

PATTERNS EVERYWHERE (ALL LEVELS)




Ages 4 to 7 (Level 1)


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| Description: | Learners will understand how patterns help us make sense of the very complex world and transform information and data into meaning. Learners will visually represent different patterns around them. |
| Leading question: | How can patterns help us make sense of our world? |
| Age group: | 4-7 |
| Subjects: | Math, Art, Computer Science, Social Science, SEL |
| Learning outcomes: | -Identify different kinds of patterns on daily life -Exemplify how meaning is connected to patterns -Differentiate between data and information, and meaning |
| Concepts and skills covered: | <ul style="list-style-type: none"> ● Pattern ● Size ● Shape ● Repetition |
| Required previous learning | None |
| Total time required: | ~ 4 hours across five days |
| Self-guided / Supervised activity: | Medium Supervision |
| Resources required: | Paper, colors, timer |

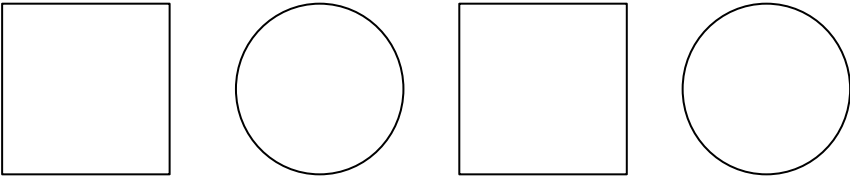
| Day | Time | Activity and Description |
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| 1 | 10 min | <p>Theme: <i>Discovering patterns in your life</i></p> <p>Introduction. Patterns are things—numbers, shapes, images—that repeat in a logical way.</p> <p>For example, every day, the sun comes out, then it leaves and the moon comes out. Or, for example, we follow the same path to go to the grocery store everyday. Also, the week has always the same number of days, and we work for some and rest for others.</p> <p>Let the learners try to come up with a few examples.</p> |
| | 30 min | <p>“The Pattern Detective.” The purpose of this activity is for you to think about your own relationship to your life in terms of patterns. It is also a chance for you to share more about yourself!</p> |

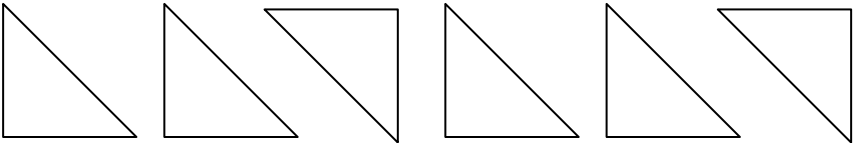
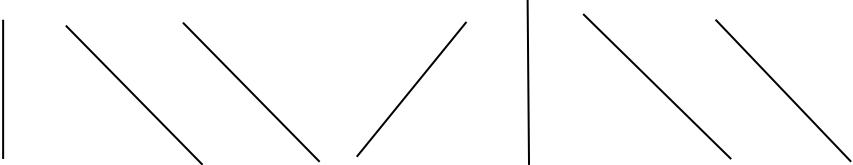
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| | | <p>Go around your house and/or neighborhood/school/class and find examples of 3 patterns. For instance, look at flowers, trees, fruits, routines that you have, how your house is constructed, etc.</p> <p>Spend some time really searching so you are able to find diverse examples with rich and different attributes - a mixture of patterns that are beautiful, surprising, complex, curious, multifaceted, mathematical, and artistic, and that come from many different areas.</p> <p>For each of these 3 patterns provide:</p> <ol style="list-style-type: none"> A visual image, sample, or rendering of the pattern. For this, you can use pencil, colors, or you can also use small stones, beans, sticks, whatever you are able to find. An image of something that the patterns remind you of. A name, one that you think is appropriately descriptive. For example, a pattern could be called “one circle after another one” or “many points clustered together.” If learners don’t know how to write, the educator or parent can write it down and then ask the learner to write it again. <p>Remember learners that not all patterns are directly observable. For example, we can see the symmetry in a fruit (if you cut it in half, then both halves probably look the same), or we can see how tiles are arranged in the floor, but there are things that we can not “see”.</p> <p>For example, we only see a pattern of day and night, after we have observed several days and nights.</p> <p>Challenge: try to also look for these kinds of patterns, and think about ways of “seeing” or representing things that we can’t usually see. For example:</p> <p>Day – Sun Night – Moon Day – Sun Night-Moon</p> <p>Learners can use this format to note their observations (although you can encourage them to also be creative regarding how to show and arrange their observations)</p> |
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| | | <p>Pattern #1</p> <p>Name: _____</p> <p>Visual representation:</p> <div style="text-align: center; border: 1px solid black; width: 200px; height: 150px; margin: 10px auto;"></div> <p>What does it remind me of? (Draw something that the pattern reminds you of)</p> <div style="text-align: center; border: 1px solid black; width: 200px; height: 150px; margin: 10px auto;"></div> | |
| | | <p>Feedback. There are no right or wrong answers here! But it is still important for learners to reflect about their work. Learners will show their list to a peer (who has also done the exercise) or to a family member, who will look closely at what they wrote. They will comment on each other's work (or just on the learner's work) using these prompts:</p> <ul style="list-style-type: none"> ● CLARIFY: Are there ideas that the learner shared that need to be clarified or explained a little bit more? ● CONNECT: Can you identify a connection with the patterns or the ideas that the learner shared? Explain what that connection is. For example, the pattern might remind you of a place you've been or your experience might be connected to one of the parts of the system that the learner identified. ● NEW IDEAS: Did the learners' analysis of the patterns extend your thinking about patterns or give you a new perspective on something? If so, share how. | |

