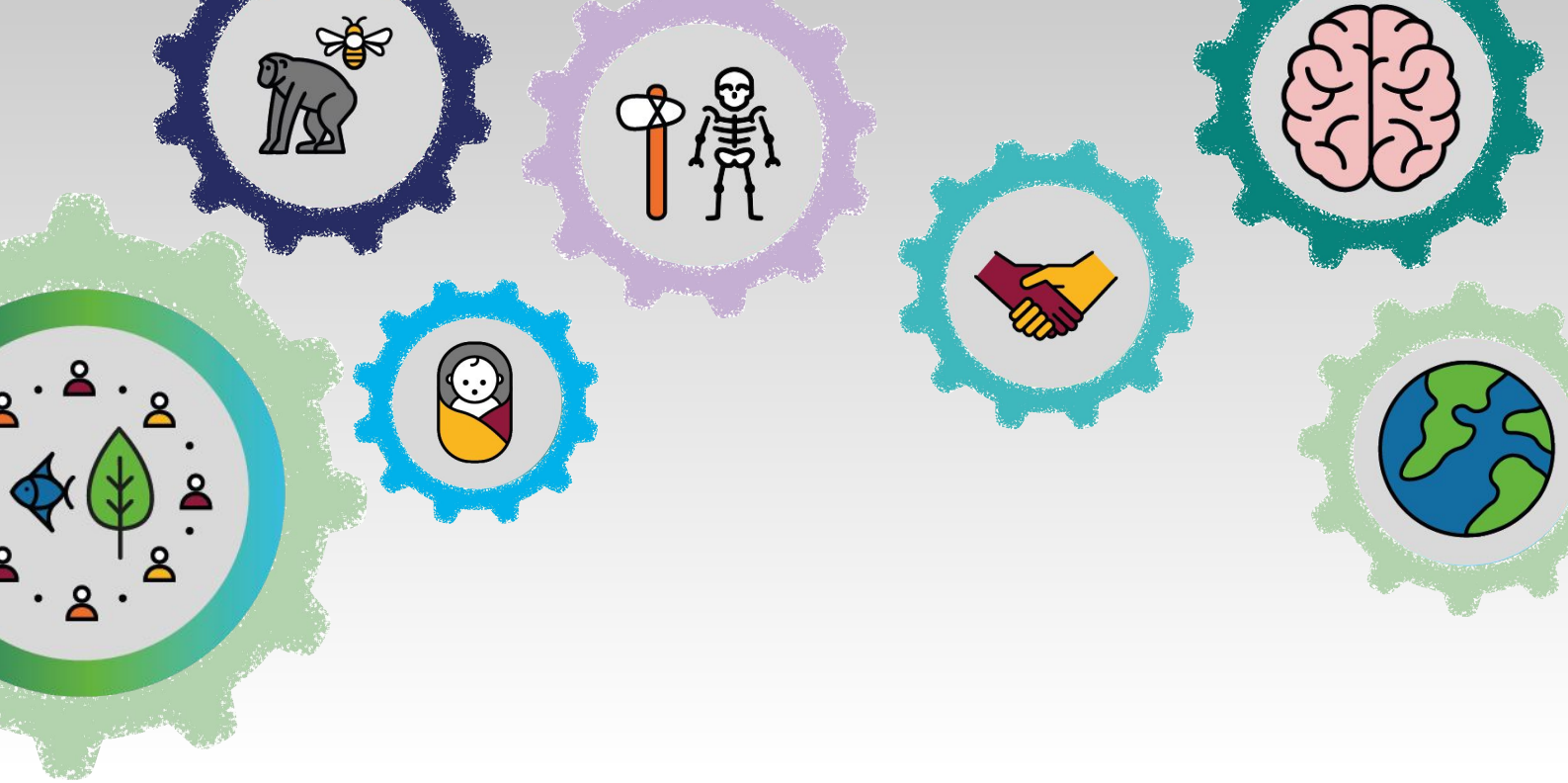


Teaching Human Behavior

A Guide to Lesson Material Development and Evaluation

Global ESD

OpenEvo.

Comparative Cultural Psychology

Table of Contents

Introduction

The scientific fields of evolutionary anthropology and behavioral sciences have produced a wealth of new insights into the nature of human behavior, cognition and culture, especially in the last several decades. This science offers immense opportunities for education in the 21st century, particularly considering the role of human behavior as driver - and solution - of many sustainable development challenges.

For complex reasons, the research questions, concepts, methods, and insights of these fields have not trickled down into general education curricula and teaching practice in a manner that would allow teachers and students to gain a deeper and connected understanding of our species, and make use of this knowledge for their own lives, and towards a sustainable development of society as a whole.

There is a genuine need to support educators in integrating this science into their teaching. This is why we have advanced the Global ESD Design Concept and begun to develop teaching materials and teacher guidance in various forms.

Aim of this guide

Achieving these aims requires a network of collaborators. With this guide, we want to enable everyone who is interested to help translate resources across the human sciences into a variety of creative commons teaching materials for use by classrooms around the world. Efforts ranging from looking out for interesting and relevant published scientific studies or syntheses, to the development of a full lesson plan, to testing and evaluating selected lesson materials with a classroom or group of teachers, all can help advance the broader vision. Many efforts are needed to advance the teaching of human behavior as an interdisciplinary theme in general education.

The guide gives you a few considerations regarding:

- The kinds of learning goals we would like students (and teachers) to develop regarding the nature of human behavior
- The types of scientific publications that can inform lesson development
- The types of lesson materials that can be developed
- Some basic criteria and elements to consider in lesson material development
- Opportunities to implement and evaluate selected lesson materials
- Entering scientific publications and lesson materials into our database

We will continually improve this guide based on new developments and feedback from you. Feel free to contact us with your questions and comments (see final page of this document)..

Learning Goals & Essential Questions

When we want to design lessons to help students learn complex ideas, it is best to start "backwards". That is, we need to first clarify what kinds of learning goals we actually want students to achieve with our lesson materials. From that flows the design of the actual lesson or unit - the content and teaching methods that would allow students to achieve those identified learning goals, and the ways we could assess their learning.

There are different kinds of learning goals:

- Specific **knowledge** of facts about a subject or topic,
- Overall **understandings** about concepts and principles,
- Targeted **skills** and abilities to carry out certain activities, such as predicting, explaining, comparing, analyzing, applying, creating, reflecting, evaluating
- Overarching **competencies**, such as cooperation, self-regulation, critical thinking

Because all learning is based on prior learning, it is also important and helpful to know what kinds of common **prior understandings** students might hold before the teaching takes place, and specifically which **misconceptions** of students we want to target.

Finally, **essential questions** guide teachers and students in their teaching and learning throughout a unit spanning various lesson materials or even throughout their schooling. Good essential questions help students develop their understandings, and can be used to identify prior conceptions of students, and for assessment of their learning.

Below are overarching and very general learning goals, misunderstandings and essential questions that we have identified for teaching about human behavior. These are not necessarily "set in stone" but are a first draft to serve as an anchor or compass for teachers and students to know what learning we want to move towards. A variety of sub-goals can be formulated from these overarching learning goals for particular lessons and units, but these subgoals should relate to these higher-level goals. Similarly, a variety of more specific sub-questions can be formulated from overarching essential questions for particular lessons and units.

Knowledge

Students will know about the various methods, research questions, and central insights of evolutionary anthropology and behavioral sciences.

Students should get to know the methods with which we can and should investigate the causes of human behaviors, especially since many of these methods are often not yet featured in the curricula of biology and other subjects, even though human behavior is implicitly or explicitly part of the curriculum and students are expected to be able to evaluate and reflect on human behavior and take the perspective of others.

Learning Goals

Understandings *Students will understand that . . .*

1 Our everyday behaviors and experiences have many causes, some of which go all the way back to their evolutionary origins.

