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Module 7

CT for language arts and humanities prospective teachers: specific features, approaches and practical solutions

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The aim of this module is to facilitate prospective teachers to embed computational thinking (CT) skills into their Language Arts and Humanities subjects. For this purpose, each subject field teacher in primary school is expected to:

- 1) gain the knowledge and skills necessary to teach CT;
- 2) understand the pedagogical approaches, tools and assessment strategies while teaching CT;
- 3) learn how to prepare instructional plans, materials and activities while integrating CT into educational process.

This module is about the "A" in STEAM. Hence, with this perspective, CT is viewed as a framework to develop students' artistic, linguistic, social, humanity skills through developing prospective arts, languages, and humanities teachers' conceptual, pedagogical, reflective competences in CT. Hence, among different disciplines this module is intended to provide examples from two different disciplines: namely teaching social studies and language arts. Examples from other disciplines will be also provided to make teachers aware of the possible implementations.

Background

CT is a framework to provide a way of looking at real-life problems so as to produce a solution which takes advantage of using computer technologies. It can also be beneficial in providing a common vocabulary, a wealth of resources, and a vibrant community of practice for teachers seeking to focus, coordinate, and improve efforts to guide rising generations in developing problem solving skills (Kimmons, 2016). Although CT means a certain degree of facility and familiarity with computers, it is much more than mere technology usage. It is a combination of disciplined mental habits, attitudes of endurance, and essential soft skills that allow not only to use technology, but to create with technology (Yadav et al., 2016).

CT is "cross-disciplinary" in nature (Yadav et al., 2017). As also suggested by Grover (2018), like any skills, CT is best taught and learned in context, and embedded into class subjects. Integrating CT into language teaching, as well as arts and humanities is as important as using STEM approach since interdisciplinary approaches is the key to success. If CT is integrated across multiple subject areas at the secondary education, it has additional advantages, such as helping students to make powerful connections between their classes and beyond, and have a rich toolkit to draw from that crosses traditional subject borders when faced with problems that are difficult to categorise within a traditional subject area (Sheldon, 2017).



While teaching "language arts and foreign languages", students can benefit from integration of CT in several ways. Students might be learning about literary elements and could be required to write an essay or short story. They will use abstraction while using plot diagram, they will be logically organising the information and will be collaborating ideas with each other and also in other subject areas (Barr, Harrison, and Conery, 2011). Students might be asked to identify major points and main ideas of a dialogue or news feed by the use of algorithms in social media, so using and applying algorithms to different structures and making abstractions out of the text they read (Angevine, 2018).

Similarly, while teaching social sciences, students might be asked to compare their lifestyle with the lifestyles of children from another country, so they will be practising skills relevant to computational thinking, such as organising and analysing data logically, and representing data through an abstraction (Barr et al., 2011). Students might be required to review data, identify patterns and trends in historical events, practising the CT skill of pattern recognition (Grover, 2018).

Hence, in this module CT is viewed as a framework to develop students' artistic, linguistic, social, humanity skills through developing prospective arts, languages, and humanities teachers' conceptual, pedagogical, reflective competences in CT. This module is composed of three units where each unit is designed in a blended approach including assessment.

- 1) CT viewed as "A" in STEAM
- 2) CT for Social Sciences
- 3) CT for Language Arts

Target group and prerequisites

This module is primarily addressed prospective teachers studying a different discipline which are referred as "Arts" in STEAM approach study. However, the module is also suitable for in-service teachers' professional development in computational thinking education. The module is prepared in blended learning approach (face to face + online) so the instructional design is flexible to be adopted in different study programs.

Keywords

STEAM, social sciences, language arts

Related competence frameworks

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Map to DigCompEdu and teacher's professional competence standard.

Learning Outcomes (LOs) and Assessment Methods

A successful learner will:

- Gain the knowledge about how to integrate CT concepts into specific fields,
- Become aware of digital tools for assisting problem solving processes for various disciplines,
- Criticizes instructional activities and different implementations from the point of inclusion of CT concepts, and
- Design and develop instructional activities that supports teaching of CT concepts within a specific discipline.

Le	arning Outcomes	Assessment Methods
1.	Understand the importance of teaching CT in the context of "A" in STEAM	Prepares a report about specific of CT according to subject field
2.	Effectively identifies and locates digital tools that can be incorporated to include CT in the subject field	Creating instructional material by using relevant tools
3.	Criticize lesson plans and activities from the point of teaching CT concepts	Contributes discussions
4.	Designs and develops instructional materials that integrates CT concepts into her/his subject field	Prepares two hours of lesson plans that concentrates on CT concepts

Module plan and didactical approaches

This module involves three units, all structured into several activities. First unit focuses on the "A" in STEAM approach and provides conceptual understanding about the phenomenon. The other two units provide specific examples about social studies and language arts. Both units include two specific implementations that focuses on delivery of CT skills. This document covers in class activities supported by digital documents and interactive (H5P) exercises which are provided through a different learning management system https://tech.ankara.edu.tr/?lang=en.



Unit 1: 7.1 CT viewed as "A" in STEAM

Activity 7.1.1 The "A" in STEAM

- Discussion as Introduction: 45 min
- Video Analysis: 30 min
- Discussion: 30 min
- Collaborative Work: 60 min

Activity 7.1.2 Integrating CT into "Arts" Disciplines

- Collaborative Work: 60 min
- Collaborative Work: 60 min
- Application: 45 min
- Assessment: 30 min
- Implementation: 60 min

Total: 7 hours

Assessment: 3 hours (creating mind map/poster, recording brainstorming ideas, making an agamograph, designing a class activity)

Unit 2: CT for Social Sciences

Activity 7.2.1 Limited Resources

- Collaborative Work 30 min
- Video Analysis 30 min
- Discussion 30 min
- Collaborative Work 60 min
- Collaborative Work 60 min
- Creating a Mind Map 30 min
- Decomposing Activity 60 min
- Research 60 min •
- Group Activity 60 min



• Develop algorithms 60 min

Assessment: 60 min

Activity 7.2.2 Natural Resources, National Income and Geography

- Warm up Activity: 30 min
- Video Analysis: 45 min
- Research: 60 min
- Hands-on Activity: 45 min
- Creating Graphs: 60 min
- Group Activity: 60 min
- Individual Activity: 60 min
- Presentation: 15 min
- Worksheet: 15 min

Total: 14,5 hours

Assessment: 2 hours (making research, creating graphs and presentations)

Unit 3: CT for Language Arts

Activity 7.3.1 Poetry Writing, Diamante Poems

- Listening and talking: 30 min
- Presentation: 15 min
- Brainstorming: 15 min
- Individual work: 15 min
- Presentation: 30 min
- Introducing the poem: 45 min
- Brainstorming: 15 min
- Presentation: 15 min
- Collaboration for pattern recognition: 30 min



- Total: 3 hours and 30 minutes
- Homework: 2 hours (making research, creating graphs and presentations)

Activity 7.3.2 Expository Writing, Learning about Fossils

- Warm up activity: 30 min
- Brainstorming: 45 min
- Presentation: 30 min
- Group Work: 15 min
- Watching a video: 30 min
- A trip to a museum: 120 min
- Drama activity: 60 min
- Homework: 120 min
- Group Work: 30 min
- Writing an essay: 60 min
- Pattern recognition: 30 min
- Writing Activity: 30 min

Total: 10 hours

Assessment: 2 hours (making research)

Flowchart about the module also visualises the upcoming module (Figure 1).







Unit 7.1 CT viewed as "A" in STEAM

Activity 7.1.1 The "A" in STEAM

<u>Aim of the Activity</u>: In this activity, the meaning and importance of "Arts" ("A" in STEAM) will be mentioned with a special focus on language arts and social sciences.

Keywords

STEM, STEAM, CT

Contribution to the learning outcomes

Le	arning Outcomes	Assessment Methods			
1.	Realize the importance of "A" in STEAM approach.	Learners are required to list the ideas and try to create a mind map/poster.			
2.	Understands the meaning of Arts and its relation with CT.	Brainstorming will be used to generate ideas.			



