Gregory Callan¹ · Stephanie Juth¹ · Soojeong Jeong¹

Published online: 15 January 2019
© Springer Science+Business Media, LLC, part of Springer Nature 2019

Educational Psychology Review (2019) 31:255–259
<https://doi.org/10.1007/s10648-019-09474-4>

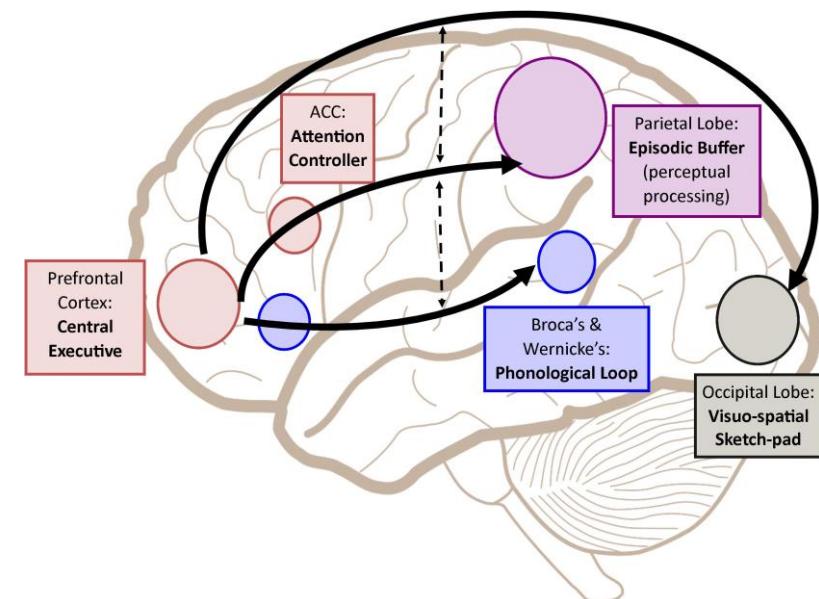
INTRODUCTION

Special Issue on Cognitive Load Theory: Editorial

Paul Ginns¹ · Jimmie Leppink^{2,3}

Published online: 2 February 2019
© The Author(s) 2019

- Recurso limitado
- Relacionada à capacidade da memória de trabalho
- Processamento simultâneo e excessivo reduz eficácia podendo levar à fadiga mental.



CARGA COGNITIVA

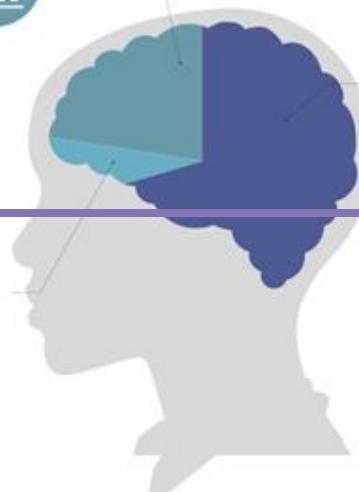
cognitive load

medrecomics.usings.com @medrecomics

intrinsic cognitive load

complexity of new information

SIMPLIFY



germane cognitive load

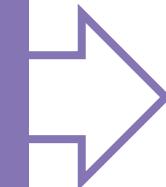
deep processing of new information by integrating it with previous learning

MAXIMISE

extraneous cognitive load

distracts working memory from processing new information

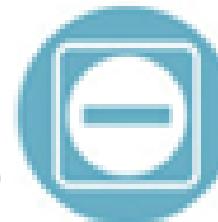
REDUCE



Carga Cognitiva Intrínseca

Nível de complexidade da nova informação

SIMPLIFIQUE!!