Student should gain a deeper understanding of the complex causes of our behaviors, especially since rather simplistic notions about causes of behavior have pervaded our culture and folk theories - from genes, to intentions, to dispositions such as "that's just the way he is/they are/I am". Reflecting on and understanding the many causes of behaviors and their interactions will help students better understand themselves, their fellow humans, and their world. It will also help students explore ways to shape behavior and change their world towards what they care about.

2 Humans have been shaped by natural selection and cultural evolution to have an elaborated capacity to cooperate beyond kin.

Students should understand that we humans are a highly cooperative species, especially since this notion might go against common cultural knowledge, which may be partly due to outdated conceptions of evolutionary theory and economics, or due to the 'invisibility' of everyday cooperation and overemphasis on violence and conflict in the media. Students should come to an understanding about why, how and under what proximate conditions we humans are able to cooperate, so that they are equipped to use this knowledge to foster cooperation in the groups and communities they are a part of. This is especially important since cooperation is one key prerequisite for addressing problems of sustainable development.

3 Our everyday behaviors can have many consequences, some of which may be intended or unintended, and some of which may expand into scales of distant time or space in the future.

Students should understand that consequences of behaviors go beyond the immediately observable and beyond the next moment. Particularly, consequences of behaviors can be emergent from complex social interactions, such that no individual intended the specific outcomes. Consequences and causes are also often linked in feedback loops, such that consequences can become new causes.

4 The (cultural) evolution and development of human behavior is relevant to the sustainability dilemmas of today.

Students should understand that to address the sustainability challenges of our time, we can and should use insights about the human condition, about the complex causes and consequences of our behaviors, and about our capacity for cooperation and cultural flexibility.

Learning Goals

Skills Students will be able to ...

1 ... use Tinbergen's questions as a tool to explore complex causality of human behavior.

Students should become familiar with the different questions that can be asked regarding the causality and variation of human behavior. Students should form a habit of asking questions about the role of evolutionary and cultural history, socio-economic context, an individual's development and experiences, and immediate circumstances in causing observed human behaviors, as well as the costs and benefits that humans might experience from a behavior in their circumstances. Tinbergen's Four questions are a helpful heuristic for this set of questions that can be made explicit to students. This will help them develop their understanding about the complex causes and consequences of behavior and how we might address them.

2 ... construct causal maps to represent causal relationships between conditions, behaviors and other factors in the development of populations and social-ecological systems.

Causal maps are an effective tool used both in science and education to reflect on complex causality of various phenomena. Through the repeated use of causal maps in the classroom, to visualize complex evolutionary and developmental causes of human traits, and to visualize complex relationships in social-ecological systems, students can develop an intuitive understanding of otherwise abstract causal relationships, including feedback loops.

3 ... represent and take perspective on the possible motivations and outcomes (costs and benefits) of human behaviors with the help of payoff matrices, and identify the scale of social interactions and possible social dilemmas.

Payoff matrices are an effective tool used in behavioral and evolutionary sciences to reflect on the (possible) proximate causes and emergent outcomes of behaviors in social interactions. Social interactions, particularly those that represent a dilemma between individual and collective interest, are at the center of our everyday experience and of problems of sustainable development. The concepts of social interactions and social dilemmas can be engaged through the use of payoff matrices.

4 ... analyze and compare phenomena (e.g. models, experiments, species, societal events, case studies, real world sustainability issues) by overarching processes and principles with the help of analogy maps.

Regular engagement with analogy mappings across content material helps train students' understanding of the nature of higher-level principles studied in models, experiments, or across case studies in biology and society, and to understand that a diversity of context-specific instantiations of these principles may exist across these contexts. Analogy maps are therefore a great way to practice transfer of learning skills.

Learning Goals

Competencies

Systems thinking competency

the abilities to recognize and understand causal relationships in complex systems on different levels, from self to the global level, and within different domains; to analyse complex systems; and to deal with uncertainty

Interdisciplinary thinking competency

the ability to apply and transfer knowledge, concepts, principles, skills and methods of different disciplines to understand and solve novel problems

Critical thinking competency

the abilities to question norms, practices and opinions; to reflect on one's own values, perceptions, opinions and actions; and to take a position in the sustainability discourse

Evaluation competency

the abilities to understand and reflect on the norms and values that underlie one's opinions and actions; and to negotiate sustainability values, principles, goals, and targets, in a context of conflicts of interests and trade-offs, uncertain knowledge and contradictions

Self-regulation competency

the abilities to understand and cope flexibly with one's feelings, thoughts and desires; to reflect on one's own role in the local community and (global) society; to be resilient in the face of adversity; to learn throughout life; and to continually evaluate and further motivate one's actions towards goals and values

Cooperation competency

the abilities to learn from others; to understand, respect and relate to the needs, perspectives and actions of others (empathy) across different socio-cultural backgrounds; to deal with conflicts in a group; and to facilitate collaborative and participatory problem solving

Future thinking competency

the abilities to assess the consequences of actions; to understand and evaluate multiple futures – possible, probable and desirable; to create one's own visions for the future; to apply the precautionary principle; and to deal with risks and changes

Strategic action competency

the abilities to collectively develop and implement innovative actions that tackle various sustainability problems at the local level and beyond

Learning Goals

Addressed misconceptions

Phenomena in biology and society are predominantly caused by the intentions of single agents.

This misconception relates to Understanding 1. This is a recognized misconception in biology education, as variations of intentionality bias, attribution error or teleological reasoning. We want to develop a notion of complex causality in students whereby many factors across levels of biological organization interact and can create emergent outcomes that no individual intended. Students should also have the opportunity to reflect on the fact that many of our behaviors, thoughts and other experiences appear without our "intention". Causal maps and Payoff matrices can be tools to help students develop an understanding of such complex causes and emergent outcomes.

Evolutionary theory implies that selfish behavior is always adaptive.

This misconception relates to Understanding 2. This is a misconception that probably stems from a notion that evolution means "the survival of the fittest" or is always and only about competition between individuals, or from conceptions of human behavior in economics (Homo oeconomicus). Students need to understand that evolution can also favor cooperation, and that this applies particularly to the evolutionary history, present and future of our species. Students need to understand what conditions and mechanisms favor this evolution of cooperation, and which conditions and mechanisms can lead to the breakdown of cooperation..

Today's sustainability problems tell us that humans are intrinsically worse than other species at sharing resources and using them sustainably.

This misconception relates to Understandings 1-4. This is a misconception we encounter among students and teachers, which implies faulty understanding about the causes of today's sustainability problems, and a problematic notion about human nature. It is important for all humans to understand that we humans have an evolved ability and motivation to share resources with others and to cooperate towards a preferred future, that we have done so throughout our evolutionary history, and that we are in fact cognitively and emotionally more equipped to do so than our closest relatives in the animal kingdom. Rather then question our inherent ability for sustainable development compared to other species, students and teachers should learn to explore the conditions and mechanisms that allow these human abilities to develop and spread so we can use them for addressing challenges of sustainable development in the future.

Essential Questions

Essential questions are there to guide teachers and students in their teaching and learning throughout a unit spanning various lesson materials or even throughout their schooling. Good essential questions help students develop their understandings and encourage them to make connections between lesson contents and the real world, or to reflect on how to use their understandings in solving real-world problems. Essential questions can be used as prompts to get initial student ideas and for assessments of their learning. The following are higher-level questions that can be adapted to learning about particular human behavioral traits and contexts.

What are the causes and consequences of an observed behavior?
This question engages students in developing their broad understanding of causes and consequences of behavior. Adapt to specific observed behaviors and specific types of causes or consequences in lessons.
Examples: Are we humans born with a sense of fairness? How does our human sense of fairness develop? How does culture influence our sense of fairness? What motivates humans to share resources with others? Which conditions of this experiment made humans cooperate less?