Discussion: The importance of "A" in STEAM

In this activity, the topic is introduced through a discussion. Based on their prior knowledge, teachers are expected to discover realities and possibilities of "Arts" concepts for STEAM approach. Students are expected to read the suggestion before to the course. Then the discussion can be conducted through similar questions such as: "Based on your STEM knowledge, try to figure out what the "Arts" can bring new and innovative to interdisciplinary teaching approach?" Then teachers are required to list the ideas and try to create a mind map/poster based on the outcomes of the discussion.

Suggested Reading:

The importance of A in STEAM

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https://www.nordangliaeducation.com/article/2017/4/25/the-importance-of-a-in-steam



Video Analysis: Computational Thinking in the Arts

Watch the video to get some insight about integrating CT into visual art.

https://www.youtube.com/watch?v=iq32rm6AVbA

By turning existing artwork into an abstract piece, teachers get to practice pattern recognition and abstraction by pulling out details and noticing patterns in the existing art piece. They also practice decomposition by breaking down the original art into components to create a theme or sense of cohesiveness in their abstract art work. (<u>https://www.codenc.org/</u>) Teachers views are also gathered through the question: "What else can you provide an example about CT and its existence in visual arts?".

Suggested reading:

Arts Integration and STEAM https://s3.amazonaws.com/EducationCloset/2020+STEAM+Resource+Pack.pdf



Discussion: Computational Thinking in Music Education

After reading the articles to get some insight about integrating CT into Music education, teachers are expected to discuss CT aspects and their integration into music lessons.

Suggested readings:

- Teaching and Learning Music through the Lens of Computational Thinking https://download.atlantis-press.com/article/125910432.pdf
- Integrating Computational Thinking with a Music Education Context <u>https://infedu.vu.lt/journal/INFEDU/article/39/info</u>

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Collaborative Work: What is the difference between STEM and

STEAM?

Based on the readings, for revealing the differences between STEM and STEAM, teachers are asked to prepare a SWOT Analysis for STEAM Approach. After working in groups, they use https://padlet.com/ to share the outcomes from all groups in one screen or use board to note all of the ideas.

Suggested readings:

- Explainer: what's the difference between STEM and STEAM? <u>http://theconversation.com/explainer-whats-the-difference-between-stem-and-steam-95</u> <u>713</u>
- STEM vs STEAM

https://www.drawright.com/blog/2015/11/13/stem-vs-steam



Activity 7.1.2 Integrating CT into "Arts" Disciplines

<u>Aim of the Activity</u>: In this activity, teachers will become aware of other disciplines like music, physical education, visual arts etc. in terms of integration of CT.

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Keywords

Social studies, language arts, music, physical education, visual arts

Contribution to the learning outcomes

Learning Outcomes	Assessment Methods			
1. Provides examples of different subject fields that integrates CT concepts.	Learners will be required to come up with activity ideas and examples.			



Collaborative Work: Integrating CT into Language Arts

The teachers are asked to explore the three activities that exist in the <u>http://ct.excelwa.org/</u>. web site under the menu item "ELA" (<u>http://ct.excelwa.org/ela/writing-historical-fiction/</u>, <u>http://ct.excelwa.org/ela/creating-a-podcast/</u>, <u>http://ct.excelwa.org/ela/lord-flies-island-map/</u>)</u>. After that, groups of 3-4 people are formed and they are expected to criticize each activity in terms of their contribution of teaching CT to target group. After some agreement on the CT aspects of the activities, their new and creative suggestions to improve the activities are also asked based on group discussion.

Suggested readings:

• Playing Beowulf: Bridging computational thinking, arts and literature through game-making

https://www.sciencedirect.com/science/article/pii/S2212868917300247

- Computer Science and Art
 <u>https://teachinglondoncomputing.org/computer-science-and-art/</u>
- Teaching Computational Thinking to English Learners

https://www.researchgate.net/publication/331844224_TEACHING_COMPUTATIONA L_THINKING_TO_ENGLISH_LEARNERS





Collaborative Work: Integrating CT into Social Studies

The teachers are asked to explore the three activities that exist in the <u>http://ct.excelwa.org/</u> web site under the Menu item "Social Studies"

(http://ct.excelwa.org/social-studies/ancient-civilizations-computer/,

http://ct.excelwa.org/social-studies/the-enigma-machine/ and

http://ct.excelwa.org/social-studies/designing-greek-monuments-3d/). After that, groups of 3-4 people are formed and they are expected to criticize each activity in terms of their contribution of teaching CT to target group. After some agreement on the CT aspects of the activities, their new and creative suggestions to improve the activities are also asked based on group discussion.

Suggested readings:

- Using Computational Thinking to Explore the Past, Present, and Future <u>https://www.socialstudies.org/publications/socialeducation/march-april2019/using-com</u> <u>putational-thinking-to-explore-past-present-and-future</u>
- Integrating Computational Thinking into Social Studies <u>https://www.tandfonline.com/doi/abs/10.1080/00377996.2020.1749017?journalCode=vt</u> <u>ss20</u>
- Computational Thinking Is Critical Thinking. And It Works in Any Subject. <u>https://www.edsurge.com/news/2019-05-21-computational-thinking-is-critical-thinking-and-it-works-in-any-subject</u>



Application: Integrate Math and Arts through Design

This activity offers a different perspective to integrate math and arts through design. The idea is making "Agamographs" for Arts in STEAM. First explore the site through reading and watching the video:

<u>https://educationcloset.com/2020/01/21/how-to-make-agamographs-with-students/</u>. More examples can be found on Pinterest/YouTube/Google Images to share in the classroom or digital means. Teachers are asked to prepare an agamograph based on their preferences and share with peers.

As an alternative, the teachers can be asked to explore the three activities that exist in the <u>http://ct.excelwa.org/</u>. web site under the menu item "MATH" (<u>http://ct.excelwa.org/math/polygon-transformations/</u>,

http://ct.excelwa.org/math/basketball-motion-analysis/ and

<u>http://ct.excelwa.org/math/superhero-transformations/</u>) and continue with group discussion as in the previous applications.





The teachers are asked to design an activity to be implemented in the classroom setting and they present it to the class. The activity could be at most two hours' class time, individual, group work or both. The activity should be combining any discipline in "Arts" with CT skills. The activity can be either hands-on or can make use if digital support. During the presentation, other participants prepare questions and recommendations for improving the idea presented. The activities are also rated during presentations so the best activity could be selected at the end.



Implementation: Best Activity Selected

The teachers are becoming students for the implementation of the best activity selected for integration of CT and "A" discipline. Reviewing the activity as a teacher and then becoming role players of the same activity will expect to bring different views to the teachers. At the end of implementation, teachers share their ideas about if they missed or misjudged any points in the activity.



Unit 7.2 CT for Social Sciences

Activity 7.2.1 Limited Resources

Aim of the Activity: In this activity, the prospective teachers are aimed to realize what kind of problems can be caused by the unconscious use of natural resources. With this awareness, prospective teachers are expected to act more consciously in the use of resources and to take part in establishing a more liveable world by sharing this awareness with their environment. With this activity, as well as logical reasoning, algorithm design, and abstraction skills of CT is addressed. All the activities presented here are designed for primary/secondary school students. They are explained according to the implementation of in-class or prospective teachers.

Keywords

Natural resources, conscious consumption, renewable resources

Le	arning Outcomes	Assessment Methods
1.	Provide examples of the depletion and surplus of natural resources.	Teachers provide students a problem related depletion and surplus of natural sources in their countries. Teacher could set a scenario how depletion of natural sources impact the economic, social or other aspect of their life.
2.	Identify the problems that humanity may encounter in case of overconsuming of natural resources.	Mind Maps Mind maps could be used as part of an overall assessment strategy for CT. Students can create. Teachers make students to create mind maps as an integral part in the learning process CT.
3.	Make suggestions for the prevention of unconscious consumption of natural resources.	Infographics asked students to create an infographic on an prevention of unconscious consumption of natural sources. In infographics, they can use critical reasoning, and make decompositions and create patterns etc.
4.	Inform society about using natural resources.	Algorithms Implementing algorithms and making abstractions are integral parts of CT. Teachers ask students to create algorithm about usage of natural resources

Contribution to the learning outcomes



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The intention is to make students realize that when available resources decrease over time, it will not be enough for everyone and this situation will have negative consequences. Teachers can form groups of 3-4 students and ask them to collect data about natural sources and overconsumption in the World. Students can use statistics of United Nations, Food and Agriculture Organization (FAO), government records, World Bank etc. to collect data as an evidence about the state of natural sources on the World and overconsumption of natural sources by using primary and secondary sources. This activity addresses the data collection and data analysis aspect of CT. In case needed, teachers can use a presentation about the "Natural resources".