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| | | <p>B= (clap your hands) </p> <p>C= (stomp your feet) </p> <p>D= (slap in thighs) </p> <p>Example: if the keys are B,D,A,C, these movements should be: Clap, slap in thighs, snap, stomp....</p> <p>The choreography that learners create should be at least 10 keys long (i.e. it should contain 10 individual letter keys such as A, B, C etc.).</p> <p>Invite learners to explore more intentionally different types of patterns.</p> <p>Let learners rehearse the choreography.</p> <p>If it is easier for the learners, instead of writing the keys, they can also draw and cut images representing the movement), rearrange them in different orders, and put them on the floor to follow.</p> <p>If they prefer it, they are welcome to create their own keys and movements (and to make more than 4 keys as well). The activity can be made as complex as the learners are willing to do it.</p> <p>Learners can reflect on their favourite songs and if they can identify the pattern in this? Which of the patterns that they made was their favourite? What made this their favorite?</p> <p>Learners can compose as many choreographies (sequence of movements) as they want!</p> <p>If possible, learners can ask somebody else at home to recreate the pattern with them. If they are in a classroom or in a group setting, encourage learners to take turns and do each other's choreography as a group, or invite them to create patterns to challenge others (it can be like a dance contest).</p> <p>Guide the learners' attention to the fact that dancing, music, and rhythm are the results of sounds and tones that repeat themselves in</p> |
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| | <p>20 min</p> | <p>different order. These are also patterns that are present in many of our lives! Reflect with the students how we don't actually see some patterns, like music, but that we can find ways to represent them.</p> <p>Also, spend some time thinking about how patterns are not only there: we don't only find them, we can also create them!</p> <p>Optional- Enrichment Activity (WhatsApp-Dependent). Copy the following images on a sheet of paper and Invite learners to take a look at them:</p>  <p>Ask learners:</p> <ul style="list-style-type: none"> - What do they see? - Encourage learners to describe the images in detail (e.g. "I see some symbols that look like the letter e" or "I see that those symbols appear in the first image and then again in the last one") - What do they think is going on here? - Encourage learners to come up with all sorts of ideas (e.g. "It looks like what someone who is learning to write will |
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| | <p>5 min</p> <p>5 min</p> <p>5 min</p> <p>5 min</p> | <p>and/or combining two similar colors/two shades of the same color for the same part of the drawing.</p> <p>After they have finished, let the paint dry, and invite them to do this exercise (“Zoom in” Thinking Routine). If learners are in a classroom setting, ask them to exchange drawings with one of their peers. If not, use their own drawing and ask the questions to a family member:</p> <ul style="list-style-type: none"> ● Make a tiny hole in a sheet of paper and have students place it on top of their drawing. Ask the learners: What do you see or notice? What is your hypothesis or interpretation of what this might be based on what you see or notice? ● Use the same sheet of paper, but make the hole a bit larger. Ask the learners: what new things do you see or notice? How does this change your hypothesis or interpretation? ● Finally, without the paper, ask the learners: What do you see or notice? What is your hypothesis or interpretation of what this might be based on what you see or notice? <p>Explain to the learners that this process of “zooming out” that they just did with their drawings is called “abstraction” and patterns help us do this. An abstraction involves the synthesis of particular facts or data into one general theory or picture about something. Abstraction is the opposite of specification or staying at the level of the details. Patterns help us move away from specifics to understand what is repeating and in what way. Without patterns, we would not be able to understand what we see around us!</p> |
| 4 | 5 min | <p>Theme: Learners begin a more “mathematical” exploration of patterns and learn about sequences</p> <p>Here is one example of a geometrical pattern (a pattern that uses geometry):</p> <div style="text-align: center;">  </div> <p>Can you guess what shape comes next? (Give enough time for learners to think)</p> |

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| | <p>5 min</p> <p>5 min</p> <p>5 min</p> | <p>Here's another example:</p>  <p>Can you guess what shape comes next?</p> <p>One last example:</p>  <p>Can you guess what line comes next?</p> <p>And here are some examples of patterns with numbers:</p> <p>1 1 1 1 1 1 1 1</p> <p>Can you guess what number comes next? Of course! 1. This is a very simple pattern.</p> <p>Let's try another one:</p> <p>1 0 1 0 1 0 1 0 1 0 1..... What number comes next?</p> <p>How about this one:</p> <p>2 3 4 2 3 4 2 3 What number comes next?</p> <p>Invite learners to design their own sequences (they can use shapes or numbers starting with number 1).</p> <p>Learners can challenge family members or peers to guess the following number in the sequence</p> |
| 5 | | <p>Theme: Patterns can be changed!</p> <p>Awareness of the basic patterns that exist in our world will help you see what's happening around you in a different light.</p> |

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| | <p>For example, if we see that whenever there are clouds, it is likely that it will rain, then we can expect that, if we see clouds, it is going to rain and we can then plan accordingly.</p> <p>But, most importantly, having an understanding of what might happen in a situation may give you the opportunity to create a different outcome than what you have seen before.</p> <p>Throughout the week, we have been keeping track of some behaviors in our diaries. Invite learners to take a look at them and try to observe some emerging patterns.</p> <p>Ask them to use emojis to identify two patterns that they believe are emerging from their observations following this structure:</p> <p>“[emoji] <--> [emoji]”</p> <p>For example, learners can say something like “When I ate chips late at night [with an emoji representing this], then I had nightmares [with an emoji representing this].”</p> <p>Are there “good” or “bad” patterns or habits?</p> <p>Let’s “Zoom out.” Ask learners to think about the same pattern in the context of a month, and in the context of a year. Is this something that they might be able to observe over the course of this time?</p> <p>Let learners brainstorm one idea to break or enhance the behavioral patterns that they identified.</p> <p>Ask them to draw a poster to remind themselves of how to break those or to encourage themselves to continue doing what they are doing correctly. They can use some of the patterns that they observed on day one or pointillism design their posters.</p> |
| <p>Assessment Criteria:</p> | <p>Final products:</p> <ul style="list-style-type: none"> - List of patterns: <ul style="list-style-type: none"> - Learners presents a complete list of 3 patterns - Each item in the list includes: <ul style="list-style-type: none"> - A visual image, sample, or rendering of the pattern. - A name, one that you think is appropriately descriptive - Posters with three suggestions to improve their habits <ul style="list-style-type: none"> - Learners are able to keep track of their behaviors over a week |