What are the similarities and differences between humans and other species? Why do these differences and similarities exist?
These questions engage students in developing their understanding about evolutionary causes of human behavior as well as deeper conceptions about specific traits.
Examples: Are humans the only species that use and make tools? What is the difference between imitation in humans and other apes? What is the difference between how humans cooperate and how other animals cooperate? Why are humans able to cooperate in these unique ways?

What are the similarities and differences between humans today and our ancestors? Why do these differences and similarities exist?
These questions engage students in developing their understanding about evolutionary and historic cultural causes of human behavior, and lets them reflect on potential challenges of mismatch.
Examples: How is the social organization that most humans live in today different from the social organization of hunter-gatherer groups? Why do we live differently today, and what challenges might this bring for well-being and sustainable development?

What are the similarities and differences between all humans today, and why do these similarities and differences exist?
These questions engage students in developing their understanding of developmental and socio-cultural causes of human behavior, builds their sense of common humanity, empathy and perspective taking.
Examples: Do you think all humans care about fairness? Why, or why not? Why might humans across cultures behave differently in this experiment? Why might 2-year old children behave differently than 4-year old children in this experiment?

Essential Questions

What are the similarities and differences in the conditions and observable behaviors of a behavioral experiment and the conditions and observable behaviors in the real world?
This question engages students in developing their abstract thinking and transfer skills and lets them reflect on the rationale behind specific behavioral experiments. It also reinforces their understanding about how proximate factors influence human behaviors.
Example: How do the conditions and observable behaviors in the Public Goods Game relate to the challenges of addressing climate change?

What are the similarities and differences between different sustainability problems in the world and at different levels of society?
This question engages students in developing their understanding of the common and similar causes of various sustainability problems, often involving a number of human behavioral and cultural dynamics and social interactions, and ways to address them.
Example: What are the similarities and differences between the challenges of sustainable forest resource use in a small village and the challenge of climate change? What are the similarities and differences between climate change and the COVID-19 pandemic?

What are the similarities and differences in the evolution of species and the present and future evolution of humanity?
This question engages students in developing their understanding of core causal evolutionary processes that help to explain, and ultimately shape, the changes they see in the world around them.
Example: How are cultural traits transmitted? How do new behaviors and technologies come about?

What are important conditions for humans to cooperate towards common goals?
This question engages students in developing Understanding 2, that is, exploring the how, when and why of human cooperation. This question represents an important research program across a variety of methods and can be revisited across content.

What research methods do evolutionary anthropologists and behavioral scientists use to understand human behavior?
This question engages students in developing their knowledge of specific research methods and what questions they allow us to answer about human behavior.

How do our behaviors impact the world today?
This question encourages students to link specific human traits to events in history or in the present, or specific problems of human well-being and sustainable development, locally and globally.
Example: Can you think of current events in society in which our human sense of fairness plays a role?

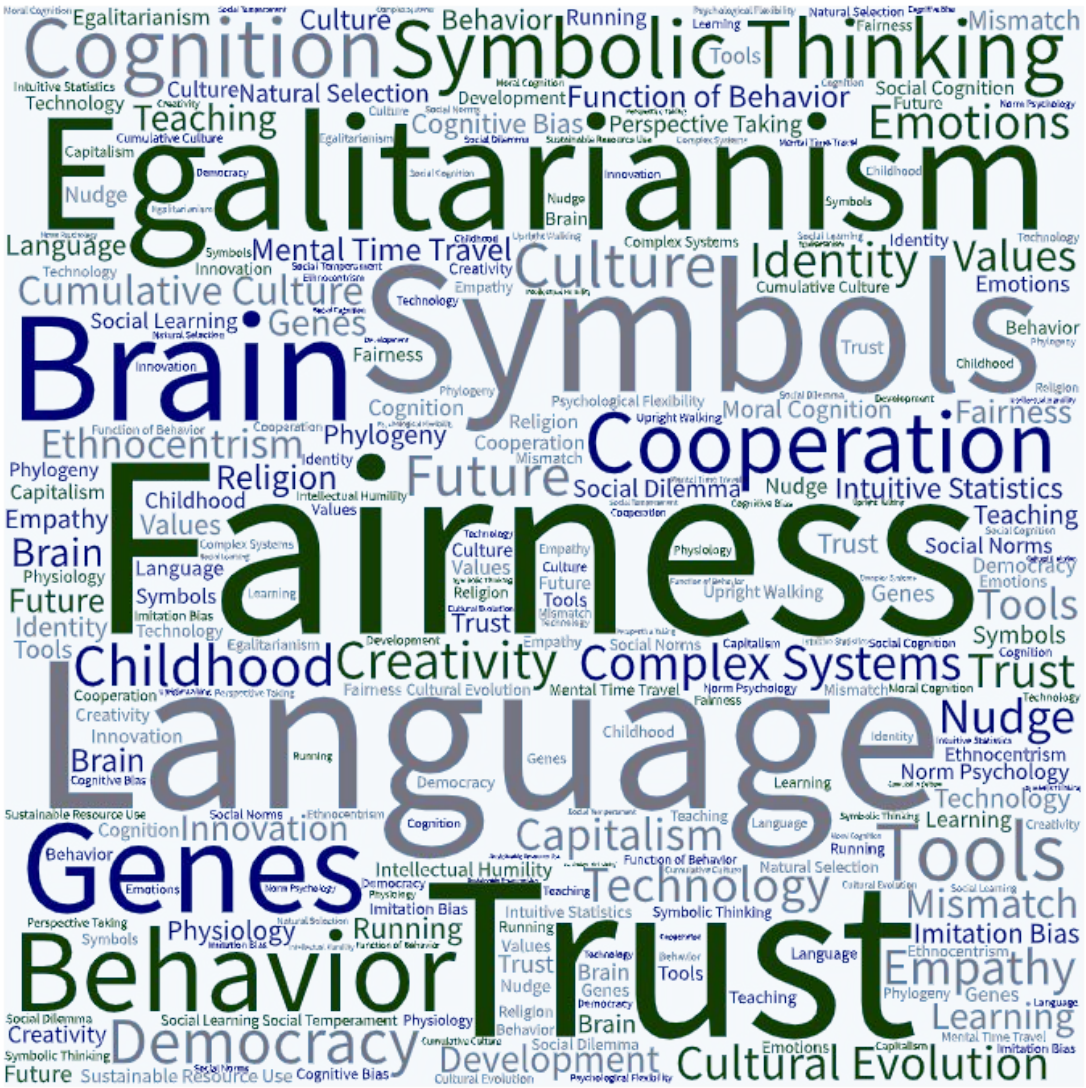
Essential Questions

How can we use our understanding about human evolution and behavior to shape our world into a direction that we all want?

These questions provide opportunities for students to reflect and discuss on what we can do to deal with certain human traits in a way that does not lead to negative consequences for ourselves, others, and our environment; and how we can use our understanding about human behavior to address real-world challenges.

Examples: What can we do to deal with our tendency for ethnocentric thinking so that it will not have negative consequences for ourselves and society? What can we do as individuals, in the school, as a community? How can we change people's motivation in our community to be more physically active?

A word cloud of some important concepts and human behaviors



The Global ESD Educational Design Concept

We have developed an educational design concept to help focus our efforts in the development of teaching materials. In education, design concepts help to focus on the content and teaching methods that are important for achieving particular aims. The main question that our design concept wants to answer is:

What kinds of content and teaching methods can help students and teachers develop the skills to reflect on the causes and consequences of everyday human behaviors, transfer their understandings to sustainable development issues, and develop their competencies for valued living and sustainable development?

Design Principles

Overarching principles for the identification of content and teaching methods

Content Anchors

Cross-cutting content anchors reflect the methods and fields of inquiry of evolutionary anthropology, behavioral and sustainability science. From these, we can identify content for the development of educational materials that can be used to explore concepts and essential questions around human evolution, behavior, and sustainability.