Video Analysis: About Waste

The intention is to make students being aware of overconsumption of natural resources. Teachers initially can display a clip about the waste of natural resources by visiting this site: Here is what everyone should know about waste

https://blogs.worldbank.org/sustainablecities/here-s-what-everyone-should-know-about-waste. Then, students are asked to create a chart and take notes on how the sources wasted, and they could classify how resources are wasted and what are the consequences of wasting sources. In this activity, first, students organize data and made classifications, and then reach to conclusions of the process through logical reasoning, where CT aspects are addressed.



Discussion: Natural Resources

The intention is to make students think about the facts and phenomenon and predict the future. Students are asked to watch the video that will be shared with them carefully and take notes of the moments that attract their attention. The video link opens (https://www.youtube.com/watch?v=R56WzcOiH7M).

After watching the video, a discussion activity is conducted on the following questions; It will be useful to state that they will be asked to criticize the video in terms of extravagancy of using natural resources.

- How did you feel when watching this video?
- What were the situations that caught your attention in the video?
- What kind of behaviours you observe were not right?
- What do you consume the most in our daily life?

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- Is there a limit to the resources of the products you consume or is it unlimited?
- What kind of situation may arise if these resources are completely exhausted?

This activity specifically focuses on abstraction aspect of CT, through discussion and analysis of the content.



The intention is to make students classify natural resources according to their origin. Students are divided into groups of 4-5 people. Then they visit the site

(https://www.nationalgeographic.org/article/conserving-earth) to extract and write the natural resources and types in the spreadsheet and then classify them by type. Students will create their own vocabulary (their own definitions) for natural resources by the help of the web site (https://www.nationalgeographic.org/topics/resource-library-distribution-natural-resources/?q= &page=1&per_page=25). For example: "A natural resource is something that is found in nature and can be used by people. Earth's natural resources include light, air, water, plants, animals, soil, stone, minerals, and fossil fuels. People need some natural resources to stay alive". (Abstraction)

Afterwards, teacher asks the students to find statistics or information on determining the amount of resources in the world. In particular, they find data on how much of the world's population is starving and to create an spreadsheet that shows the distribution of them by continents. (For data collection: <u>https://worldpoverty.io/map</u> and

https://wrr-food.wri.org/executive-summary-synthesis). They can show the ratio to the spreadsheet by dividing the number of people / population under continents heading. They can also create a chart using these data (World Food Organization data etc). and create statistics that show how much bread, water or other kind of food is wasted in the world, where they can rate how many people can be saturated with bread or food wasted daily. This task can be supported by:

https://unstats.un.org/sdgs/report/2019/The-Sustainable-Development-Goals-Report-2019.pdf or http://www.fao.org/faostat/en/#data. This task can either be completed by all groups or each group can be assigned different topics like water, forest, mines, minerals etc. Students could visit the site where forest statistics are given and determine the amount of trees cut in a day, and then find the statistics on how many tons of waste paper has been thrown away and could be recycled. It is possible to calculate how many trees can be saved with the support from https://www.theworldcounts.com/challenges/planet-earth/forests-and-deserts/rate-of-deforestati on. For example, 4 people die due to starvation. In the rain forest, 340 trees are cut every ten seconds, how many people can access clean water resources, find out the results of wasting resources under the headings, and explain the level of resource waste (https://www.theworldcounts.com/stories/natural-resources-for-kids). Some parts of these

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assignments, can also be used as homework. Moreover, students can also work on the two

Natura	al Resources - Ad	ctivity 1						2	
\int	paper	glass	sand	iron	plastics	tin	fruit	vegetables	
	medicine	food	oil	clay	rubber	aluminum	clothing	natural gas	
	renewable								
plants animals									
digi	tal activit	ies, Natura	l Resource	s – Activity	y 1 & 2, to r	einforce th	eir concep	tual knowledg	e
Nat Match	ural Resou	rces - Activit	ty 2 category					¢.	
Dra	ag the words into	the correct boxes							
Res	ources formed in th	ne Earth's crust from	plant and animal matt	er over many years :				renewable resources	
Res	Resources that replaced by nature and can be used over and over :							water resources	

Resources that hold different metals and chemicals :

Rivers, oceans, glaciers, lakes :

Resources that cannot be replaced, or will take millions of years to replace : Forests, wildlife, crops : renewable resources water resources mineral resources biotic resources fossil fuels nonrenewable resources

In this activity, the focus is on data collection, organization, visualization and analysis in terms of CT implementation.



The intention is to provide experiences to students for focusing on specific information and linking with them. Students here can create some cause-effect charts in order to analyze the diverse dimensions of scarcity of natural sources and the consequences of overconsumption. The teacher tells the students to classify natural resources as of renewable and non-renewable. Students can analyze the state of what amount of the non-renewable sources and create graphics (bar or line). Data can be extracted from https://www.wri.org/our-work/topics/energy, <a href="https://www.

Similar information can also be found here

https://www.bbc.com/future/article/20120618-global-resources-stock-check or http://www.bbc.com/future/bespoke/BBCF infoData stock check.pdf.



The teacher guides the students to the

<u>https://www.nationalgeographic.org/article/conserving-earth/</u> site, so that students can describe resources as renewable or non-renewable where they are told to divide the natural resources into subtitles and write the subtitles related to the resources under them. Students are asked to find out how much natural resources are left in the world, especially by examining websites such as FAO or the World Bank. Then, by using the images in

https://www.nationalgeographic.org/encyclopedia/non-renewable-energy/, they may be asked to analyze the situations that humanity may encounter in case of depletion of natural resources according to following headings.

Renewable	Non-renewable	The state of resources		

Students can also work on the two digital activities, namely "Renewable and Nonrenewable Resources - Activity 3Interactive Content" and "Non-renewable energy word group - Activity 4", to reinforce their conceptual knowledge.

Renewable and Nonrenewable Resources - Activity 3

Find the Renewable and Nonrenewable Resources in the grid below

Find th	ne word	s from th	ne grid										
Y	S	0	L	А	R	0	К	Y	G	V	D	Q	Find the words
Ρ	0	W	E	R	W	G	Z	Z	G	0	С	A	fossil fuel biomaga
н	Y	D	R	0	Е	L	Е	С	Т	R	Ι	С	hydroelectric geothermal
V	ı.	\cap	ы	V	ы	٨	т		D	٨	I.	I	coal



This activity not only makes student find and analyze data but also they try to make predictions based on the data through CT.



COAL

The intention is to make the students address the results of overconsumption. Students are asked to create a mind map that addresses overconsumption of resources using online tools such as: https://www.lucidchart.com/, https://coggle.it/ or https://www.mindmeister.com/. First they can work on an digital interactive concept map as an example: Natural Resources Concept Map:



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Later, students can interfere how overconsumption of natural sources results in the World and they could classify their responses under the relevant headings. They can extract this information from the information on the site <u>https://friendsoftheearth.uk/natural-resources</u>.

Students can also create a chart about renewable resources include timber, wind, and solar besides nonrenewable resources include coal and natural gas. Examples are found at: <u>https://ourworldindata.org/energy</u>. This activity mainly addresses logical reasoning and decomposition aspect of CT.



Decomposing Activity: Solving an Overconsumption Problem

Here students are expected to solve a problem about overconsumption of natural resources by breaking it into smaller pieces which directly refers to decomposition aspect of CT. Students can find visuals from the web sites:

https://www.worldbank.org/en/news/press-release/2018/09/20/global-waste-to-grow-by-70-perc ent-by-2050-unless-urgent-action-is-taken-world-bank-report) or https://ourworldindata.org/world-population-growth.

They can classify the types of waste by finding out how much waste is produced in which continent. They can create graphics by entering the numbers in the spreadsheet.



