Vectors with Geogebra	Season	01
	Episode	13
	Time frame	1 period

Objectives :
- Discover the concepts of translation and vectors.

Materials :
- *Task sheet*

1 – Computer activity

Whole period

Students are working alone on a computer. They have to complete some tasks using GeoGebra, to introduce the concepts of translation and vectors.

Vectors with Geogebra	Season	01
	Episode	13
	Document	Task sheet

In this session, you will work with GeoGebra on two new concepts, *translation* and *vector*. All answers can be written on this paper.
First, open Geogebra and translate it into English. Then, in the View Menu, put the Axes off and the Grid on. We will not use coordinates in this activity.

Task #1

1. Place 5 points A, B, C, D, E, so that no three of them are collinear.
2. (a) Build the midpoint I of segment BC.
   (b) Use the "Reflect Object in Point" to draw the point C' such that I is also the midpoint of AC'.
   (c) What can you say about the quadrilateral $ABC'C$? Prove it.

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3. (a) Build the midpoint J of segment BD.
   (b) Build the point D' such that J is also the midpoint of AD'.
   (c) What can you say about the quadrilateral $ABD'D$?

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4. (a) Build the midpoint K of segment BE.
   (b) Build the point E' such that K is also the midpoint of AE'.
   (c) What can you say about the quadrilateral $ABE'E$?

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5. (a) In the "Line through Two Points" menu, choose the tool "Vector between Two Points". Use it to draw the vectors $\overrightarrow{AB}$, $\overrightarrow{CC'}$, $\overrightarrow{DD'}$ and $\overrightarrow{EE'}$.
   (b) What can you say about these vectors?

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6. Use the mouse to move the point C.
   (a) What do you notice about points I and C' when you do so?

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   (b) What do you notice about vector $\overrightarrow{CC'}$?

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In this situation, we say that the points C', D' and E' are the images of C, D and E under the translation of vector $\overrightarrow{AB}$.

Call the teacher to check the answers before proceeding to task #2.

Task #2

Open a new Geogebra document, with the axes off and the grid on.

1. Place two points A and B, not on the same horizontal line but not too far apart, and draw the vector $\overrightarrow{AB}$.
2. (a) Draw a triangle CDE with area 6.
   (b) Use the method introduced in task #1 to draw the images C', D', E' of C, D, E under the translation of vector $\overrightarrow{AB}$.
   (c) Draw the triangle $C'D'E'$.
   (d) What can you say about the triangles CDE and $C'D'E'$? What is the area of $C'D'E'$?

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3. (a) Draw a square $FGHI$ with side 3.
   (b) Use the tool "Translate Object by Vector" to draw the images F', G', H', I' of F, G, H, I under the translation of vector $\overrightarrow{AB}$.
   (c) Draw the quadrilateral $F'G'H'I'$.
   (d) What can you say about the quadrilateral $F'G'H'I'$.

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4. Use the mouse to move the point B. What's going on when you do so ?

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Call the teacher to check the answers before proceeding to task #3.

Task #3

Open a new Geogebra document, with the axes *and* the grid off.

1. Place three non-collinear points A, B, C, then draw the vectors $\overrightarrow{AB}$ and $\overrightarrow{BC}$.
2. Draw a regular pentagon P away from A, B and C.
3. Use the "Translate Object by Vector" to draw with just two clicks the image P' of the pentagon P under the translation of vector $\overrightarrow{AB}$.
4. Use the same method to draw the the image P'' of the pentagon P' under the translation of vector $\overrightarrow{BC}$.
5. What transformation maps P to P'' ? Check your answer by applying this transformation.

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Call the teacher to check the answer.

Vectors with Geogebra	Season	01
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	Document	Correction sheet

In this session, you will work with GeoGebra on two new concepts, *translation* and *vector*. All answers can be written on this paper.
First, open Geogebra and translate it into English. Then, in the View Menu, put the Axes off and the Grid on. We will not use coordinates in this activity.

Task #1

1. Place 5 points A, B, C, D, E, so that no three of them are collinear.
2. (a) Build the midpoint I of segment BC.
   (b) Use the "Reflect Object in Point" to draw the point C' such that I is also the midpoint of AC'.
   (c) What can you say about the quadrilateral $ABC'C$? Prove it.
   $ABCC'$ is a parallelogram because its diagonals have the same midpoint.
3. (a) Build the midpoint J of segment BD.
   (b) Build the point D' such that J is also the midpoint of AD'.
   (c) What can you say about the quadrilateral $ABD'D$?
   $ABDD'$ is a parallelogram too for the same reason.
4. (a) Build the midpoint K of segment BE.
   (b) Build the point E' such that K is also the midpoint of AE'.
   (c) What can you say about the quadrilateral $ABE'E$?
   $ABEE'$ is a parallelogram too for the same reason.
5. (a) In the "Line through Two Points" menu, choose the tool "Vector between Two Points". Use it to draw the vectors $\overrightarrow{AB}$, $\overrightarrow{CC'}$, $\overrightarrow{DD'}$ and $\overrightarrow{EE'}$.
   (b) What can you say about these vectors ?
   They are equal because all of them have the same length and the same direction than $\overrightarrow{AB}$.
6. Use the mouse to move the point C.
   (a) What do you notice about points I and C' when you do so ?
   They move.
   (b) What do you notice about vector $\overrightarrow{CC'}$?
   It move but don't change.

In this situation, we say that the points C', D' and E' are the images of C, D and E under the translation of vector $\overrightarrow{AB}$.

Call the teacher to check the answers before proceeding to task #2.

Task #2

Open a new Geogebra document, with the axes off and the grid on.

1. Place two points A and B, not on the same horizontal line but not too far apart, and draw the vector $\overrightarrow{AB}$.
2. (a) Draw a triangle CDE with area 6.
   (b) Use the method introduced in task #1 to draw the images C', D', E' of C, D, E under the translation of vector $\overrightarrow{AB}$.
   (c) Draw the triangle $C'D'E'$.
   (d) What can you say about the triangles CDE and $C'D'E'$? What is the area of $C'D'E'$?
   $\triangle CDE$ and $\triangle C'D'E'$ have the same shape and the same area.
3. (a) Draw a square $FGHI$ with side 3.
   (b) Use the tool "Translate Object by Vector" to draw the images F', G', H', I' of F, G, H, I under the translation of vector $\overrightarrow{AB}$.
   (c) Draw the quadrilateral $F'G'H'I'$.
   (d) What can you say about the quadrilateral $F'G'H'I'$.
   The quadrilateral $F'G'H'I'$ is also a square with side 3.
4. Use the mouse to move the point B. What's going on when you do so ?
   The vector $\overrightarrow{AB}$ change so the square $F'G'H'I'$ move according to the move of B.

Call the teacher to check the answers before proceeding to task #3.

Task #3

Open a new Geogebra document, with the axes *and* the grid off.

1. Place three non-collinear points A, B, C, then draw the vectors $\overrightarrow{AB}$ and $\overrightarrow{BC}$.
2. Draw a regular pentagon P away from A, B and C.
3. Use the "Translate Object by Vector" to draw with just two clicks the image P' of the pentagon P under the translation of vector $\overrightarrow{AB}$.
4. Use the same method to draw the the image P'' of the pentagon P' under the translation of vector $\overrightarrow{BC}$.
5. What transformation maps P to P'' ? Check your answer by applying this transformation.
   P'' is the image of P under the translation of vector $\overrightarrow{BC}$.

Call the teacher to check the answer.