Teaching Tools

Teaching tools are used across diverse lessons to develop the skills that evolutionary anthropologists, behavioral and sustainability scientists use in exploring the causes and consequences of human behavior, as well as the complex relationships in social-ecological systems.

Educational Design Principles

Focus on Human Behaviors

Focus on the aspects and everyday experience of human behaviors relevant to human well-being and sustainable development (e.g., prosociality, cooperation, sense of belonging, curiosity and creativity, learning and teaching, empathy and compassion, sense of fairness, perspective taking, flexibility, self-control, goals and values, health, prevention).

What this means for lesson development:
Select especially those scientific resources that explore important and relevant human traits and/or concepts related to such traits, for development of lesson materials.

Explore Complex Causality

Explore and reflect on the many causes and consequences of human behavior and on the complex causal relationships in human evolution, behavior, and social-ecological systems: How do immediate internal and external factors, as well as individual development and evolutionary history affect human behavior? Why do these mechanisms and patterns of behavior exist compared to other possibilities? What consequences do behaviors have for individuals and their environment, in the short-term and in the long-term?

What this means for lesson development:
Select especially those scientific resources for development of lesson materials that help students explore and connect certain causes of observed human traits, and/or concepts related to such causality. Build elements into the lesson design that make complex causality explicit or that lets students reflect on and discuss causality further, such as causal maps and payoff matrices (p. 14) or specific discussion prompts (e.g. What if questions…).

Teach for Transfer

Ensure students can transfer understandings to novel phenomena, everyday experience and relevant problems of sustainable development across multiple scales and contexts of global society. Teaching for transfer requires the iterative exploration of diverse human behaviors and contexts.

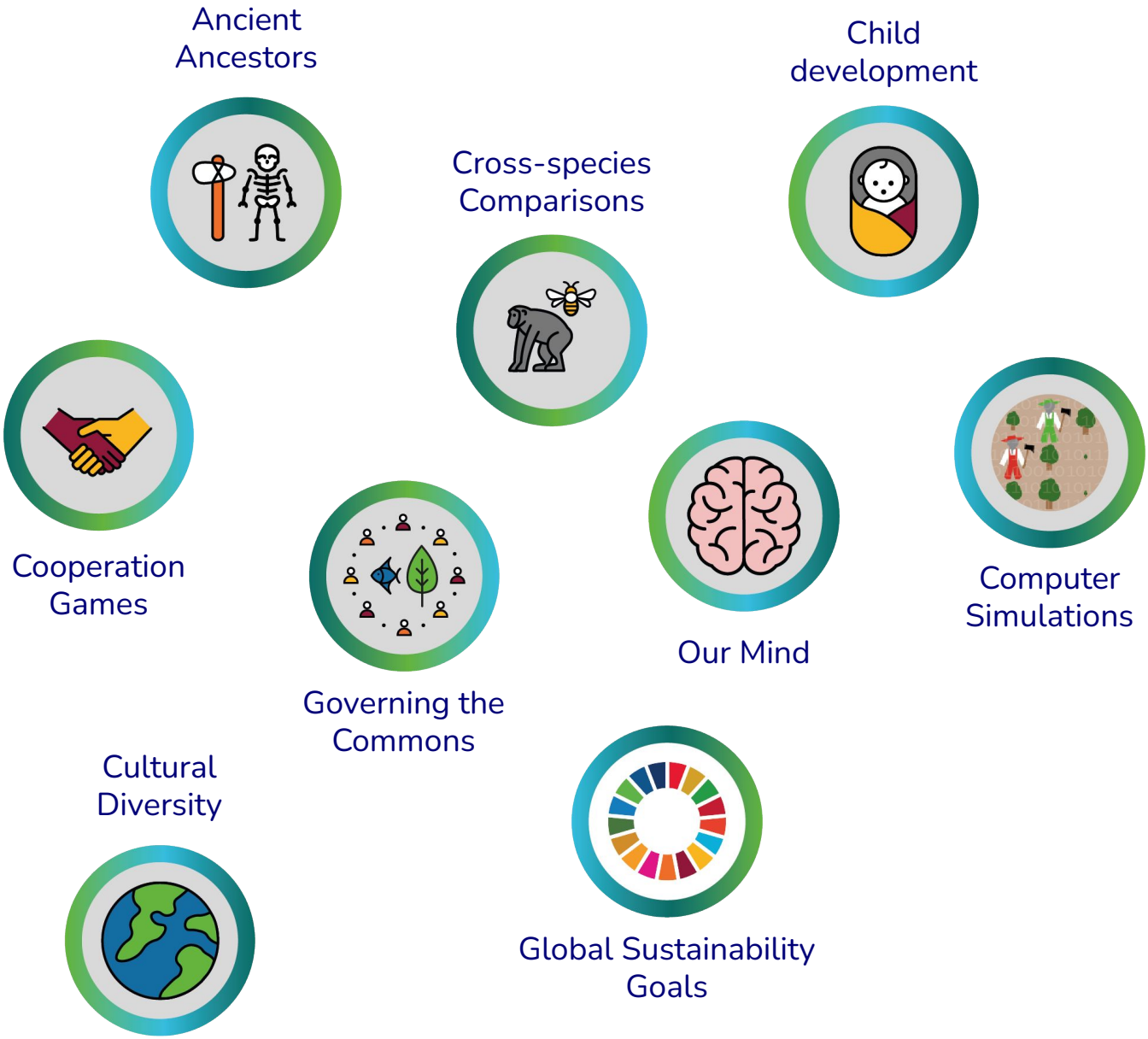
What this means for lesson development:
Build elements into the lesson design that let students practice transfering their understanding to new contexts, draw on or transfer to their own experience and to problems of sustainable development, such as analogies, analogy maps (p. 15), and discussion prompts.

Learn more about the educational design principles here: http://design-principles.globalesd.org

Content Anchors

We have identified a set of *content anchors* which, on the one hand, help teachers get an overview of some of the fields of inquiry and methods of evolutionary anthropology and behavioral science. On the other hand, they represent opportunities for engaging content in the classroom, such as through computer simulations, cooperation games, noticing processes of our mind, and making connections to issues of sustainable development.

Note that this list of content anchors is not meant to be exhaustive and is just one way to categorize content for exploring the causes and variation of human behavior in the classroom.



Teaching Tools

We have identified a set of teaching tools that can be used throughout various lessons with the aim of developing student understanding and skills. The teaching tools mostly represent core methods and concepts used by behavioral scientists.

Tinbergen's Questions

Our behaviors have many causes, from immediately prior factors, to events in our individual past, to factors in our cultural and evolutionary history. With the help of content anchors, we can explore these different kinds of causes. **Tinbergen's questions** are a helpful heuristic for **exploring and sorting these different types of causes** into four different types:

- Immediate environmental triggers and proximate physiological mechanisms
- Causes in the development of individuals
- Causes in ancestral (cultural and evolutionary) history
- Causes that are related to the function or adaptive value of the behavior and that cause an individual to repeat the behavior (or not), or that lead to the behavior becoming more or less common in a population.

Consider using Tinbergen's question as a background framework for the choice of lesson content and for the development of discussion and reflection questions about the various possible causes of human behavior (see essential questions, p. 6). Tinbergen's questions can also be made explicit to student at appropriate grade levels and with sufficient prior knowledge..