Students create smaller parts or subtitles makes it more specific of overconsumption of natural sources as infographic above. *Here teachers should* guide students through a selection of primary and secondary sources and discuss how it informs their understanding of overconsumption and scarcity of natural sources. Teachers have students decompose current topic of study into smaller parts. For instance, students can classify the natural sources into meaningful titles such as minerals, water, soil, forests etc. in spreadsheet.

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Then they could visit

https://unstats.un.org/sdgs/report/2019/The-Sustainable-Development-Goals-Report-2019.pdf and extract the numbers of people who suffer lack of natural resources. Then they create tables and insert some cliparts that represent the natural sources (see below) and fill the chart by classifying. In order to extract the information they can visit https://www.footprintnetwork.org/licenses/public-data-package-free/



https://www.123rf.com/photo_132759809_stock-vector-ecology-natural-resources-isolated-ico ns-finite-or-renewable-sources.html

Afterwards, students can read the text in the same site and create a table given below to find out the type of overconsumption of natural sources (such as acidization, pollution etc. Students also could create or pick up some cliparts that represent the natural resources and embed them into the table to improve pattern recognition ability.

Natural Resources	Overconsumption	Measures for overconsumption

Suggested Reading: Resources and Consumption https://populationmatters.org/the-facts/resources-consumption

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Research: Remaining Resources

The intention is to make students to think how to avoid overconsumption and save the planet through abstraction. Students can search the amount of remaining sources given above and create detail from their findings to explore how the people cope with balancing the remaining sources and World population. In addition, compare that to their country and other nations. Students can predict how long the world population can grow by calculating the existing reserves and the rate of increase in the world population, or convert them into formulas to create rates. They can also make estimations how much food and water they may need by counting population growth by continents.



Students are asked to create topics related to the overconsumption of natural resources and explain their effects on living things and nature. They can also be asked to write down how



much natural resources remain in the World in the spreadsheet by using statistics and to show them with graphics by the use of http://data.footprintnetwork.org. Afterwards, students can fill the table below, where they can calculate how they spend natural resources daily and how much they can save if they behave differently.

Natural Resources	Overconsumption	How could we save?
Water		
Food		
Transportation		
Petrol, coal etc.		
Energy		
Recyclable material		



Collaborative Work: Building models

Students can engage with natural sources and understand how overconsumption shapes our life by creating infographics. Students can build their models by sketching, building a physical scale model or utilizing computer software. Preparing Infographic: The groups are asked to prepare an infographic where they can share the graphics they prepared and the ideas they find. Some example tools: a) https://www.canva.com/create/infographics/ b) https://piktochart.com/, c) https://www.easel.ly/.

For example, students could create titles such as food, energy, water, etc. They can create a loop or recycle model to create subtitles to prevent their overconsumption. (A similar application can be done below visual) https://www.footprintnetwork.org/licenses/public-data-package-free/)





In addition, they can develop a model for how much energy will be needed in every five or ten years by comparing the amount of non-renewable energy given in the data analysis section and the average population increase in the world (they can write simple formulas in spreadsheet format).

The infographic prepared by the students is examined with the participation of the teacher and the whole class. After sharing correction suggestions, if any, the infographic is reproduced and students are asked to carry out informative work with the people around them using these materials.

This activity about the creating infographics focused on the data visualisation aspect of CT.



Develop Algorithms: Saving Natural Resources

The intension here is to make students develop algorithms that provide solutions to save natural resources. Saving natural resources and especially preparing recycle charts gives students a chance to develop algorithms. Teachers ask students to create step-by-step instructions about what should be done to protect natural resources such as water, soil, minerals etc. Food saving algorithm can be given as an example.



Food Saving Algorithm (http://data.footprintnetwork.org/)

- 1. Plan your weekly meals to waste less food.
- 2. Only buy food on your shopping list.
- 3. Start a compost pile.
- 4. Cut down on processed foods in your cupboards.
- 5. Pack your lunch with reusable containers.
- 6. Skip fast food.
- 7. Reuse water bottles and plastic bags.

Students can also develop similar algorithms for saving water, minerals, forests, soil, energy etc. like in the below visual. This activity is directly related with the algorithm design aspect of CT.



http://www3.weforum.org/docs/Harnessing Artificial_Intelligence_for_the_Earth_report_2018 .pdf

As a review activity, students can work on the "Natural Resources Worksheet" as a classroom activity.



Activity 7.2.2 Natural Resources, National Income and Geography

<u>Aim of the Activity</u>: In this module, it is aimed that prospective teachers actively participate in the applications that will develop their computational thinking skills, analyse the lesson plans and recognize the requirements for the development of computational thinking skills, develop their own course designs in groups, and apply and develop the lesson designs in real classroom settings for social sciences subject area teaching. The module aims to reach these goals by integrating CT skills into social studies subject that are natural resources, national income and geography. All the activities presented here are designed for primary/secondary school students. They are explained according to the implementation of in-class or prospective teachers.

Keywords

Social studies teaching, map skills, spatial thinking concepts, identity, location, direction, symbols, scale, natural sources

Le	arning Outcomes	Assessment Methods
1.	How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective.	Students are asked to use different maps and interpret the symbols of legend for geographical representations.
2.	How to use maps to organize information about people, places, and environments in a spatial context.	Teachers direct students to extract information related to people, population and places from economic maps.
3.	Maintain geographical location of a country.	Students ask describe how to find and maintain geographical location of their country.
4.	Explain the relationship between natural sources and economic activities in a country.	Teacher make students to create a comparing matrix concept map to show relations of natural sources and economic activities.
5.	Identify main symbols could be embedded into a legend.	Students are provided some symbols in a map and asked to create a legend in a blank map.
6.	Develop an economic map contain statistics and graphs of economic activities in their countries.	Teachers provide some statistics on main economic activities of a country and ask students to create graphs in spreadsheet program and embed it into map.

Contribution to the learning outcomes

CT for	language	arts	and	humanities
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7.	Relates the country's natural resources and economic activities by analysing the geographical location (based on latitude and longitude) and physical properties of the student country.	Teacher provide students a list of natural resources of a country and ask to create an algorithm that show the flow of economic activities.

Computational thinking activities help teachers to develop spatial thinking skills to students. Students could comprehend and analyse the facts linked to the place and spaces in their near environment and around the world. CT foster students to have to gain spatial thinking which is very essential for learning social studies particularly geography. CT also help students to use math and science and language skills to comprehend spatial relationships. CT also provide advantage to develop map skills through activities that address the spatial thinking skills. Hence, this activity focuses on integration of CT into Social Studies subject area.



Warm up Activity: How could we teach Spatial Thinking and Map

Skills through CT?

In these activities recommended here make students to gather and organize data and information from a variety of sources, and using various technologies, on relation of geography and natural activities. (data collection, analysing, creating pattern, abstract thinking can be implemented easily to these kind of activities).



https://commons.wikimedia.org/wiki/File:Latitude and Longitude of the Earth fr.svg





Video Analysis: Longitudes and Latitudes

Teacher can show the picture above in order that students to recall the facts on the longitudes and latitudes. If possible they can show the <u>https://www.youtube.com/watch?v=toyuU6Q1IW8</u> and help the student to grasp the idea. Later teacher could show an outline map of their country and ask students to write the location of their countries.



Teachers ask students to find a blank map or to draw a bank map if possible (use appropriate programs or ready maps on the computer). Allows them to create an empty legend box in the bottom right corner of the map. Teacher asks students to investigate what kind of information can be written into the legend (data collection). Then teachers ask students to collect information on what can be written into the legend by examining the relevant maps. The teacher asks the students to write the geographical location of the country and put the rose compass and the colour scale indicating the altitude into the legend box (the map can be like below).

Visit this site: <u>https://paintmaps.com/</u>



https://commons.wikimedia.org/wiki/Category:SVG_maps_of_Turkey#/media/File:BlankMapTurkishPr ovincesRegions.svg



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The teacher gives assignment students to first determine the geographic location and then display them appropriately on the map. Using the grids, students can draw on the map longitude and latitude and write their degrees on top of the relevant line of longitude. Teacher asks the students to calculate the distance between the first and last meridians in which the country located and write it in the legend. (Students can calculate by using the standard distance of two meridian (111 km) (data collection, abstract thinking, pattern recognition, and decomposition). Students also can estimate and write the scale of map. The last activity is for the students to divide the map into regional district or administration division of the country. After these activities teachers ask students to create the steps in order to create this kind of map in an optional way (algorithmic thinking). After creating this map and filling the legend appropriately students can move next step.