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| | <ul style="list-style-type: none"> - Learners are able to identify three patterns of behavior during the week. - Learners brainstorm a concrete and actionable idea to improve their habits - Learners design a creative poster |
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| Inspiration: | <ul style="list-style-type: none"> • Arvind Ranganathan • Patterns Book • https://artplusmarketing.com/using-patterns-to-make-sense-of-your-world-d8034650bd98 • https://www.mathnasium.com/examples-of-the-golden-ratio-in-nature |
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Ages 8 to 11 (Level 2)

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| Description: | In this project, learners will understand how patterns help us make sense of the very complex world and transform information and data into meaning. Learners will visually represent different patterns around them. |
| Leading question: | How can patterns help us make sense of our world? |
| Age group: | 8-11 |
| Subjects: | Math, Art, Computer Science, Music, Social Science |
| Learning outcomes: | <ul style="list-style-type: none"> -Identify different kinds of patterns on daily life -Exemplify how meaning is connected to patterns -Differentiate between data and information, and meaning |
| Concepts and skills covered: | <ul style="list-style-type: none"> • Pattern • Symmetry • Choreography • Abstraction • Sequences • Fibonacci sequence |
| Required previous learning | None |
| Total time required: | ~4 hours across 5 days |
| Self-guided / Supervised activity: | Medium Supervision |
| Resources required: | Paper, colors, acrylic paint or something that could leave a colorful trace on paper when learners use their fingers to draw |

| Day | Time | Activity and Description |
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| 1 | 10 min | <p>Theme: <i>What is a pattern?</i></p> <p>Introduction. Patterns are things—numbers, shapes, images—that repeat in a logical way. Patterns play essential roles in nature, music, dance, art, visualization, number, measurement, games & puzzles, knots, and even history and politics! For example, every day, the sun comes out, then it leaves and the</p> |

| | <p>10 min setting up</p> <p>10 min of reflection everyday</p> | <p>moon comes out. Or, for example, we follow the same path to go to the grocery store everyday. Also, the week has always the same number of days, and we work for some and rest for others.</p> <p>Let the learners try to come up with definitions and a few examples.</p> <p>Begin Day 1 asking learners to set up some sheets of paper as a diary to keep track and notes of the following things:</p> <table border="1" data-bbox="472 562 1196 1879"> <thead> <tr> <th data-bbox="472 562 667 627"></th> <th data-bbox="667 562 764 627">Day 1</th> <th data-bbox="764 562 862 627">Day 2</th> <th data-bbox="862 562 959 627">Day 3</th> <th data-bbox="959 562 1057 627">Day 4</th> <th data-bbox="1057 562 1196 627">Day 5</th> </tr> </thead> <tbody> <tr> <td data-bbox="472 627 667 1050">Did I lose my temper today? If I did, when did it happen? What happened before that? What happened after?</td> <td data-bbox="667 627 764 1050"></td> <td data-bbox="764 627 862 1050"></td> <td data-bbox="862 627 959 1050"></td> <td data-bbox="959 627 1057 1050"></td> <td data-bbox="1057 627 1196 1050"></td> </tr> <tr> <td data-bbox="472 1050 667 1434">Did I have nighttime fears or nightmares? What did I do during the day that day? When did I have my last meal?</td> <td data-bbox="667 1050 764 1434"></td> <td data-bbox="764 1050 862 1434"></td> <td data-bbox="862 1050 959 1434"></td> <td data-bbox="959 1050 1057 1434"></td> <td data-bbox="1057 1050 1196 1434"></td> </tr> <tr> <td data-bbox="472 1434 667 1677">Did I wake up rested today? What time did I go to bed the night before?</td> <td data-bbox="667 1434 764 1677"></td> <td data-bbox="764 1434 862 1677"></td> <td data-bbox="862 1434 959 1677"></td> <td data-bbox="959 1434 1057 1677"></td> <td data-bbox="1057 1434 1196 1677"></td> </tr> <tr> <td data-bbox="472 1677 667 1879">Another behavior or reaction that they would like to pay</td> <td data-bbox="667 1677 764 1879"></td> <td data-bbox="764 1677 862 1879"></td> <td data-bbox="862 1677 959 1879"></td> <td data-bbox="959 1677 1057 1879"></td> <td data-bbox="1057 1677 1196 1879"></td> </tr> </tbody> </table> | | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 | Did I lose my temper today? If I did, when did it happen? What happened before that? What happened after? | | | | | | Did I have nighttime fears or nightmares? What did I do during the day that day? When did I have my last meal? | | | | | | Did I wake up rested today? What time did I go to bed the night before? | | | | | | Another behavior or reaction that they would like to pay | | | | | |
|--|---|--|-------|-------|-------|-------|-------|-------|---|--|--|--|--|--|--|--|--|--|--|--|---|--|--|--|--|--|--|--|--|--|--|--|
| | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Did I lose my temper today? If I did, when did it happen? What happened before that? What happened after? | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Did I have nighttime fears or nightmares? What did I do during the day that day? When did I have my last meal? | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Did I wake up rested today? What time did I go to bed the night before? | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Another behavior or reaction that they would like to pay | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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| | | attention to | | | | | | |
| | | Another behavior or reaction that they would like to pay attention to | | | | | | |
| | 5 min | <p>Invite learners to pay attention throughout the day and see if there is another behavior that we have not thought about, but that they would like to investigate.</p> | | | | | | |
| | At least 30 min, invite learners to spend enough time really observing their surroundings | <p>“The Pattern Detective.” The purpose of this activity is for you to think about your own relationship to your life in terms of patterns. It is also a chance for you to share more about yourself!</p> <p>Go around your house and/or neighborhood/school/class and find examples of 10 patterns. For instance, “How does your family usually spend time during the week?,” “How does your body move when you dance?,” “How do the phone or waking up alarm ring?,” “What does school, a class or homework feel like?,” “How do the tiles in your kitchen look like?,” “What do plant leaves or branches look like?,” “What does the inside of a fruit look like?,” etc.</p> <p>Spend some time really searching so you are able to find diverse examples with rich and different attributes - a mixture of patterns that are beautiful, surprising, complex, curious, multifaceted, mathematical, and artistic, and that come from many different areas.</p> <p>For each of these 10 patterns provide:</p> <ul style="list-style-type: none"> d. A brief description of the pattern itself: what are its main features- colors, shape, timing, etc.), where it arises, where did you find it, what does it remind you of, etc. e. A brief description of why you found this pattern compelling enough to include it in your collection. f. A visual image, sample, or rendering of the pattern. For this, you can use pencil, colors, or you can also use small stones, beans, sticks, whatever you are able to find. g. A name, one that you think is appropriately descriptive <p>Remember learners that not all patterns are directly observable. For example, we can see the symmetry in a fruit (if you cut it in half, then both halves probably look the same), or we can see how tiles are arranged in the floor, but there are things that we can not “see”. For example, we only see a pattern of day and night, after we have observed several days and nights. Or, for instance,</p> | | | | | | |