Example lessons that explore causality based on Tinbergen's questions:

- Causes of our moral intuitions
- Cognitive Biases and their Functions
- Do humans share with a stranger? Ultimatum- and Dictator-Game

Learn more about Tinbergen's Questions here: http://tinbergen.globalesd.org

Causal Mapping

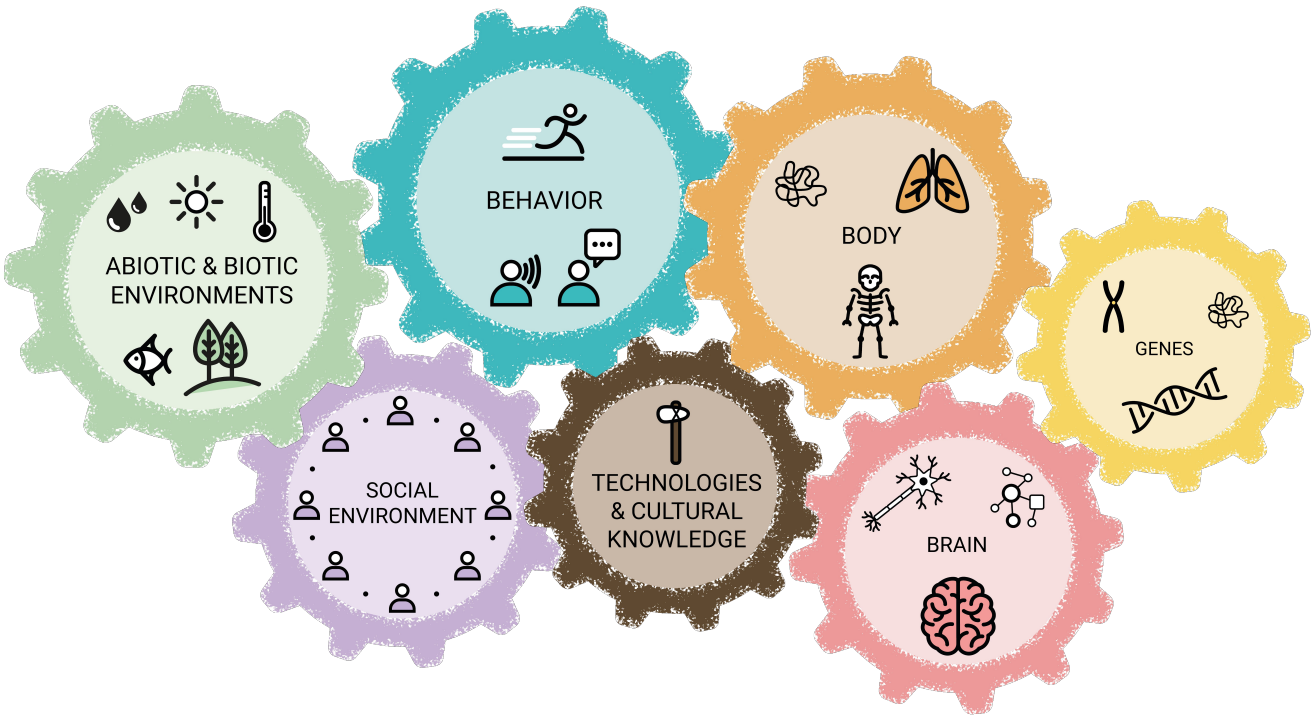
The evolution and development of our behaviors, as well as the sustainable development of social-ecological systems, can not be attributed to single causes or linear cause-effect relationships. Rather, they are shaped by complex causal relationships. The **construction and discussion of causal maps** in the classroom cultivates in students and teachers an **understanding about such complex causal relationships in different phenomena.**

Consider integrating causal mapping activities in a lesson that explores some concrete causes and consequences of human behavior, such as evolutionary, developmental or proximate causes, especially when feedback loops between factors are in place.

Example lesson materials that use causal maps:

- NetLogo Model - Two Foresters
- Human evolution causal maps

We have identified a set of *Causal Domains* to help sort and represent different types of causes and traits which interact in evolution and development.



Learn more about Causal Mapping here: http://causal-mapping.globalesd.org

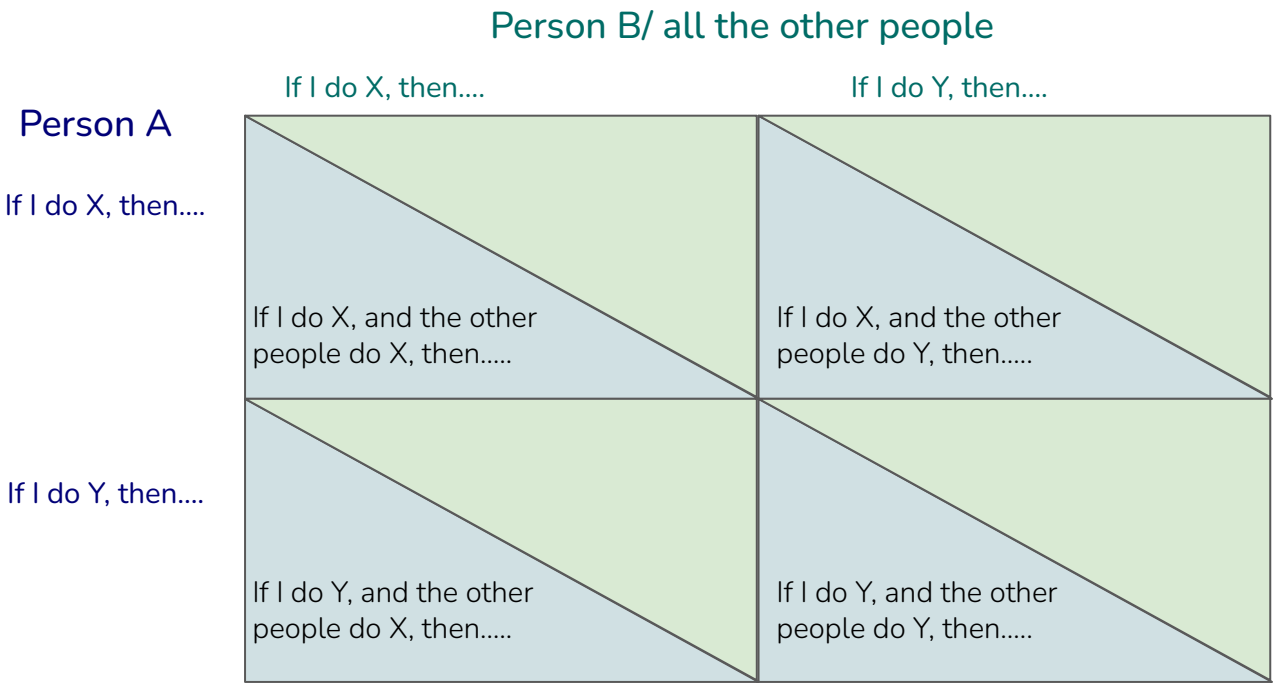
Payoff Matrices

Evolutionary biologists, economists and sustainability scientists sometimes represent the costs and benefits that people (or other animals) get from a behavior through a so-called **payoff matrix**. Using payoff matrices in the classroom helps us **reflect on the possible motivations for and consequences of behaviors** in particular situations, and helps us understand the concept of **social dilemma**.

Consider integrating Payoff Matrices in lessons, especially for behavioral experiments that investigate the causes and consequences of human social behavior.

Example lessons that use Payoff Matrices:

- Introduction to social dilemmas and the payoff matrix
- Do humans share with a stranger? Ultimatum- and Dictator-Game
- Public Goods Game
- Do humans return lost wallets to their owners?



Learn more about Payoff Matrices here: http://payoff-matrix.globalesd.org

Analogy Mapping

Because all learning involves developing a transfer of relationships among ideas or phenomena, analogies play an important role in science and education. They allow us to illustrate abstract concepts, to transfer overarching principles between content, and to use our understanding of familiar phenomena in order to understand new phenomena. The **discussion of analogies and use of analogy maps** in the classroom fosters **networked learning and learning transfer.**

Consider using analogy maps in lessons, especially to drive reflection on questions about similarities and differences between phenomena (see essential questions), or in a lesson that explicitly explores an analogy for phenomena.