Creating Graphs: Economic Geography

Teacher claim student to collect some information about the main economic resources and activities of a country. Teacher ask student to maintain main topics by using national income statistics from statistical governmental bodies' records (pattern recognition, decomposition and data collection). Students can be demanded to classify the topics in a relevant way and write on a table by using simple spreadsheet programs (or similar programs on the other data process programmes). An activity can be organized to fill in spreadsheet.



Students also can list the main contributions of economic resources of a country top down by classifying and create a table. 4 topics such as agriculture, services, industry, services etc (every country has own income items). Students also study what region has special income resources and write it on the table. Thus they can create a cross table the amount of national income and its contributors and regional dissemination of economic activities. (data collection, pattern recognition, decomposition and abstract thinking). Then students ask to create a graphic by using spreadsheets and install this graphic to side of the blank map. Then students can the main economic activities into small parts. Teachers demand students to find or create (if possible) a symbol or get a clipart that represent main economic activity that contribute to national income and put this symbol or clipart into legend (4 or 5 clipart enough). (pattern recognition). Then they can use this clipart's by disposing of them on the relevant region on the map. It is expected from students to show economic resources of country on the map by disposing relevant clipart (pattern recognition, decomposition, abstract thinking).



Individual Activity: Developing Economic Map

Later students also can count the percentage of contribution main economic resources of countries' national income in a bar graphic or paste graphics and attach these graphics on the side of the blank map. (spreadsheet can be used). We expect simply students to develop a kind of map such as:



https://www.google.com/imgres?imgurl=http%3A%2F%2Fheymissaworld.weebly.com%2Fuploads%2F2%2F0%2F8%2F2%2F20827782%2Feur opean_economic.jpg&imgrefurl=http%3A%2F%2Fheymissaworld.weebly.com%2Fworld-geography-class.html&tbnid=jPGHERC437DF6M&vet= 12ahUKEwjApJ7Xw7_oAhXDAROKHXqDBEMOMygAegUIARDgAO..i&docid=ty2OyFBUaOceVM&w=865&h=640&q=economic%20resources%2 00f%20europe%20map&ved=2ahUKEwjApJ7Xw7_oAhXDAROKHXqDBEMOMvgAegUIARDgAQ

Lastly teachers could ask students to create a matrix of concept map and show the main economic activities of country and find a clipart that represent each activity promptly. Then they can add some columns and topics that show the other factors such as climate, sea, history or geographical conditions etc. that impact the economic. Students can be asked to add another column that contain a symbol that show how can the economic resources could be processed (a factory, a hotel, a port etc.). Then they can also another column that indicate the jobs and professions are needed for these economic activities. The best part is to make the students compile the information and create an infographic.

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Presentation: Computational Thinking in Social Sciences Spatial

Thinking

Based on the presentation, the importance of spatial thinking and CT will be underlined to make them merging the social studies geography knowledge and skills with CT.





Worksheet: General Summary

With this activity, students are required to foster implementation skills for CT. For this reason, they are expected to work on sample worksheets. For example:

https://www.superteacherworksheets.com/maps/latitude-longitude.pdf?up=1470043034

Students can also do a hands-on activity through the use of interactive map <u>http://mapmaker.nationalgeographic.org/</u>. Each student selects their own country and add layers to create their own maps that display energy, food etc. based on their choices. For this activity, water, human populations, environment, energy, and food are suggested. Later, students can work on a digital activity, named "Natural Resources Worksheet".

atitude, Longi	tude, Hemispheres	0
nswer the questions about l	atitude, Longitude, and Hemispheres.	
Drag the best word(s) f	rom the box to complete each sentence.	
Lines of	measure how far from the equator a place is.	Prime Meridian
Lines of	run from the North Pole to the South Pole.	meridians
lines of ines of longitude run	run from the North Pole to the South Pole. and	parallels

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Unit 7.3 CT for Language Arts

Activity 7.3.1 Poetry Writing, Diamente Poems

<u>Aim of the Activity</u>: It is aimed to teach both students and prospective teachers how to write diamente poems as well as theoretical knowledge about poetry writing. Students and prospective teachers will gain information about process writing approach and gain experiences in composing their stories by following this approach. If students have preliminary knowledge on subjects including nouns, verbs and adjectives, they do not have difficulties composing diamente poems correctly.

In this unit, through various activities, it is aimed to improve students and prospective teachers' computational thinking skills especially on abstraction, separation, pattern recognition, logical reasoning, pattern decomposition, error detection and algorithm design.

Keywords

Poetry writing, process writing approach, nouns, verbs, adjectives

Contribution to the learning outcomes

Learning Outcomes	Assessment Methods
1. Read with emphasis on intonation and pronunciation.	Asking them to read a poem and a story.
2. Read poetry.	Asking them to read a poem.
3. Determine the story elements in the texts he read. (The subject of the text, plot, location, time, characters)	Asking WH questions for students to explain the elements of the story.
4. Determine an appropriate title for the content of the read text.	Asking students to create titles for stories inline with their contents.
5. Write poetry.	Using control list to assess their diamante poems.
6. Explain the contribution of nouns and adjectives to the meaning of the text.	Finding nouns and adjectives in a read story and explaining their contribution to the meaning of the sentences.
7. Realize the meaning features of verbs.	Explaining kinds of verbs they found in a given story.



8. Recognize text types. Gives brief information regarding prose and poetry by giving examples for both.	Complaining prose and poetry in terms of six traits; ideas, organization, word choice, sentence fluency, voice, and grammar.
9. Determine the main idea of the text.	Explain the main idea of the story.



Discussion: Listening to and Talking about a Story - The Lorax

The instructor will choose and read a children's picture book in which students will see several examples of nouns, adjectives, and verbs. The title of the story will not be shared with students. After the story was read, the instructor will ask WH questions for students to comprehend the completely. Sample stories be found sites like: story can on https://theshortstory.co.uk/resources/free-short-stories/ For narrated stories: http://www.openculture.com/freeaudiobooks

For example: The Lorax:

https://www.youtube.com/watch?v=EdWesdMfyd4

The instructor clicks on the third link listed as suggestions. Then students and prospective teachers listen to the 18 minutes long story called The Lorax written by Dr. Seuss.



https://www.youtube.com/watch?v=EdWesdMfyd4

After the story is heard, the instructor asks the following questions:

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- What was the Lorax?
- Why was the Lorax there?
- Why was the Lorax lifted and taken somewhere from the far end of town where the Grickle-grass grows?
- Who is Once-ler?
- What do you know about Once-ler?
- Who did Once-ler call on the phone and what did he say?
- What are the consequences of the Once-ler family expanding their factory?
- Where does this story take place?
- Who is the main character of the story?
- What would you do if you were given a seed?
- What is the main idea of the story?
- What is the theme of the story?

By asking students and prospective teachers finding the main idea of the story and summarizing the story, the instructor aims to improve their abstraction skills from computational thinking skills.



Presentation: Different types of words

The instructor gives a short presentation, a mini-lesson, on different types of words. In this mini lesson, students and prospective teachers will see several examples of all these different types of words and will discuss their functions and meanings in sentences. A worksheet about word types, provided below, will be given to the students and prospective teachers.

Nouns: A **noun** is a <u>word</u> that functions as the name of a specific object or set of objects, such as living creatures, places, actions, qualities, states of existence, or ideas.

Adjectives: In <u>linguistics</u>, an **adjective** is a word that <u>modifies</u> a <u>noun</u> or <u>noun phrase</u> or describes its referent. Its <u>semantic</u> role is to change information given by the noun.



is a word (part of speech) that in syntax conveys an Verbs: A verb. action (bring, read, walk, run, learn), an occurrence (happen, become), or a state of being (be, exist, stand). Nouns Adjectives Verbs School Beautiful Run Student Boring Speak Entertaining Read Country City Short Listen Mirror Thick Come Rest Banana Long Small Bend Apple Read Apron Heavy Computer Soft Write Pencil Magical Carry

Sources: <u>https://en.wikipedia.org/wiki/Noun</u> https://en.wikipedia.org/wiki/Adjective https://en.wikipedia.org/wiki/Verb



Brainstorming: Finding appropriate titles, adjectives, verbs, and

nouns for the story

When students and prospective teachers were correctly answer all the detail questions regarding the story, the instructor asks the students and prospective teachers to find an appropriate title for the story. Responses of all students and prospective teachers will be taken and written on the board without filtering any responses. Later, as a class, they will determine an appropriate title.