one way to “see” patterns in music is when we represent them with our bodies when we dance. Challenge: try to also look for these kinds of patterns, and think about ways of “seeing” or representing things that we can’t usually see.

Learners can use this format to note their observations (although you can encourage them to also be creative regarding how to show and arrange their observations)

Pattern #1

Name: _____

Visual representation:





Main features:

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What does it remind me of?

Why do I find it compelling?

Feedback. There are no right or wrong answers here! But it is still important for learners to reflect about their work. Learners will show their list to a peer (who

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| | | <p>has also done the exercise) or to a family member, who will look closely at what they wrote. They will comment on each other's work (or just on the learner's work) using these prompts:</p> <ul style="list-style-type: none"> ● CLARIFY: Are there ideas that the learner shared that need to be clarified or explained a little bit more? ● CONNECT: Can you identify a connection with the patterns or the ideas that the learner shared? Explain what that connection is. For example, the pattern might remind you of a place you've been or your experience might be connected to one of the parts of the system that the learner identified. ● NEW IDEAS: Did the learners' analysis of the patterns extend your thinking about patterns or give you a new perspective on something? If so, share how. |
| 2 | 15 mins | <p>Theme: <i>Non-visual patterns: music</i></p> <p>After exploring patterns in general, and facing the challenge of representing non observable patterns, learners will begin to explore less observable patterns with routines, routes, sounds, music, movement, and their bodies. They will also explore ways of representing patterns.</p> <p>Music and Patterns. After setting up their diary, learners will think about ways of understanding music and how it is related to patterns. They will create their own movement and sound pattern taking into account the following keys:</p> <div style="display: flex; flex-direction: column; align-items: center;"> <div style="display: flex; align-items: center; margin-bottom: 10px;"> A = (snap your fingers)  </div> <div style="display: flex; align-items: center; margin-bottom: 10px;"> B= (clap your hands)  </div> <div style="display: flex; align-items: center; margin-bottom: 10px;"> C= (stomp your feet)  </div> <div style="display: flex; align-items: center;"> D= (slap in thighs)  </div> </div> <p>Example: if the keys are B,B,D,A,C,C,B,B,D,A,C,C, this in movements should be: Clap, clap, slap in thighs, snap, stomp, stomp....</p> <p>The choreography that learners create should be at least 20 keys long (i.e. it should contain 20 individual letter keys such as A, B, C etc.).</p> |

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| | 20 min | <p>Invite learners to explore more intentionally different types of patterns. For example, creating a “symmetric” pattern (e.g. BBDA ADBB) or a “cluster” pattern (e.g. BBBBBD ACD), What would a “spiral” look like when it comes to choreography? (Again, there is no right or wrong answer or correct interpretation of the type pattern. These names and ideas should just be scaffolds for the students to explore).</p> <p>Let learners rehearse the choreography.</p> |
| | 30 min | <p>If it is easier for the learners, instead of writing the keys, they can also draw and cut images representing the movement), rearrange them in different orders, and put them on the floor to follow.</p> |
| | 5 min | <p>If they prefer it, they are welcome to create their own keys and movements (and to make more than 4 keys as well). The activity can be made as complex as the learners are willing to do it.</p> |
| | 5 min | <p>If possible, learners can ask somebody else at home to recreate the pattern with them. If they are in a classroom or in a group setting, encourage learners to take turns and do each other’s choreography as a group, or invite them to create patterns to challenge others (it can be like a dance contest).</p> |
| | 5 min | <p>Guide the learners’ attention to the fact that dancing, music, and rhythm are the results of sounds and tones that repeat themselves in different order. These are also patterns that are present in many of our lives! Reflect with the students how we don’t actually see some patterns, like music, but that we can find ways to represent them.</p> |
| | 30 min | <p>Also, spend some time thinking about how patterns are not only there: we don’t only find them, we can also create them!</p> <p>Brainstorm with the learners what are other types of patterns (e.g. patterns in time - routines; patterns in how they get from one place to another- routes; patterns in how the school year is set up, etc.)</p> <p>Optional- Enrichment Activity (WhatsApp-Dependent). Copy the following images on a sheet of paper and Invite learners to take a look at them:</p> <p>Ask learners:</p> |