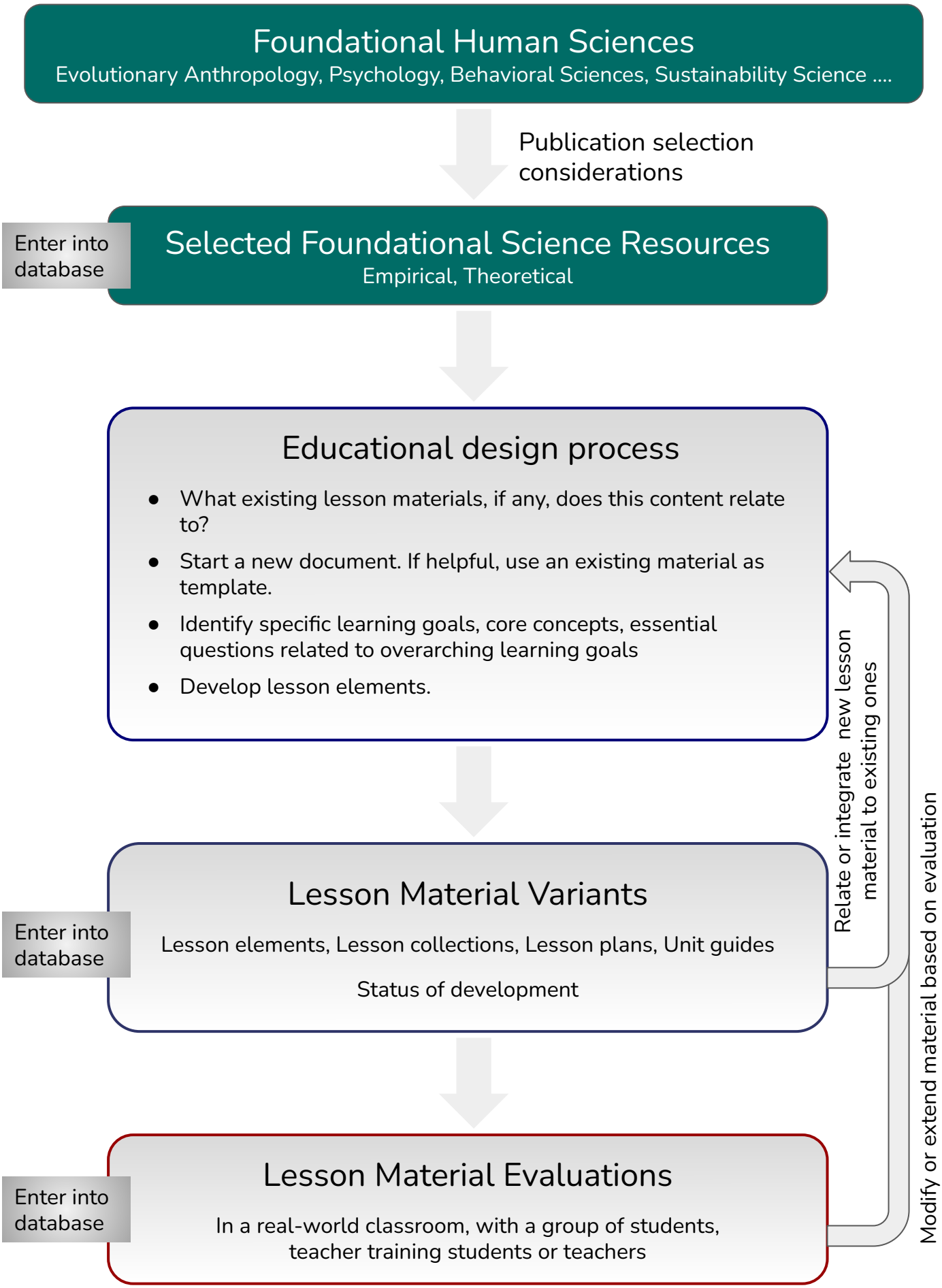
Examples lessons that use analogy maps:

- Moral Taste Buds
- Cultural Evolution
- Three Mexican Fisheries
- Honeybee Democracy

Overarching principles, processes, conditions, behaviors	X (source analogy; a particular context)	Y (target of explanation; a different context)
Similarities		
Differences		

Learn more about Analogy Mapping here: http://analogy-mapping.globalesd.org

Science-to-Lesson Workflow



Types of Scientific Resources

We broadly classify the types of scientific resources that are amenable for lesson development into two types - one type more empirical and one type more theoretical. However, there are not necessarily strict boundaries between them - for example, a publication may be empirical but offer important theoretical perspectives.

Empirical: Experiments / Observations

These are specific studies or series of studies from a diversity of evolutionary anthropology and behavioral science research fields and methods, including cross-species, developmental, cross-cultural behavioral experiments and field observations, genetics, modeling, ethnographies. Creating lesson materials based on such publications provide opportunities for students to engage in various aspects of nature of science (methods, data analysis and interpretation).They also offer a salient way for students to make sense of concepts and develop particular kinds of understandings on the nature of human evolution, human behavior and sustainability. Furthermore, they offer opportunities for assessment of student knowledge and understanding of the methods of evolutionary anthropology and behavioral science, and of the kinds of insights that they allow.

Examples of such scientific resources are:

- Bateson, M., Nettle, D., & Roberts, G. (2006). Cues of being watched enhance cooperation in a real-world setting. https://doi.org/10.1098/rsbl.2006.0509
- Koomen, R., & Herrmann, E. (2018). An investigation of children's strategies for overcoming the tragedy of the commons. https://doi.org/10.1038/s41562-018-0327-2
- Street, S. E., Navarrete, A. F., Reader, S. M., & Laland, K. N. (2017). Coevolution of cultural intelligence, extended life history, sociality, and brain size in primates. https://doi.org/10.1073/pnas.1620734114

Theory building: Reviews, Syntheses and Hypotheses

Publications that review and synthesise existing research and insights on particular phenomena and concepts, or derive particular hypotheses from these insights, offer a helpful way to contextualize particular studies into a body of theory and identify core understanding for students and teachers to develop. Often popular science books by important scientists in the field are part of these types of resources.

Examples of such scientific resources are:

- Chudek, M., & Henrich, J. (2011). Culture-gene coevolution, norm-psychology and the emergence of human prosociality. https://doi.org/10.1016/j.tics.2011.03.003
- Richerson, P. J., & Boyd, R. T. (2005). Not by Genes Alone. How Culture Transformed Human Evolution. Chicago, USA: University of Chicago Press.
- Sterelny, K. (2012). Language, gesture, skill: The co-evolutionary foundations of language.. https://doi.org/10.1098/rstb.2012.0116
- Tomasello, M., Melis, A. P., Tennie, C., Wyman, E., & Herrmann, E. (2012). Two Key Steps in the Evolution of Human Cooperation. The Interdependence Hypothesis. https://doi.org/10.1086/668207

Types of Lesson Materials

A range of lesson materials can be developed from scientific resources, with varying scope and guidance for teachers - from stand-alone worksheets on a particular study or concept, a lesson collection on a particular theme, a full lesson plan outlining elements and guidance for teachers, or even a full unit on a topic or concept spanning several lessons. Collaborative lesson material development should be a continuous, flexible process, and being networked across elements - e.g. existing stand-alone lesson elements may at some point be integrated into a lesson collection, a full lesson plan or a unit; additional stand-alone lesson elements may at some point be developed to supplement an existing collection, lesson plan or unit. All lesson elements can be implemented by teachers - if necessary with support - and based on the experience, lesson elements can be modified or further guidance and considerations for classroom implementation added.

Lesson elements (such as worksheets, reading texts, discussion guides..)

One easy way to translate scientific resource into a teaching material is to develop worksheets on a particular study, a reading text on a particular theme or concept, or a set of discussion questions on a particular content or theme. However, care should be taken that the context of that lesson material (why is it important and relevant for students to engage) should be sufficiently clear to teachers and students. Ideally, it connects to or can easily be integrated in other lesson materials.