Later, the instructor asks students and prospective teachers which adjectives they heard in the story. Heard adjectives will be listed on the board too. Then, students and prospective teachers will be asked to think about other adjectives that can be used in the story instead of the listed ones. The same procedure will be repeated for other types of words (nouns and verbs). So, students and prospective teachers will brainstorm again to find different nouns, adjectives and verbs that will be used and are related to the content of the story.

By asking students and prospective teachers finding an appropriate title for the story and additional nouns, adjectives and verbs that they could add to the story, the instructor aims to improve their abstraction, logical reasoning and pattern recognition skills from computational thinking skills.



C Individual work: Choosing Objects in the Classroom, Finding Appropriate Adjectives

The students and prospective teachers will work on a digital interactive activity, named as "Brief information about word types". In this activity, they are expected to drag the objects they see in the classroom to the school picture.





Then, students and prospective teachers will work on an interactive activity, named as "Adjectives and nouns". In this digital activity, they are expected to drag the correct adjectives and nouns" to the given sentences to make meaningful sentences.

Drag the words into the correct boxes			
I wore a	at the party y	resterday.	
Can you help me with lifting th	s	?	
l put my	in my closet.		
We met our new neighbors who moved to the			
I started reading my	c	luring the summer va	
They bought	for my m	nother on her birthday	
I underlined the words I do not	know with a		
My uncle fell because he was	sitting on a		
I wore a	, as the weath	ner was very cold.	
The or	the baby's hea	ad was very cute.	

Finally, students and prospective teachers will work on an interactive activity, named as "Find the verbs". In this digital activity, they are expected to click on the verbs given in ten sentences.

> The presenter talked for over an hour. The teachers all ran out the door the moment school was over. Everyone who came will receive a prize. To live in harmony with each other is man's greatest hope. More than anything else, people want to be loved. Dana laughed all the way to the beach. Tim has said that he can't come on Tuesdays. The plants will grow if you give them water and sunlight. Only after we entered the dungeon did we know our true strength as warriors. Flip those burgers now!

By asking students and prospective teachers deciding which objects can be belong to the school and class and to dragging the school-related images on the picture of school building, they see

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on the screen, the instructor aims to improve their logical reasoning skills from computational thinking skills.



Presentation: Teaching and Learning about Poetry Writing

The instructor gives a presentation about "Teaching and learning about poetry writing". Through this presentation, the students and prospective teachers will gain information about different kinds of poems including acrostic, found, concrete, diamante, and etc.; writing poetries through process writing approach; and rules of poetry writing. The goal is to motivate students and prospective teachers and make them be aware of the process they will be experiencing. Through the presentation, students and prospective teachers will see examples of different poems and will reach a consensus on the characteristics of certain types of poems.



While doing this activity, the instructor asks students and prospective teachers to take notes of the prominent features of the poetry genres and asks them to sense and discuss their similarities and differences with their peers. Thus, the instructor aims to improve their pattern recognition skills from computational thinking skills.







Introducing the Poem

Instructor says that she/he will read students and prospective teachers a poem. The poem tells about anything she/he wants (the poem can be generated through





https://www.poem-generator.org.uk/ based on your preference).

Eyes shut – mental imaging (abstraction), the first reading: To get the class to concentrate the instructor asks everyone to shut their eyes. She/he asks them to think of mental pictures, images as they listened to his/her reading of the poem. For example: in the class, students and prospective teachers can listen to the first 15 minutes of Little Prince, which is one hour and 45 minutes long. Remaining of the poem can be listened to at home after class:

https://www.youtube.com/watch?v=APG1upS8LDw

After the poem was listened to, the instructor asks students and prospective teachers to explain similar and different features of certain poems like cinquin, Haiku, limericks, diamente. Then, he/she asks the class to write and algorithm design for the diamente poem similar to the example given below:



Students and prospective teachers will answer the below questions to create their algorithm design:



- Is the word in the first line a noun?
- Are there two words in the second line?
- Are the two words in the second line adjectives?
- Are the adjectives in the second line related to the noun in the first line?
- Are there three words in the third line?
- Are words in the third line verbs?
- Are the verbs in the third line related to the noun in the first line?
- Is there one word in the last line?
- Is the word in the last line a noun?
- Is the word in the last line the antonym or the synonymous of the noun in the first line?

By asking students and prospective teachers to listen the poem with eyes closed and imagine the scenery the instructor aims to improve students and prospective teachers' abstraction skills and by asking them to determine whether a poem is diamente or not he/she works on developing students and prospective teachers' algorithm design skills from computational thinking skills.

D Brainstorming: The Ideas about the Poem

The students will be asked to think of a title for the poem. They will discuss their ideas with their partners and then write their title down on the poem sheet. The purpose is to build up a collective impression of what the students will think the poem is about.

By asking students and prospective teachers to determine the topic of their poems and finding appropriate title, the instructor works on developing their abstraction and pattern recognition skills.



Before we leave this module instructor tells more about diamante poems. The word 'diamante' comes from diamond and that tells you about their shape. But there's also a clear structure to them that gives you a chance to practice your parts of speech. This is how a diamante poem is put together. The instructor shows the template for diamante poem.



Writing Diamante

NOUN ADJECTIVE ADJECTIVE VERB VERB VERB PARTICIPLE PARTICIPLE PARTICIPLE VERB VERB VERB ADJECTIVE ADJECTIVE NOUN

Below, two examples of diamante poems are given. The first one represents a single topic while the second one was written about contrasting topics as summer vs. winter.

First example: single topic.	Second example: contrasting topics.	
Cats	Summer	
playful, aloof	warm, gentle	
hiding, stalking,	swimming, sunbathing, ball playing	
pouncing mice, leaves, butterflies, bees	the world spins in space	
hissing, meowing, purring	snowballing, skating, huddling	
alert, waiting	cold, harsh	
alive.	winter.	

By asking students and prospective teachers to read and analyse the poems to determine whether they are composed on a single or contrasting topics, the instructor works on students and prospective teachers' pattern recognition skills as one of the computational thinking skills.

Collaboration for Pattern Recognition

After the students and prospective teachers learn how to make diamond poetry, they are given examples of poems that conform to the rule and do not comply with the rule, and are asked to stick those who follow the rule to the right part of the poster, and those who do not, to the left part. Some examples of poems are given below, that some of them represent the correct form while others do not:



Examples of poems that are following the rules of Diamante poems		
Match	Home	
Fun, exciting	Warm, lovely	
Solving, thinking, writing	Resting, eating, sharing	
Discovering numbers, enjoying words	Being happy, being productive	
Reading, dreaming, listing	Working, typing, reading	
Enjoying, magical	Formal, elite	
Literature	Office	

Examples of poems that are not following the rules of Diamante poems		
Book		
Notebook, heavy	Summer	
Listening, looking, thinking	Season, hot	
Good to have, easy to carry	Resting, sunbathing	
Watching, wanting, beautiful	Cold, dry	
Bright, expensive	Winter	
Computer		

By asking students and prospective teachers to read and analyse the poems to determine whether they are following the correct form of a diamante poem or not, the instructor works on students and prospective teachers' error detection skills as one of the computational thinking skills.

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Activity 7.3.2 Expository Writing, Learning about Fossils

Aim of the Activity:

The aim of this activity is to increase reading comprehension and descriptive writing skills of the students and prospective teachers with the help of non-fiction texts describing fossils. The subject of this activity is to obtain information and to answer questions about fossils through analysing non-fiction texts.

In this unit, through various activities, it is aimed to improve students and prospective teachers' computational thinking skills especially on abstraction, separation, pattern recognition, logical reasoning, pattern decomposition and algorithm design.