CARGA COGNITIVA

cognitive load

mcdreeamiemusings.com @mcdreeamie

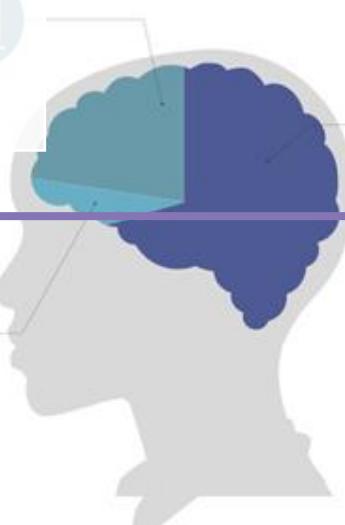
intrinsic
cognitive load
*complexity of new
information*
SIMPLIFY



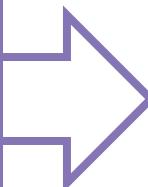
extraneous
cognitive load



*distracts working
memory from
processing new
information*
REDUCE



germane
cognitive load
*deep processing of
new information by
integrating it with
previous learning*
MAXIMISE



Carga Cognitiva Estranha

Distraí a memória de
trabalho do
processamento de novas
informações
REDUZA!





Estratégias para REDUZIR A CARGA COGNITIVA

- 1
- 2
- 3

Faça intervalos: há evidências de que intervalos geram ganhos substanciais no desempenho de tarefas.

Reduza a carga “estranha”! Toda informação desnecessária deve ser eliminada e...

O contato com a natureza ajuda! Há evidências de que apenas olhar para cenários naturais reduz a carga cognitiva.



International Journal of
Environmental Research
and Public Health



Review

Associations between Nature Exposure and Health: A Review of the Evidence

Marcia P. Jimenez^{1,2,*†}, Nicole V. DeVille^{1,3,*†}, Elise G. Elliott^{3,4}, Jessica E. Schiff⁴, Grete E. Wilt⁴, Jaime E. Hart^{3,4,†} and Peter James^{2,3,4,†}

Published online in Wiley Online Library (wileyonlinelibrary.com) DOI: 10.1002/ace.3334

The Impact of Breaks on Sustained Attention in a Simulated, Semi-Automated Train Control Task

AMELIA REES¹, MARK W. WIGGINS^{1,*}, WILLIAM S. HELTON², THOMAS LOVEDAY¹ and DAVID O'HARE³

¹Centre for Elite Performance, Expertise, and Training, Macquarie University, North Ryde, Australia

²Department of Psychology, University of Canterbury, Christchurch, New Zealand

³Department of Psychology, University of Otago, Dunedin, New Zealand

Consolidando...