Lesson collection on a particular theme

Usually, a range of studies from many research groups exist that investigate a particular theme or that use a particular research paradigm - examples are the many studies investigating the effect of eye images on human social behavior, or the many studies investigating the development of mental time travel in children. It can be helpful for teachers to have available a collection of such studies on such a theme, ideally including some short overview and background information on the theme or research paradigm. Teachers can then choose more flexibly, which material from the collection they would like to use in their classroom and in what curricular context. From the collection of conceptually similar studies, teachers can also choose one to serve as a basis for an assessment in order to assess student understanding and transfer of learning.

Lesson plan

Teachers may often need more guidance on the specific knowledge, understandings and skills that students should develop with the help of a lesson, on how to implement a lesson, or how to assess student learning. Lesson plans include these kinds of elements and are a “step up” from stand-alone lesson elements, giving teachers a bit more guidance. In lesson plans, we can also communicate to teachers some more background information on the relevance of the lesson content, point them to related lessons, give some guidance on how to implement and adapt the lesson for particular contexts, or communicate what kinds of student reactions and questions or challenges to expect while implementing the lesson. Such information can also be updated when the lesson has actually been implemented in a real-world classroom.

Types of Lesson Materials

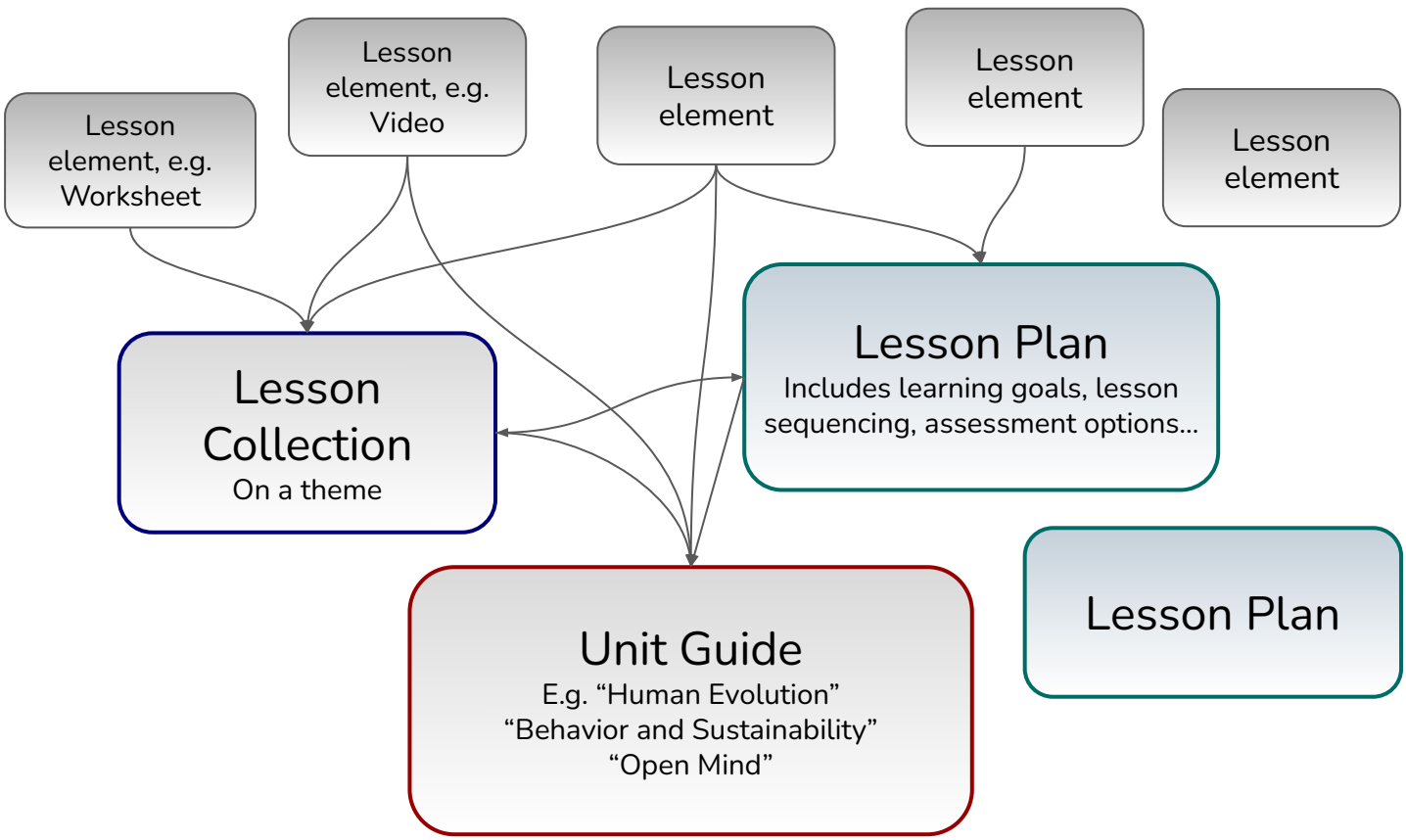
Unit guide

While there is no strict boundary between a “lesson” and a “unit”, a unit usually is about a larger topic spanning several lessons. Examples of units may be “Human Evolution”.

However, a problem in education is often that overarching concepts that should be revisited and developed across grades, subjects and topics are treated as a “topic” and just covered within a unit, ticked off and then forgotten. Evolution is such a prime concept often “covered” in a separate unit in some grade in the biology curriculum.

We want to encourage teachers to view the concepts of evolution, human behavior, and sustainability as concepts that should be revisited and applied throughout the curriculum. Nonetheless, teachers (and students) are usually used to working through topics in their teaching, and topics help students and teachers to chunk up their teaching and learning into manageable units. The development of units will therefore be helpful for teachers and students. Nonetheless, the unit plan should serve more as a guide for teachers so they may be encouraged to more flexibly adapt the unit elements to their own teaching, or to revisit or recombine unit elements, essential guiding questions and specific content across other themes in the curriculum. The aim is to strike a balance between a specific unit plan that helps teachers know what to do, and flexibility so that teachers develop the confidence and skills to become flexible in teaching the concepts across contexts.

Unit guides can be seen as higher level thematic frameworks that integrate and point teachers to a specific set of lesson elements, lesson collections and lesson plans.



Behavioral experiments or observations

Study Selection Considerations Checklist

- ❏ Is the behavior investigated in this experiment or observation of importance for student understanding of human evolution, human behavior, or of relevance for their well-being or for sustainable development? (Educational Design Principle 1, p. 10)
- ❏ Does the experiment or observation and its outcomes help students understand the complex causes of human behavior - such as evolutionary, developmental, cultural historic or immediate causes of behavioral variation? (Educational Design Principle 2, p. 10)
- ❏ Are there opportunities to connect the phenomena researched in this study to student prior knowledge of human evolution, their everyday lives, or societal sustainability problems? (Educational Design Principle 3, p. 10)
- ❏ Can the phenomenon researched in this study be linked to themes in various other subjects? (Educational Design Principle 3, p. 10)
- ❏ Will the design of this study be easy to understand and appealing to students? Are there images, videos and other materials available to communicate the study design?
- ❏ Are the outcomes of this study easy to communicate and interpret for students? Is it possible to create age-appropriate representations of study outcomes?
- ❏ Is this publication Open Access and/or can figures and text be used free of charge for the development of creative commons classroom materials? (Check the Rights and Permissions information of the publication). If not, how can images and data representations be reproduced?