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| | |  <ul style="list-style-type: none"> - What do they see? - Encourage learners to describe the images in detail (e.g. <i>"I see some symbols that look like the letter e"</i> or <i>"I see that those symbols appear in the first image and then again in the last one"</i>) - What do they think is going on here? - Encourage learners to come up with all sorts of ideas (e.g. <i>"It looks like what someone who is learning to write will write," "they look like letters in another language"</i>, etc.) - What do they wonder about these patterns? <p>If you are in a classroom setting, student responses to these three questions can be written down and recorded so that a class chart of observations, interpretations, and wonderings are listed for all to see. otherwise, just have the learners write down their answers to the three questions.</p> <p>The images represent a song! Play the song for them:</p> |
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| | | <ul style="list-style-type: none"> • If video is available, ask students to watch this video: //www.youtube.com/watch?v=MWbzRP5gJw4 • If you are teaching the project in a classroom setting, play this song for them: https://voca.ro/1dnr91Bu64wi. • You can also share with the learners via WhatsApp the following voice note: https://voca.ro/1dnr91Bu64wi <p>Ask the learners to try to follow with their fingers the patterns in the images that they just saw (part 2). The images are representing the rhythms of the song in different ways. Someone “translated” the patterns of rhythm to something that we can see. This is called a Musicgram and is very similar to how musicians “write” music.</p> <p>Invite learners to create their own “Musicgram” for their favorite song in a sheet of paper! The musicgram needs to have the following characteristics:</p> <ul style="list-style-type: none"> - “Translating” one minute of a song - Visually, a “reader” should be able to differentiate between the “chorus” and the rest of the song - There should be at least 5 different signs |
| 3 | <p>5 min</p> <p>10 min</p> <p>20 min</p> | <p>Theme: <i>How do you use patterns? Patterns to “Zoom out”</i></p> <p>“Zooming out” to understand what we usually see when we are “zoomed in”</p> <p>Vision involves identifying patterns, like combining pixels. Somehow we organize the flickering map of brightness and color into surfaces, textures, shapes and objects embedded in a three-dimensional space. This was the inspiration for a drawing technique called pointillism. Famous painters, such as Georges Pierre Seurat and Vincent van Gogh used this technique. And it is also used in computers and screens.</p> <p>Let’s see how this works.</p> <p>Have learners decide on a design they would like to paint. This can be very simple such as a rainbow or flower. Older learners can try drawing a simple landscape.</p> <p>Have learners sketch that design with pencil.</p> <p>Have learners decide on the colors that their design will have (ideally, no more than three). So, for instance, they will use green for the stem of the flower, and pink for the flower.</p> <p>Instead of filling the white space with traces, invite learners to leave marks with their fingers until most of the space has been filled. They can explore with</p> |

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| | | <p>Let's try another one:</p> <p>1 0 1 0 1 0 1 0 1 0 1 0 1..... What number comes next?</p> <p>How about this one:</p> <p>1 3 5 7 9 11.... What number comes next? How do you know what number comes next? (Start guiding learners towards the idea that there is a rule that can help them find the following number. In this case, the rule is adding "2" to the previous number)</p> <p>Let's try another one:</p> <p>3 6 9 12 15..... What number comes next? How do you know? (In this case, the rule is that all these numbers are the multiples of three, ordered from the smallest to the largest)</p> <p>9 18 27 36 45..... What number comes next? How do you know (These are the multiples of 9)</p> |
| | 15 min | <p>Invite learners to design their own sequences starting with number 1 and based on a rule (at least two). They can come up with this rule combining addition, subtraction, and multiplication. For example, "the next number will be the previous number times 3, minus 1 (The sequence would be: 1 2 5 14)"</p> <p>Learners can challenge family members or peers to guess the following number in the sequence</p> |
| | 10 min | <p>Extra challenge: Finally, consider the following numbers:</p> <p style="text-align: center;">0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55,</p> <p>Can you predict what number comes next? (Set the timer again, and give students 5 min to find the pattern. They can do this in small groups if they are in a classroom setting).</p> |
| | 15 min | <p>This is called the Fibonacci sequence. Each number is the sum of the two numbers that precede it. Give time for students to double check this pattern. It's a simple pattern, but it appears to be a kind of built-in numbering system to the universe</p> |
| | 10 min | <p>Invite learners to create their own dance choreography using the Fibonacci sequence e.g. blank (0), tap (1), tap (1), snap (2)... or make up your own dance choreography based on the sequences that they came up with.</p> |

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| | <p>Here are some examples of things where we can also find the Fibonacci sequence:</p> <ol style="list-style-type: none"> a. The number of petals in a flower consistently follows the Fibonacci sequence. Famous examples include the lily, which has three petals, buttercups, which have five (pictured at left), the chicory's 21, the daisy's 34, and so on. b. The Fibonacci sequence can also be seen in the way tree branches form or split. A main trunk will grow until it produces a branch, which creates two growth points. Then, one of the new stems branches into two, while the other one lies dormant. This pattern of branching is repeated for each of the new stems. Root systems and even algae exhibit this pattern. c. The head of a flower is also subject to Fibonacci processes. Typically, seeds are produced at the center, and then migrate towards the outside to fill all the space. Sunflowers provide a great example of these spiraling patterns. The seed heads are so tightly packed that the total number can get quite high — as many as 144 or more. And when counting these spirals, the total tends to match a Fibonacci number. <p>If possible, challenge the learners to go around and try to find flowers, cones, trees, ferns, shells, or objects that follow the Fibonacci sequence.</p> |
| 5 | <p>Theme: Patterns can be changed!</p> <p>Awareness of the basic patterns that exist in our world will help you see what's happening around you in a different light.</p> <p>For example, if we know that two things have been happening together in the past, we might be able to predict what will happen in the future. For example, if we see that whenever there are clouds, it is likely that it will rain, then we can expect that, if we see clouds, it is going to rain. This approach is the foundation of almost every discipline, including architecture, design, math, and science.</p> <p>But, most importantly, having an understanding of what might happen in a situation may give you the opportunity to create a different outcome than what you have seen before.</p> <p>Throughout the week, we have been keeping track of some behaviors in our diaries. Invite learners to take a look at them and try to observe some emerging patterns.</p> |