A memória de trabalho é um recurso limitado, porém essencial para a aprendizagem

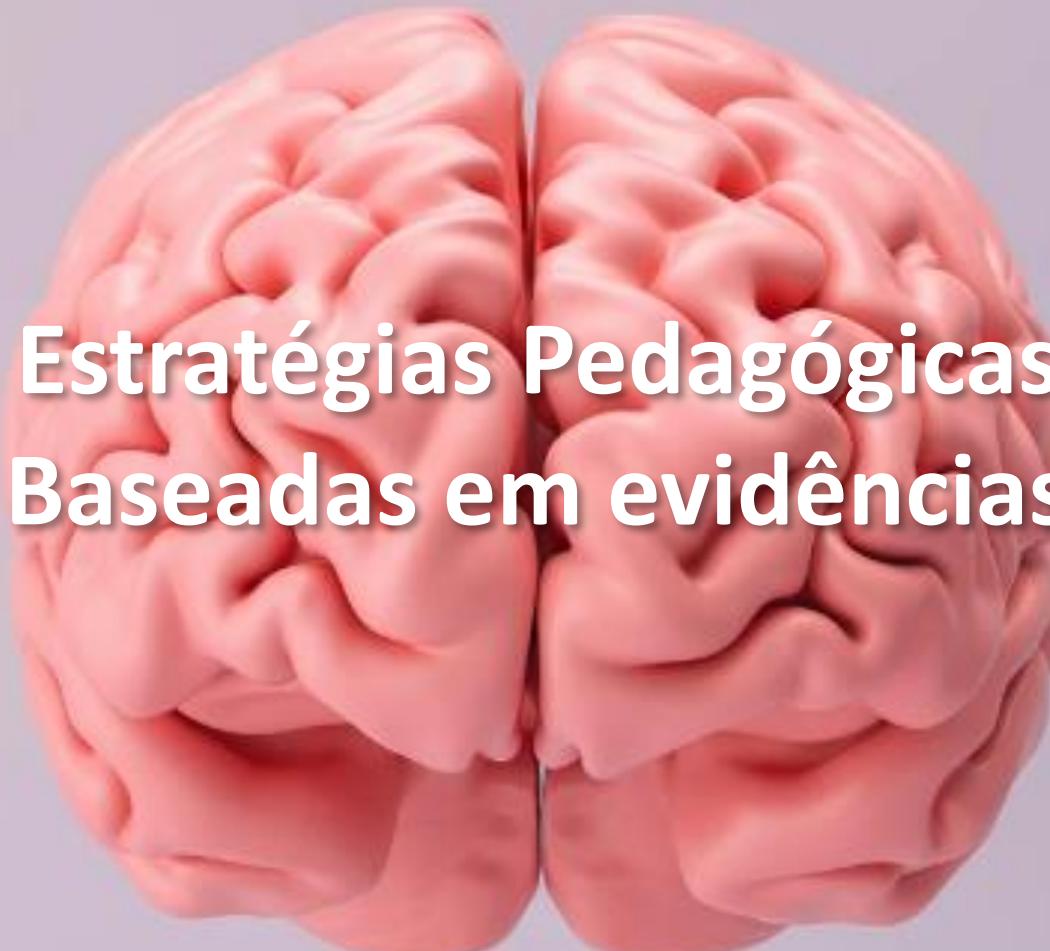
Tem curta duração e é uma das funções executivas que nos permitem realizar tarefas complexas

Informações retidas apenas na memória de trabalho são esquecidas com facilidade (estudei na véspera da prova)

A carga cognitiva intrínseca de uma lição tem a ver com o grau de complexidade inerente

A carga cognitiva extrínseca tem a ver com as informações complementares

Na dúvida: simplifique e reduza!



Estratégias Pedagógicas Baseadas em evidências

To make purposeful use of cognitive science practices, teachers and school leaders need to know the core concepts that underpin them.

If we look below the surface, strategies such as interleaving and retrieval practice are based on key memory processes as well as Cognitive Load Theory.

This poster defines some of the key terminology to support teachers and school leaders in building a shared understanding of these concepts in their school.



Working memory

This is where new information is processed. It has a limited capacity and may vary from person to person. Working memory can be overloaded, inhibiting learning.

Long term memory

This is where previous learnt information is stored. It has a potentially unlimited capacity.

Encoding

This is how information from the working memory is transferred to the long term memory. Information not encoded can be forgotten.

Retrieval

This is when information from the long term memory is brought back into the working memory. Retrieval can strengthen memory.

Memory Processes Memória

Teoria da Carga Cognitiva + ve Load Theory

Cognitive Load

This is the amount of working memory being used when asked to process information or a task.

Intrinsic Load

This is the level of challenge or difficulty inherent in the information or task.