Behavioral experiments or observations

Lesson development considerations

- What learning goals should students achieve with this lesson material? What are the understandings, knowledge and skills that this lesson material should help students develop?
- What are the important concepts covered in this lesson?
- What overarching questions does this material help students answer?
- Write an introductory text for teachers that gives them a short overview of the research and helps them understand the significance of this research in the scientific field and for student learning.
- How can we engage students at the beginning of the lesson, such as with an activity, a reflection and discussion question, an image, or eliciting their initial understanding about a concept?
- How can we best communicate the research question and its significance in relation to understanding human evolution, human behavior and/or sustainability?
- How can we best communicate the experimental design? Text description, tables, videos, images, photos,....
- What kinds of questions about the experimental design might students have? How can we give guidance to teachers so that they can answer these questions?
- Can students be asked to make predictions about the outcomes of the experiment and to explain the reasons for their thinking?
- How can we best communicate the outcomes of the experiment? What graphical representations are possible and appropriate?
- How can we let students communicate their initial interpretation of the outcomes, especially regarding particular causes of observed behavioral variation?
- How can we help students change or extend their initial interpretation to achieve a deeper understanding about the various causes of observed behavioral variation?
- How can we engage students in possible critiques and open questions regarding study design and interpretation?
- How can we engage students in transferring the outcomes of the study and interpretations to everyday experience, to challenges of sustainable development, or to different themes and subject areas?
- How can we assess student achievement of the learning goals during and at the end of the lesson? For example, students may be asked to write a small text answering a subset of the essential questions.

Publication selection considerations

- Are the behaviors and concepts synthesised or clarified in this publication of importance for student understanding of human evolution, human behavior, or sustainable development, or are they of relevance for their well-being?
- Do the behaviors and concepts synthesised or clarified in this publication help students understand the complex causes of human behavior - such as evolutionary, developmental, cultural historic or immediate causes of behavioral variation, and their interactions?
- Are there opportunities to connect the behaviors and concepts to student prior knowledge of human evolution, their everyday lives, or to societal sustainability problems?
- Can the concepts synthesised or clarified in this publication be linked to curriculum themes in various subjects?
- Will the concepts and generalizations be easy to understand and appealing to students? Are there images, diagrams, videos and other materials available to communicate the concepts?
- How can this publication be helpful in informing the design of various lesson materials, such as
  - Framing lesson opening questions regarding certain concepts
  - Framing discussion questions on particular experiments or observations
  - Creating a reading text and discussion questions on a particular phenomenon
  - Creating a lesson that explores a certain concept or theory
  - Creating background information and overviews for teachers in lesson plans, lesson collections or unit guides

Lesson or unit development considerations

- In what way can the publication be helpful for lesson development? Can the synthesis be taught as a unit itself, or can the perspectives of the synthesis be used to inform the design of a lesson on a particular study, or be the basis of a reading text
- What learning goals should students achieve with this lesson material? What are the understandings, knowledge and skills that this lesson material should help students develop?
- What are the important concepts covered in this lesson?
- What overarching questions does this material help students answer?
- How can we engage students in the concepts or hypotheses, such as with an activity, a reflection and discussion question, an image, or eliciting their initial understanding about a concept?
- How can we best communicate the concept or theories? Text description, videos, diagrams, photos,....
- How can we best communicate the significance of the concepts, hypotheses or theories in relation to understanding human evolution, human behavior and/or sustainability?
- How can we engage students in possible critiques and open questions regarding the concepts or hypotheses?
- How can we engage students in transferring the implications of the hypothesis or theory to everyday experience, to challenges of sustainable development, or to different themes and subject areas?
- How can we assess student achievement of the learning goals during and at the end of the lesson?

Lesson Evaluation

Ultimately, we want to know if and how the developed lesson materials are actually useful for teachers and students in real-world classrooms across grades, subject areas and cultural contexts, and we want to learn from teachers about how they adapt materials to their context. To this aim, we encourage people to collaborate with us, with students and with educators to implement lesson materials. If you are an educator or interested in implementing a lesson with a classroom or a group of teachers, you can do the following:

- Develop your own lesson material, from scratch or based on existing materials in development, on a particular topic of interest that you would like to implement
- Search in the lesson database (see p. 28) for lesson materials of interest that are ready to be implemented in classrooms

The following are some possible occasions for testing and evaluating lesson materials:

- Working with a teacher and classroom in Leipzig, regionally or even internationally depending on the ability and need for communication and face-to-face meeting possibilities
- Implementing lessons and units during student group visits and project days at the MPI-EVA
- Exploring lesson materials with teacher training students as part of a teacher training module (at University of Leipzig as well as other teacher training institutes)
- Implementing and evaluating lesson materials as part of a Master or Staatsexamen thesis
- Exploring lesson materials during a teacher workshop or webinar

The evaluation data to collect can include basic observation notes on the implementation, including what worked well and not so well and student questions, collect produced worksheets and other artifacts, written feedback, teacher lesson implementation strategies and adapted lesson plans, or interviews with teachers and students.
Sometimes it will be helpful to be able to collect data from these interventions that can be used for scientific publication. In this case, you need to get informed consent of the participants for the use of anonymized data.

Feedback and insights from lesson testing and evaluation can feed into lesson material development in a number of ways, possibly in direct collaboration with the teachers:

- Adding to the lesson material a few notes for teachers on things to expect in the classroom, such as time and classroom organization considerations, possible student prior knowledge and misconceptions, possible student questions and ways to respond to them, considerations for specific contexts (cultural, socio-economic….)
- Adapting the lesson design, such as deleting, modifying, adding certain lesson elements (figures, text, discussion questions,…) or changing the order of elements
- Developing a new lesson plan or unit guide based on the experience of implementing a series of lessons on a particular topic or in a particular subject, or based on what a teacher has newly developed.

Lesson Documentation and Evaluation -Template

The following pages are templates which provide some core elements for documenting the implementation of lesson materials in a classroom. Similar documentation applies for implementation with a group of teachers or teacher training students, etc.

Date: _____ School: _____ Number of students/participants:_____

Grade: _____ Subject: _____

Other context-related comments

e.g. whether this is part of a project week, or part of a unit on a particular topic, whether many students are missing, classroom size and infrastructure

Lesson Documentation and Evaluation -Template

Planned lesson element	Implementation notes	Observation notes
E.g.: Warm up activity: …. Group work ….. Final reflection….	e.g. was this phase carried out as planned, what was omitted, added, shortened, etc, and why	e.g. student questions, discussions, student prior knowledge, difficulties with particular lesson elements (concepts, materials etc), any other unexpected, surprising, noteworthy experiences

Lesson Documentation and Evaluation -Template

Other observational materials:

Possibly photos/photocopies of student work, chalkboard or of teacher lesson plan

Teacher feedback regarding how the lesson went:

Recommendations and **considerations** for future implementation/for adapting lesson design:

Literature and Lesson Databases

We are curating a database for the entry of foundational science publications and lesson materials to allow the streamlining and collaborative science-to-lesson development process. Under the following links, you can access the database to search for entries by various criteria.

- Database of scientific publications and references: https://airtable.com/shrQlNPzyAmCutdyB
- Database of Global ESD lesson materials: https://airtable.com/shrji2mVBNInK9z5p
- Database of Global ESD lesson materials by stage of development: https://airtable.com/shr2HDHPrlcjq9fOy

With the help of a form, you can submit new entries, both for scientific publications and for lesson materials. Under the following links, you can access the forms to submit specific entries

- Form for submitting scientific publications: https://airtable.com/shrtlsR2Mpd0A3BA9
- Form for submitting lesson materials: https://airtable.com/shr6rrHWeBco74Fno

Please contact us if you would like be involved in adding or editing anything in the database or any lesson materials directly, or if you have questions or problems related to the database.

Please contact us if you would like be involved in the development or evaluation of lesson materials for teaching human behavior, or if you have any questions. Visit our website for more information and materials.

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Comparative Cultural Psychology

Max Planck Institute for evolutionary anthropology
Department of Comparative Cultural Psychology | Education

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