This module is designed for elementary school students and prospective teachers who will serve as primary school teachers.

Keywords

Reading Comprehension, Expository Writing, K-W-L chart

Contribution to the learning outcomes

L	earning Outcomes	Assessment Methods
1.	Recognizes the main parts of reading material. Gives brief information about the front cover, back cover and contents of the book.	Finds content pages, dictionaries. Shows front and back covers of nonfiction books.
2.	Answers the questions about the read text.	Answers questions about fossils and rocks.
3.	Asks questions about the text.	Asks questions about fossils and rocks.
4.	Applies reading strategies.	Takes notes and underlines while reading.
5.	Estimates the meaning of words and phrases by using context. a) Students are expected to check the meaning of the predicted words and phrases from	Uses dictionaries to define words.



	dictionaries. b) Students are encouraged to form a dictionary from their newly learned words and phrases.	
6.	Distinguishes text types. Give general brief information by providing examples of narrative, informative texts and poems.	Writes compare and contrast text.
7.	Recognizes the elements that make up narrative and informative texts. Gives brief information about introduction, body and conclusion sections.	Shows beginning, middle and end of a text/material/resource.
8.	Uses information sources effectively. Provides information on how to use the contents and glossary in printed and digital content to access information.	Uses printed and digital resources effectively.
9.	Questions the reliability of information sources. Written sources (magazines, books, brochures, newspapers, etc.) are examined and evaluated.	Distinguishes facts from opinions.
10.	Write expository text.	Writes and essay on fossils.



SWarm up activity: What is Non-Fiction? Features of Expository

The intention is to explore previous knowledge and beliefs about facts, opinions and what non-fiction is. The instructor introduces the module using a presentation about expository texts.



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The instructor shows two images and asks students about what they think; are they similar or not? Which one can be fictional or non-fictional? and Why?

The instructor asks students and prospective teachers to talk about the similarities and differences between two observed images. While doing this, the instructor aims to increase their pattern recognition skills as one of the computational thinking skills.



https://p1.pxfuel.com/preview/446/304/923/tree-beauty-in-nature-scenics-nature-mountain-wat er-tranquility-tranquil-scene.jpg



Additionally, one open-ended questions given below will be asked to students and prospective teachers in order to get their previous knowledge and encourage them to think about the nature of expository writing:

Write a sentence telling us what you think 'non-fiction' is. If someone has already explained it, will you put that into your own words please?

The instructor asks students and prospective teachers to determine which one of the following sentences describe the features of expository writing and which ones are describing the features of other genres. Students and prospective teachers can complete this activity by writing true or false next to each statement.

GENERALLY IN EXPOSITORY WRITING:

STATEMENT	TRUE	FALSE
Purpose is to inform, to report, or to explain		
Information is can be taken from anywhere		
Unfamiliar concepts and vocabulary are defined		
Purpose is to inform about our own experiences		
Facts and opinions are clearly distinguished and well documented		
Recommendations are offered		
Important points are emphasized		
The purpose is to entertain readers		
Facts and opinions are not separated from each other		

By asking students and prospective teachers to determine which expressions are correct and which ones are not about expository writing, the students and prospective students are forced to think the features of expository writing while making their decisions. Thus, the instructor works on developing their classifying skills based on logical reasoning as one of the computational thinking skills.



Brainstorming: Expository Writing



The instructor asks students and prospective teachers to brainstorm and make a list of items about different kinds of expository texts they might see around them. Students and prospective teachers' examples can be listed as it was given below:

Applications	 Logos
Biographical sketches	• Math
Case studies	• Memos
Concept books	• Newspaper writing
• Demonstrations	Nonfiction trade books
• Dictionaries	Recipes
• Directions	Reference books
• Fact books and fact sheets	Responses
• Histories	Resumes and summaries
• Interviews	Reviews
• Journals	Science notes
• Labels	• Surveys
• Letters	• Text books
	• Travel guides

Then, instructor gives presentations named as "Kinds of expository writing" and "Mini lessons in expository writing".





Questions to ask during the inquiry process:
 What do I know? What don't I know about what I know? What the readers need to know about what I know? What do I need to know? What would I like to know? What would I like to do? What problems need solving? Who might have solutions to those problems?

Later, instructor asks them to distinguish which kinds of materials listed below are typical kinds of nonfiction text and which ones are not? And explain their reasons.



TEXT SAMPLES						
Applications	ABC books	A	annotated	bibliograpł	nies	
Case studies	Narr	ative texts	Sin	nulated jour	rnals	
Concept books	s Demonstra	ations	Reading logs			
Literature response journals Dream of			diaries	Dict	ionari	es
Directions	Science f	iction	Inter	views	Jou	rnals
Labels	Friendly letters	Memos		Newspape	r writ	ing
Nonfiction tra	de books R	lecipes	Refer	ence books		Responses
Resumes and s	summaries R	eviews		Commerci	als	Surveys
Text books	Travel guides		Advertis	ement		
Sample of nonfiction texts			Not sar	nple of n	onfic	tion texts

By asking students and prospective teachers to determine the sample of nonfiction texts and explaining the criteria behind their decisions, the instructor works on developing their classifying skills based on logical reasoning as one of the computational thinking skills.



The instructor gives brief explanations about opinions then asks students and prospective teachers to answer following questions:



- What opinions do you hold strongly?
- Should an opinion be based on facts?
- How could we decide if someone's opinion is believable or not?

Facts and Opinions: The instructor reminds students and prospective teachers that when they compose their expository texts they can emphasize their beliefs or opinions by using some transition words such as 'in my opinion . . .' or 'I think/feel/believe that . . .'.

Fact or opinion?: The instructor explains that a fact is something that everyone would know was true without questioning the statement. On the other hand, an opinion is something that some people think or feel, but it might not be true or valid for everyone. The instructor gives sample statements for facts and opinions. For instance, same samples of facts are given below:

- Ankara is the capital city of Turkey.
- Two times three is six.
- There are four seasons in a year.

Instructor gives some examples of opinions like given below:

- Ankara is more beautiful than Paris.
- Dogs are better pets than cats.
- Eating fast food is good for your soul.



After receiving information about facts and opinions and seeing multiple examples, students will be paired and asked to work on the digital activity named "Fact or Opinion" as a whole class. The teacher will assist students' thinking and guide them to find the correct answers.

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Fact or Opinion			
A fact is a statement that can be tested by experimentation, observation, or research and shown to be true or untrue.			
An opinion is a person's belief, feeling, or judgment about something. It is a subjective or value judgment, and it cannot be proven.			
Directions: Read each question. Decide whether each example is a fact or opinion. Choose the word, fact or opinion beside the appropriate sentence.			
Movies are generally more interesting than books			
O Opinion			
O Fact			
There are 12 months in the year			
O Opinion			
O Fact			

By asking students which sentences are facts and which ones are opinions and explaining the criteria behind their decisions, the instructor works on developing their classifying skills based on logical reasoning as one of the computational thinking skills.



Watching a video: About Fossils

The instructor shows a video named as "What are fossils and how are they formed | Learn about Fossils" which is a little bit more than 3 minutes long. After seeing the video, students will talk about fossils and how they are formed.

https://www.youtube.com/watch?v=xQBkawjFVIA

After seeing the video, the instructor emphasizes the importance of the order of the steps in the formation of fossils and points out that if this order is not followed correctly, fossils will not be formed. Then, instructor asks students to create and write an algorithm design, in which students describe the process and steps regarding the formation of fossils. Thus, instructors can increase students' algorithm design skills and since students will be summarizing the process of forming fossils they will also increase their abstraction skills as one of the computational thinking skills.



A trip to a Museum: Exploring Dinosaurs



A visit can be arranged to a museum in which students can see diverse samples of fossils (for example, MTA Museum of Ankara in Turkey). The images from the museum are given below. While visiting the museum, students will be informed about what they will be seeing.



A specialist in the museum can answer the questions of students about fossils. Students' questions might include:

- "What period do these dinosaurs belong to?"
- "Where were the dinosaur skeletons found?"
- "How are so many bones put together?" •
- "Which bones make up which body part of the dinosaur?"