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| | <p>Ask them to write down three patterns that they believe are emerging from their observations following this structure:</p> <p>“When I _____, then _____ happened.”</p> <p>For example, learners can say something like “When I ate chips late at night, then I had nightmares.”</p> <p>Are there “good” or “bad” patterns or habits?</p> <p>Let’s “Zoom out.” Ask learners to think about the same pattern in the context of a month, and in the context of a year. Is this something that they might be able to observe over the course of this time?</p> <p>Let learners brainstorm some ideas to break or enhance each of three patterns that they identified.</p> <p>Ask them to make a poster to remind themselves of how to break those. They can use some of the patterns that they observed on day one or pointillism design their posters.</p> |
| <p>Assessment Criteria:</p> | <p>Final products:</p> <ul style="list-style-type: none"> - List of patterns: <ul style="list-style-type: none"> - Learners presents a complete list of 10 patterns - Each item in the list includes: <ul style="list-style-type: none"> - A brief description - A brief description of why they found this pattern compelling enough to include it in the collection. - A visual image, sample, or rendering of the pattern. - A name, one that you think is appropriately descriptive - Choreography. Learners are able to create and follow a choreography build with four simple steps. - Musicgram (optional): <ul style="list-style-type: none"> - Learners creatively “translate” from sound to paper one minute of their favorite song. The musicgram includes: <ul style="list-style-type: none"> - At least 5 different signs - Posters with three suggestions to improve their habits <ul style="list-style-type: none"> - Learners are able to identify two behaviors or reactions that they would like to observe based on some examples - Learners are able to keep track of their behaviors over a week - Learners are able to identify three patterns of behavior during the week. - Learners brainstorm two concrete and actionable ideas to improve their habits - Learners design a creative poster to remind themselves about their ideas to break their negative patterns of behavior. |

Ages 11 to 14 (Level 3)





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| Description: | In this project, learners will understand how patterns help us make sense of the very complex world and transform information and data into meaning. Learners will visually represent different patterns around them. |
| Leading question: | How can patterns help us make sense of our world? |
| Age group: | 11-14 |
| Subjects: | Math, Art, Computer Science, Music, Social Science |
| Learning outcomes: | -Identify different kinds of patterns on daily life -Exemplify how meaning is connected to patterns -Differentiate between data and information, and meaning |
| Concepts and skills covered: | <ul style="list-style-type: none"> ● Pattern ● Symmetry ● Choreography ● Abstraction ● Sequences ● Fibonacci sequence |
| Required previous learning | None |
| Total time required: | ~5 hours across 4 days |
| Self-guided / Supervised activity: | Medium Supervision |
| Resources required: | Paper, colors, acrylic paint or something that could leave a colorful trace on paper when learners use their fingers to draw |

| Day | Time | Activity and Description | | | | | | |
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| 1 | 10 min | <p>Theme: <i>What is a pattern?</i></p> <p>Introduction. Patterns are things—numbers, shapes, images—that repeat in a logical way. Patterns play essential roles in nature, music, dance, art, visualization, number, measurement, games & puzzles, knots, and even history and politics! For example, every day, the sun comes out, then it leaves and the moon comes out. Or, for example, we follow the same path to go to the grocery store everyday. Also, the week has always the same number of days, and we work for some and rest for others.</p> <p>Let the learners try to come up with definitions and a few examples.</p> | | | | | | |
| | 10 min setting up | Begin Day 1 asking learners to set up some sheets of paper as a diary to keep track and notes of the following things: | | | | | | |
| | 10 min of reflection everyday | <table border="1" style="width: 100%; text-align: center;"> <tr> <td style="width: 15%;"></td> <td style="width: 15%;">Day 1</td> <td style="width: 15%;">Day 2</td> <td style="width: 15%;">Day 3</td> <td style="width: 15%;">Day 4</td> <td style="width: 15%;">Day 5</td> </tr> </table> | | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 |
| | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 | | | |

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| | 5 min | Did I lose my temper today? If I did, when did it happen? What happened before that? What happened after? | | | | | |
| | | Did I have nighttime fears or nightmares? What did I do during the day that day? When did I have my last meal? | | | | | |
| | | Another behavior or reaction that they would like to pay attention to | | | | | |
| | | Another behavior or reaction that they would like to pay attention to | | | | | |
| | | Invite learners to pay attention throughout the day and see if there is another behavior that we have not thought about, but that they would like to investigate. | | | | | |

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| | <p>At least 30 min (encourage learners to spend enough time looking closely at their surroundings)</p> | <p>“The Pattern Detective.” The purpose of this activity is for you to think about your own relationship to your life in terms of patterns. It is also a chance for you to share more about yourself!</p> <p>Go around your house and/or neighborhood/school/class and find examples of 10 patterns. For instance, “How does your family usually spend time during the week?,” “How does your body move when you dance?,” “How do the phone or waking up alarm ring?,” “What does school, a class or homework feel like?,” “How do the tiles in your kitchen look like?,” “What do plant leaves or branches look like?,” “What does the inside of a fruit look like?,” etc.</p> <p>Spend some time really searching so you are able to find diverse examples with rich and different attributes - a mixture of patterns that are beautiful, surprising, complex, curious, multifaceted, mathematical, and artistic, and that come from many different areas.</p> <p>For each of these 10 patterns provide:</p> <ul style="list-style-type: none"> h. A brief description of the pattern itself: what are its main features- colors, shape, timing, etc.), where it arises, where did you find it, what does it remind you of, etc. i. A brief description of why you found this pattern compelling enough to include it in your collection. j. A visual image, sample, or rendering of the pattern. For this, you can use pencil, colors, or you can also use small stones, beans, sticks, whatever you are able to find. k. A name, one that you think is appropriately descriptive <p>Remember learners that not all patterns are directly observable. For example, we can see the symmetry in a fruit (if you cut it in half, then both halves probably look the same), or we can see how tiles are arranged in the floor, but there are things that we can not “see”. For example, we only see a pattern of day and night, after we have observed several days and nights. Or, for instance, one way to “see” patterns in music is when we represent them with our bodies when we dance. Challenge: try to also look for these kinds of patterns, and think about ways of “seeing” or representing things that we can’t usually see.</p> <p>Learners can use this format to note their observations (although you can encourage them to also be creative regarding how to show and arrange their observations)</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Pattern #1</p> </div> |
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| | 10 min | <p>Name: _____</p> <p>Visual representation:</p> <div data-bbox="570 474 1200 789" style="border: 1px solid black; height: 150px; width: 100%;"></div> <p>Main features:</p> <ul style="list-style-type: none"> • • • <p>What does it remind me of?</p> <div data-bbox="537 1073 1164 1209" style="border: 1px solid black; height: 65px; width: 100%;"></div> <p>Why do I find it compelling?</p> <div data-bbox="537 1318 1105 1493" style="border: 1px solid black; height: 83px; width: 100%;"></div> <p>Feedback. There are no right or wrong answers here! But it is still important for learners to reflect about their work. Learners will show their list to a peer (who has also done the exercise) or to a family member, who will look closely at what they wrote. They will comment on each other's work (or just on the learner's work) using these prompts:</p> <ul style="list-style-type: none"> • CLARIFY: Are there ideas that the learner shared that need to be clarified or explained a little bit more? • CONNECT: Can you identify a connection with the patterns or the ideas that the learner shared? Explain what that connection is. For example, the pattern might remind you of a place you've |
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| | | <p>been or your experience might be connected to one of the parts of the system that the learner identified.</p> <ul style="list-style-type: none"> ● NEW IDEAS: Did the learners’ analysis of the patterns extend your thinking about patterns or give you a new perspective on something? If so, share how. |
| 2 | 10 min | <p>Theme: <i>Non-visual patterns: music</i></p> <p>After exploring patterns in general, and facing the challenge of representing non observable patterns, learners will begin to explore less observable patterns with routines, routes, sounds, music, movement, and their bodies. They will also explore ways of representing patterns.</p> <p>Music and Patterns. Learners will think about ways of understanding music and how it is related to patterns.</p> <p>They will create their own movement and sound patterns by arranging different keys.</p> <p>Here is an example of keys that they can use:</p> <div style="display: flex; flex-direction: column; align-items: center;"> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="margin-right: 10px;">A = (snap your fingers)</div>  </div> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="margin-right: 10px;">B= (clap your hands)</div>  </div> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="margin-right: 10px;">C= (stomp your feet)</div>  </div> <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">D= (slap in thighs)</div>  </div> </div> <p>Encourage learners to create their own keys and movements (and to make more than 4 keys as well). The activity can be made as complex as the learners are willing to do it.</p> <p>Example: if the keys are B,B,D,A,C,C,B,B,D,A,C,C, this in movements should be: Clap, clap, slap in thighs, snap, stomp, stomp....</p> |