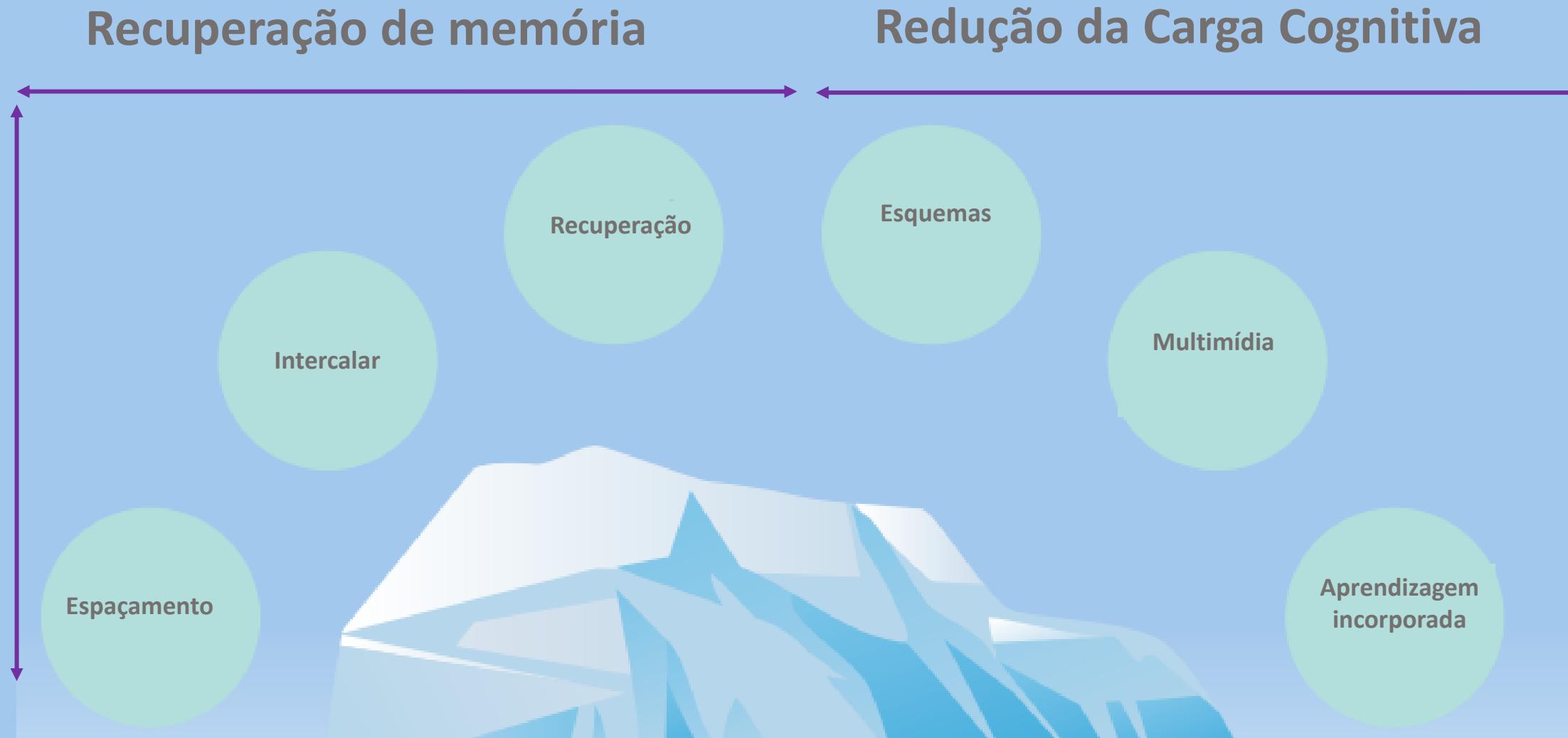
Extraneous Load

This is the level of challenge or difficulty contained in the presentation of the information or task, or by environmental factors.



Further information and guidance can be found in the EEF's evidence review 'Cognitive science approaches in the classroom: a review of the evidence'

Estratégias Pedagógicas Baseadas em evidências



Cognitive Science in the Classroom: Evidence and Practice Review

July 2021

Thomas Perry¹
Rosanna Lea¹
Clara Rübner Jørgensen¹
Philippa Cordingley²
Kimron Shapiro¹
Deborah Youdell¹

with
Julia Harrington³
Amy Fancourt³
Paul Crisp²
Niall Gamble¹
Christina Pomareda¹