Meanwhile, the instructor asks students:

- "Are the bones in this dinosaur fossil's legs longer or shorter than those of those dinosaurs?" "How many bones can it has in its tail?"
- "How are the bones of the feet?"
- "How tall can it be?" •
- "How many pounds can it be?" •
- "Which animals can we compare this dinosaur to?"

After answering the instructors' questions students will be given a paper and different colour crayons to draw dinosaur skeletons based on their observations.

During the trip, the instructor and students can take pictures of fossils. After the photos taken at the museum, they can return to the school and make some evaluations. As a whole class, students can create a story about their trip and following drama activity can be performed.



By asking students which bones belong to which part of the dinosaur's body or which period that bone might belong to, where that bone might have been found, the instructor works on developing students' abstraction, logical reasoning, decision making and pattern recognition skills as some of the computational thinking skills.



Drama Activity: Dinosaurs Era

Students can dream that they were living during the dinosaurs' era. In the warming stage of the drama two or more students can come together and form one dinosaur. During the acting stage, students can discuss and act what they were doing, what would they eat, where would they sleep and in which conditions they were when they died. In the evaluation stage of drama, students can create a frozen image and act like dead dinosaurs. After the drama activity is completed, pictures made by students and photos taken at the museum are exhibited in the classroom.

The instructor asks the students to imagine the old times by making drama, to take roles and to reflect that period by pretending. Thus, he/she works on increasing students' abstraction skills as one of the computational thinking skills.



Homework: Research on Fossils

Students will be asked to research about fossils. Since they have already gained some information about fossils they will be asked to complete K-W-L chart (Know – Want – Learned) and will read printed and digital resources to find answers for the questions they wrote on their worksheet.

What do I know about fossils?	What I want to know about fossils?	What I learned about fossils?



Students will be informed about different levels of questions they can ask in the middle part of the worksheet given above. The instructor gives examples of three different levels of questions such as:

Level 1: WH questions

What is ...? When did . . .? Who are the main . . .?

Level 2: Association and connections

How would you compare . . . with? Can you explain the features of . . .? Can you identify the main idea of . . .? How would you summarize . . .?

Level 3:

Why do you think . . .? What evidence did you find . . .? Can you make a distinction between . . .? Can you predict the outcome if . . .?

Then, students will compose an informative text regarding fossils by using some of the transitions words given them in the classroom such as;

In short
Obviously
As a result
However
Therefore
On the other hand

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So
I understand that
Yet
Although
For this reason
This line shows that
This states that
This is not unlike
After that
Another key characteristic is
An example of this concept is

The instructor asks the students to fill out KWL charts. In which students will write how much they know about the topic. On the second part of the worksheet, students will write their own questions regarding fossils. On the last part of the worksheet, students will summarize what the learned after their research about fossils. By giving this assignment, the instructor works on increasing students' pattern recognition and decomposition skills.



Group Work: Finding bones in boxes

Students, in groups of 3-4, come next to the soil-filled boxes prepared by the instructor.



http://tippytoecrafts.blogspot.com/2012/06/dramatic-play-dino-camp.html



The instructor tells "Now all of you are palaeontologists, that is a fossil scientist. Wearing these aprons, you will find the animal bones in these boxes in groups. Note that if you use hard objects, you can damage the bones and historical examinations may become unavailable. Therefore, start research using brushes only. Try to join the bones you find. Discuss in your groups which animal the bones belong to, which parts of the animal these bones belong to. Think about how many years they lived, what they did and write an observation report on these topics." By asking students to answer these questions, the instructor aims to increase their pattern recognition and logical reasoning skills as some of the computational thinking skills.



Writing an essay: About Found Bones

The instructor gives a presentation named "Expository text structure" about different texts types of expository writing.



Students will be informed about key words to use in their essays such as;

- Alike, different from
- Although



- And yet
- Even though
- In much the same way, instead
- Looks like, same as
- On the other hand, on the contrary
- Unlike, whereas

To compose their compare and contrast text on different bones. Students' written texts will be assessed according to information given to them on a presentation named as "Assessment in expository texts" in terms of Six Traits control list given below:

Control List for Six Traits

Six Traits	Indicator		No
	Presents content that is informative or explains		
Idaaa	Includes accurate facts or evidence to support thesis		
lueas	Develops a clear main idea		
	Reports interesting, supporting details		
	Gives examples and non-examples to support facts		
	Limits or narrow the topics		
	Demonstrate an identifiable organization structure and expository strategies		
Ouganizatio	Exhibits paragraphs that are unified		
n	Incorporates transitional devices and cue words to connect main ideas		
	Follows a logical sequence of events		
	Employs subheadings to aid understanding		
	Sounds objective		
	Presents authoritative tone, full of conviction		
Voice	Reveals a unique perspective		

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	Conveys a clear sense of audience	
	Discloses a passion for the topic	
	Combines sentences	
	Expresses sentences that are concise and varied	
Sentence		
Fluency		
	Uses specific informative words with appropriate connotations	
Word	Provides vocabulary that accurately specifies the subject or facts	
Choice	Defines unfamiliar concepts or terms	
	Identifies citations, footnotes, quoted information	
Conventions	Includes bibliography	
Conventions	Delineates page numbers	
	Establishes correct margins	
	Indents paragraphs	
	Displays accurate spelling	

By, asking students to compose a nonfiction text and asking them to use the keywords of this genre, the instructor aims to increase students' abstraction skills as one of the computational thinking skills.



Students will be told that there are three types of rocks. The images of solidification, metamorphism and sedimentary rocks will be shown in the presentation and their differences and similarities will be discussed. Students will see pictures of different rocks and will be asked to classify them.





https://tr.pinterest.com/pin/166070304987449908/?nic_v1=1aeGE68Hf8JqpCcD14xIxLv%2Bu CqSYxFddYyz1cvkqcGCwQSfSINQ%2BF3DXE2ghGWclM

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https://tr.pinterest.com/pin/139752394662656869/?nic_v1=1aYeJw7wvVpCFubaihcVCMA774 7q0e80rt0iuD8IMPf6gX0up%2B2Iu%2F3jnuaJNfvije

Students are given materials (clay, pebbles, transparent and shiny beads, natural cement, lemon salt and sea sand) to make three types of rock samples. By doing this activities, the instructor works on improving students' classifying and pattern recognition skills as some of the computational thinking skills.



This activity intended to foster creative writing. The relevant sections on pages 16 and 17 from the book titled as "Fossils" will be shared as information. The real Unicorn's visual and story will be shared with the students. Then the snake stone, magical stones, lightning, sponge beads and pictures of the auspicious buns will be shown to the students, but the explanations will not be read.

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https://pubhtml5.com/twef/hspb/basic

Students will be asked to create a convincing short text about what they actually were (before they become a fossil) and what they can do in public beliefs about one or more visuals they choose. In this activity students can use their imagination and add some opinions into their expository texts.

By doing this activities, the instructor works on improving students' abstraction skills as one of the computational thinking skills.





Learning resources presented in this module are especially designed for primary/secondary school students. However, they can also be used by prospective teachers in pilot implementation. In this way, the prospective teacher not only experiences the activity as a student but also become aware about how to behave and organize the activity once she/he became a teacher. Furthermore, necessary adaptations, simplifications and additions can always be done to the activities based on country and age differences.



All assessment tasks should be handed in before the deadline set.

Assassment task	Assassment aritaria and method
should measure and provide evidence about the achievement of learning outcomes of the module	for written assignments: e.g. lengths (in words), structure (introduction, main part, conclusions), proper use of terms and concepts.
 Understand the importance of teaching CT in the context of "A" in STEAM 	Prepares a report about specific of CT according to subject field
 Effectively identifies and locates digital tools that can be incorporated to include CT in the subject field 	Creating instructional material by using relevant tools
 Criticize lesson plans and activities from the point of teaching CT concepts 	Contributes discussions
 4) Designs and develops instructional materials that integrates CT concepts into her/his subject field 	Prepares two hours of lesson plans that concentrates on CT concepts





Although the instructional activities and materials here are developed for primary/secondary school students, they are prepared as examples. Hence, more difficult and varied versions of these materials can be prepared in a flexible way that addresses different needs of countries and age levels.

Digital interactive exercises provided through H5P tool and other worksheets can also play a guide role and can be enhanced and revised according to expectations of implementers.



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