Ask learners:

- What do they see? - Encourage learners to describe the images in detail (e.g. *"I see some symbols that look like the letter e"* or *"I see that those symbols appear in the first image and then again in the last one"*)
- What do they think is going on here? - Encourage learners to come up with all sorts of ideas (e.g. *"It looks like what someone who is learning to write will write," "they look like letters in another language"*, etc.)
- What do they wonder about these patterns?

If you are in a classroom setting, student responses to these three questions can be written down and recorded so that a class chart of observations, interpretations, and wonderings are listed for all to see. otherwise, just have the learners write down their answers to the three questions.

The images represent a song! Play the song for them:

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| | | <ul style="list-style-type: none"> • If video is available, ask students to watch this video: //www.youtube.com/watch?v=MWbzRP5gJw4 • If you are teaching the project in a classroom setting, play this song for them: https://voca.ro/1dnr91Bu64wi. • You can also share with the learners via WhatsApp the following voice note: https://voca.ro/1dnr91Bu64wi <p>Ask the learners to try to follow with their fingers the patterns in the images that they just saw. The images are representing the rhythms of the song in different ways. Someone “translated” the patterns of rhythm to something that we can see. This is called a Musicgram and is very similar to how musicians “write” music.</p> <p>Invite learners to create their own “Musicgram” for their favorite song in a sheet of paper! The musicgram needs to have the following characteristics:</p> <ul style="list-style-type: none"> - “Translating” one minute of a song - Visually, a “reader” should be able to differentiate between the “chorus” and the rest of the song - There should be at least 5 different signs |
| 3 | <p>5 min</p> <p>10 min</p> <p>20 min</p> | <p>Theme: <i>How do you use patterns? Patterns to “Zoom out”</i></p> <p>“Zooming out” to understand what we usually see when we are “zoomed in”</p> <p>Vision involves identifying patterns, like combining pixels. Somehow we organize the flickering map of brightness and color into surfaces, textures, shapes and objects embedded in a three-dimensional space. This was the inspiration for a drawing technique called pointillism. Famous painters, such as Georges Pierre Seurat and Vincent van Gogh used this technique. And it is also used in computers and screens.</p> <p>Let’s see how this works.</p> <p>Have learners decide on a design they would like to paint. They can try drawing a simple landscape or a portrait.</p> <p>Have learners sketch that design with pencil.</p> <p>Have learners decide on the colors that their design will have. So, for instance, they will use green for the stem of the flower, and pink for the flower.</p> <p>Instead of filling the white space with traces, invite learners to leave marks with a q-tip (if unavailable, they can use their fingers, but ideally they would use something with a finer tip) until most of the space has been</p> |