¹ University of Birmingham, England

² Centre for the Use of Research and Evidence in Education (CUREE), England

³ Queen Anne's School and BrainCanDo, England

Date of systematic review searches: August 2020

Date of practice review data collections: November to December 2020



Cognitive Science in the
Classroom
Evidence
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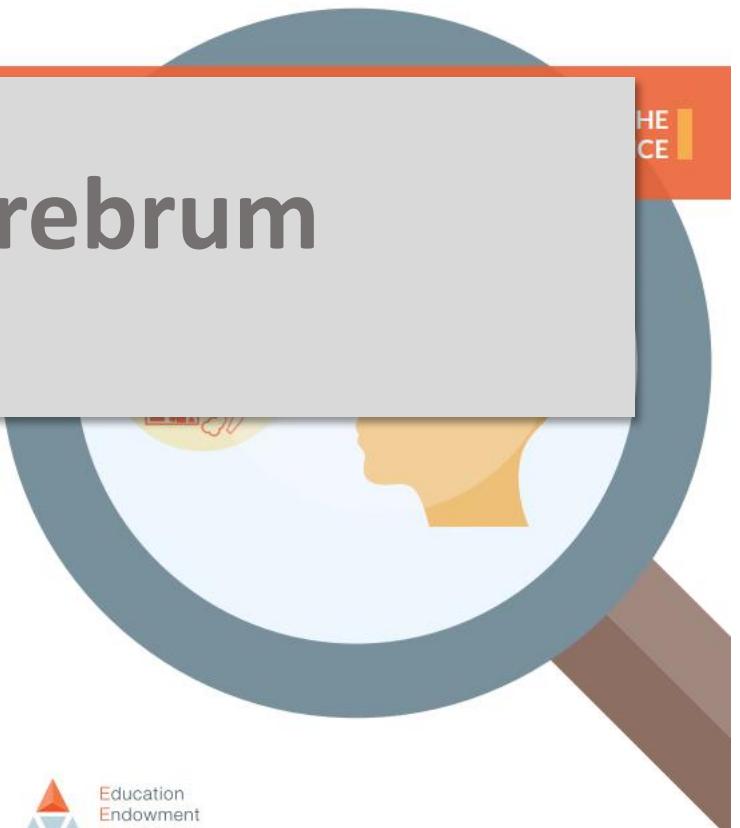
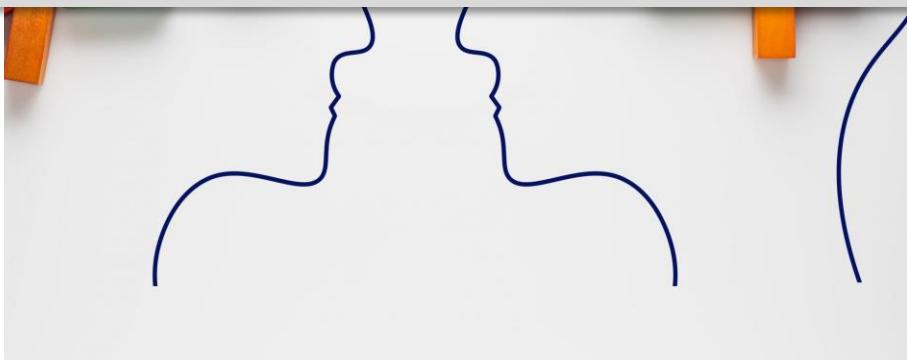
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neuroplasticidade