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| | <p>15 min</p> <p>20 min</p> <p>10 min</p> | <p>How about this one:</p> <p>1 3 5 7 9 11.... What number comes next? How do you know what number comes next? (Start guiding learners towards the idea that there is a rule that can help them find the following number. In this case, the rule is adding “2” to the previous number) Let’s try another one:</p> <p>3 6 9 12 15..... What number comes next? How do you know? (In this case, the rule is that all these numbers are the multiples of three, ordered from the smallest to the largest)</p> <p>9 18 27 36 45..... What number comes next? How do you know? (In this case, these are the multiples of 9)</p> <p>Invite learners to design their own sequences starting with number 1 and based on a rule (at least five). They can come up with this rule combining addition, subtraction, and multiplication. For example, “the next number will be the previous number times 3, minus 1 (The sequence would be: 1 2 5 14)”</p> <p>Learners can challenge family members or peers to guess the following number in the sequence.</p> <p>Extra challenge: Finally, consider the following numbers:</p> <p style="text-align: center;">0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55,</p> <p>Can you predict what number comes next? (Set the timer again, and give students 5 min to find the pattern. They can do this in small groups if they are in a classroom setting).</p> <p>This is called the Fibonacci sequence. Each number is the sum of the two numbers that precede it. Give time for students to double check this pattern. It's a simple pattern, but it appears to be a kind of built-in numbering system to the universe</p> <p>Invite learners to create their own dance choreography using the Fibonacci sequence e.g. blank (0), tap (1), tap (1), snap (2)... or make up your own dance choreography based on the sequences that they came up with.</p> <p>Here are some examples of things where we can also find the Fibonacci sequence:</p> |
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| | 20 min | <p>d. The number of petals in a flower consistently follows the Fibonacci sequence. Famous examples include the lily, which has three petals, buttercups, which have five (pictured at left), the chicory's 21, the daisy's 34, and so on.</p> <p>e. The Fibonacci sequence can also be seen in the way tree branches form or split. A main trunk will grow until it produces a branch, which creates two growth points. Then, one of the new stems branches into two, while the other one lies dormant. This pattern of branching is repeated for each of the new stems. Root systems and even algae exhibit this pattern.</p> <p>f. The head of a flower is also subject to Fibonacci processes. Typically, seeds are produced at the center, and then migrate towards the outside to fill all the space. Sunflowers provide a great example of these spiraling patterns. The seed heads are so tightly packed that the total number can get quite high — as many as 144 or more. And when counting these spirals, the total tends to match a Fibonacci number.</p> <p>Now, let's see an interesting pattern that emerges when we divide each term of the Fibonacci sequence by the term before it. Do this with at least 10 consecutive terms (Learners can practice division by doing this by hand). Learners may complete this table by themselves:</p> <table border="1" data-bbox="553 1243 1417 1860"> <thead> <tr> <th>Terms in Fibonacci sequence</th> <th>Previous Term</th> <th>Ratio</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1</td> <td>1</td> </tr> <tr> <td>2</td> <td>1</td> <td>2</td> </tr> <tr> <td>3</td> <td>2</td> <td>1.5</td> </tr> <tr> <td>5</td> <td>3</td> <td></td> </tr> <tr> <td>8</td> <td>5</td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> </tbody> </table> | Terms in Fibonacci sequence | Previous Term | Ratio | 1 | 1 | 1 | 2 | 1 | 2 | 3 | 2 | 1.5 | 5 | 3 | | 8 | 5 | | | | | | | | | | |
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| Terms in Fibonacci sequence | Previous Term | Ratio | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 2 | 1 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | 5 min | <table border="1" data-bbox="553 241 1419 373"> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> </table> <p>What do you notice? (Input: the ratios should be approaching the number 1.6666).</p> <p>This number, 1.6666 is called <i>phi</i>, and is also very present in nature.</p> <p>For example, this shape, a rectangle in which the ratio of the sides a/b is equal to phi (ask learners to draw this rectangle), can result in a nesting process that can be repeated into infinity — and which takes on the form of a spiral. It's called the logarithmic spiral, and it abounds in nature! see natural examples below - spiral seashell, hurricane, and our galaxy, the Milky Way</p> <p>If possible, challenge the learners to go around and try to find flowers, cones, trees, ferns, shells, or objects that follow the Fibonacci sequence.</p> | | | | | | |
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| 5 | | <p>Theme: Patterns can be changed!</p> <p>Awareness of the basic patterns that exist in our world will help you see what's happening around you in a different light.</p> <p>For example, if we know that two things have been happening together in the past, we might be able to predict what will happen in the future. For example, if we see that whenever there are clouds, it is likely that it will rain, then we can expect that, if we see clouds, it is going to rain. This approach is the foundation of almost every discipline, including architecture, design, math, and science.</p> <p>But, most importantly, having an understanding of what might happen in a situation may give you the opportunity to create a different outcome than what you have seen before.</p> <p>Throughout the week, we have been keeping track of some behaviors in our diaries. Invite learners to take a look at them and try to observe some emerging patterns.</p> <p>Ask them to write down five patterns that they believe are emerging from their observations following this structure:</p> <p>“When I _____, then _____ happened.”</p> | | | | | | |

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| | <p>For example, learners can say something like “When I ate chips late at night, then I had nightmares.”</p> <p>Are there “good” or “bad” patterns or habits?</p> <p>Let’s “Zoom out.” Ask learners to think about the same pattern in the context of a month, and in the context of a year. Is this something that they might be able to observe over the course of this time?</p> <p>Let learners brainstorm some ideas to break or enhance the behavioral patterns that they identified.</p> <p>Ask them to make a poster to remind themselves of how to break those or to encourage themselves to continue doing what they are doing correctly. They can use some of the patterns that they observed on day one or pointillism design their posters.</p> |
| <p>Assessment Criteria:</p> | <p>Final products:</p> <ul style="list-style-type: none"> - List of patterns: <ul style="list-style-type: none"> - Learners presents a complete list of 10 patterns - Each item in the list includes: <ul style="list-style-type: none"> - A brief description - A brief description of why they found this pattern compelling enough to include it in the collection. - A visual image, sample, or rendering of the pattern. - A name, one that you think is appropriately descriptive - Choreography. Learners are able to create and follow a choreography build with four simple steps. - Musicgram (optional): <ul style="list-style-type: none"> - Learners creatively “translate” from sound to paper one minute of their favorite song. The musicgram includes: <ul style="list-style-type: none"> - At least 5 different signs - Posters with three suggestions to improve their habits <ul style="list-style-type: none"> - Learners are able to identify three behaviors or reactions that they would like to observe based on some examples - Learners are able to keep track of their behaviors over a week - Learners are able to identify five patterns of behavior during the week. - Learners brainstorm three concrete and actionable ideas to improve their habits - |

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| | - Learners design a creative poster to remind themselves about their ideas to break their negative patterns of behavior. |
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| Inspiration: | <ul style="list-style-type: none">• Arvind Ranganathan• Patterns Book• https://artplusmarketing.com/using-patterns-to-make-sense-of-your-world-d8034650bd98• https://www.mathnasium.com/examples-of-the-golden-ratio-in-nature |
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