Módulo 2 do Programa Cerebrum 2o semestre





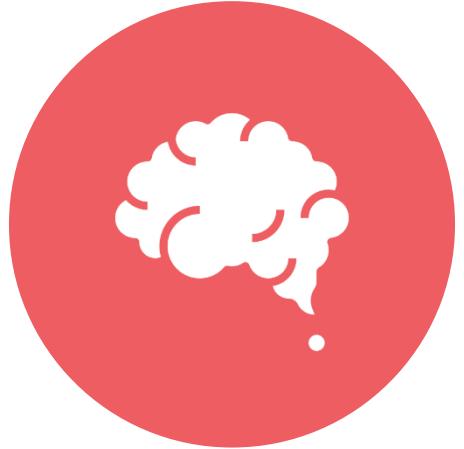
Atividade Semanal EF3



Sentidos



Sentidos



Percepção



Sentidos



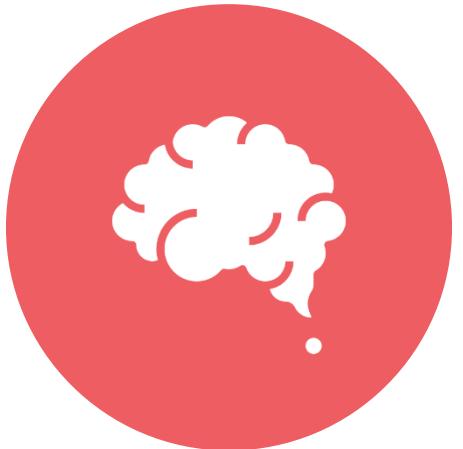
Percepção



Memória



Sentidos



Percepção



Memória

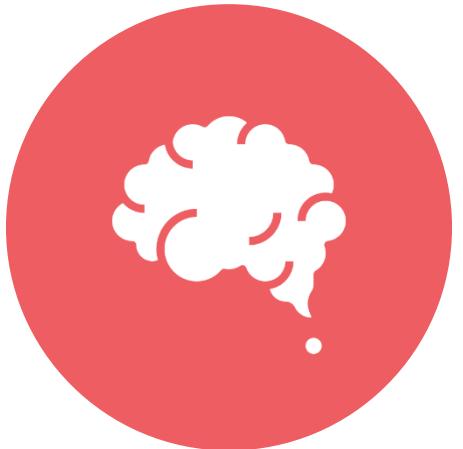


Carga Cognitiva



Sentidos

Aplicar estratégia **multissensorial** em sala de aula e avaliar o impacto nos alunos.



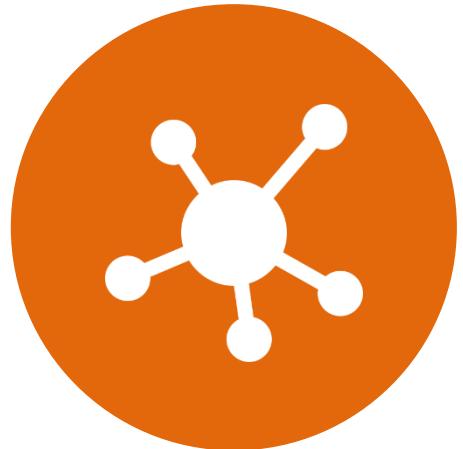
Percepção

Trabalhar estratégia de sondagem (a escolher) e relatar como foi a construção da aula a partir do coletivo.



Memória

Atividade aberta: como você trabalha os processos de recuperação para facilitar retenção na memória de longo prazo em sala de aula?



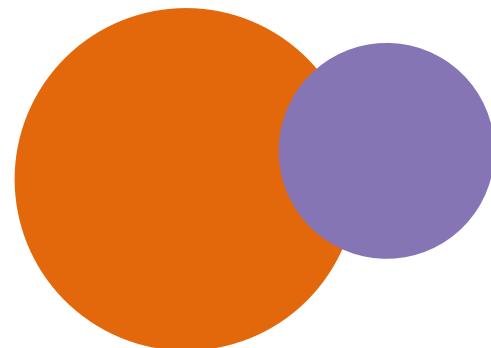
Carga Cognitiva

Eleger estratégia de redução da carga cognitiva intrínseca ou extrínseca e aplicar, observando o impacto.



Virgínia Chaves

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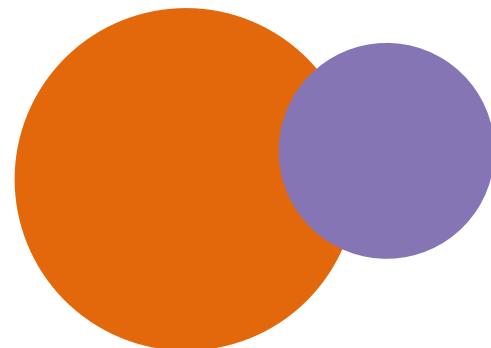
Glia Neurociência





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