Teaching Mathematics with Technology (TMT)

Video - Constructing a text box and using the input bar

Opening Webcam

Hello and welcome to the second week of the ***Teaching Mathematics with Technology*** course. In this video, we will get introduced to adding text boxes and creating variables and objects through the input bar in Geogebra. I will open the Geogebra Classic application Version-5 on my Ubuntu Linux System. You can open the same version on Windows or Mac system or access Geogebra online at https://www.geogebra.org/classic

Geogebra construction

In this video we will learn how to *construct a text box* and also the *use of the input bar.* We will construct a triangle like the one you are seeing on the screen in front of you. We will measure the three angles of this triangle and we will demonstrate that the sum of the measures of the angles of a triangle are always equal to 180^0.

Let me open a new Geogebra window. So to construct a triangle, we already know that we need three points. So I'm going to go to the *point tool box* select *point.* The tooltip says that I need to *select position or line function or curve.* So I'm going to select three positions on the screen, which will be the three vertices of the triangle that I'm going to construct. I then need to construct segments which will join these points. The segment tooltip says select two points at a time which is what I'll do to construct the three segments. I'll also label the objects that are already constructed. So I'll label the vertices namely A,B and C.

Now, to demonstrate the sum of measures of angles property, I need to define the angles of the object as well. So I'm going to the *angle toolbox* select *angle.* For angle I need to select 3 points at a time- *A,C and B to define angle ACB,* then B, A and C to define *angle BAC* and C, B and A to define *angle CBA*. I am also going to label these angles with the name and value; right now only the value is seen. So I'm going to show the name and value, for all the three angles. So we have $\gamma=48.2^0$, $\alpha=¿46.21^0$ ($\beta=¿85.59^0$). So I have defined three angles in the object.

Now it is important to note that, for Geogebra it is still not a triangle. We have three segments, we have three angles and three vertices. But to define this as a triangle or polygon, we need to go to the *polygon toolbox,* select the *polygon tool,* which says select all vertices,then first vertex again. So, I'm to select *BAC* and then back to B again. Now that the polygon is defined, you can see that the polygon has an existence by itself. I can change the colour of the polygon and other properties of the polygon, I can change the thickness as well. So these are the properties of the polygon that I can alter.

Now I want to explain that the sum of the measures of angles is 180^0. So, to put this information on the Geogebra file, I will use the *text box function* of Geogebra. The *text box* is available in the third tool box on the right. I'll click on this *ABC Text tool* which says select position or existing point. So, I can select any part of the Geogebra screen and start typing. I will say that the sum of measures of angles of a triangle (here I have got *triangle ABC* so I would like to use a symbol- triangle. So in this *text box* you can see that I have something called *symbols* which will give me a whole list of symbols that I can use in the *textbox*. So the basic option, there are several options but the basic option has got the most useful symbols that I'll use in Geogebra. So I have the *triangle symbol* here) ΔABC, sum of angle (again I will go to symbols and I will pick up the *angle symbol*) $\measuredangle ACB$ + (I can copy the angle symbol in the textbox) $\measuredangle CBA + \measuredangle BAC =$ (now I want to actually pick up the objects that are defined in Geogebra; and the objects that I will pick up are α, β, γ. So here I need to go to the *objects option* in the *textbox.* We earlier used the symbols option for picking up symbols. I will go to objects which will show me the list of all the objects defined so far in the Geogebra sketch. I have got α, β, γ here so I'm going to say) $\alpha+\beta+\gamma$. Now you can see that, I can also expand the text box by going to the bottom right and when the arrow comes I can increase it so you can see that in the text box above I have entered α, β, γ but in the preview below Geogebra substitutes these objects with the actual values, and that is equal to 180. I need the degree symbol so I go to *symbols basic* and here is the *degree symbol* which I'll insert into my *textbox.* Now when I say *OK*, I have got the *textbox* in which I have defined the property of the sum of measures of angles of a triangle and I have said that it is 180^0 .

Now the important thing to notice, I have typed 180 as a number and that's a static number; but supposing I wanted to compute the number actually by adding these three values, then I would need to use the *input bar.* You can see the *input bar* at the

bottom of the Geogebra screen so there I will go and create a variable - *Sum of Angles* = (and here I will have to say it is $\alpha+\beta+\gamma$. These symbols are available when I click on the α sign at the bottom right of the *input bar*.) so I have got $\alpha+\beta+\gamma$. I have defined the sum of angles in the input bar but I cannot see it in the graphic screen. I need to see it on the algebra screen. So I'll have to say *view algebra* and when I have the algebra screen visible for me I can see it in the top sum of angles equal to 180^0. If I move the mouse over, it will give me the formula also for it- angle sum of measures equal to $\alpha+\beta+\gamma$. So I need to now go back to my *textbox* and replace the 180^0 that I typed in manually, with the object *Sum of Angles* which is already available on the screen. And if I say *OK,* then I've got a computed value for the sum of angles. In geogebra if I now move the *point A* we can see that the value of the three angles changes, but the property that the sum of the measures will always be 180^0 still holds true. So in this way we have been able to use a *textbox* to show the properties of the sum of measures of angles in a triangle is 180^0 .

We have been able to show that in this Geogebra sketch the *textbox* can therefore be used in different ways to provide information in the Geogebra sketch itself, and that will enable the explanation of these sketches in the classroom. We have used the input bar so far to create a variable. But the input bar has at least two more uses which I will now show you.

The second use of the input bar is actually to create objects on the screen directly without using the *tool box*. So let me close the algebra view. Let me use a graphics view to move this construction to the side so that I have more space. So here I can go to the *input bar* and I can say *plot circle.* And when I say *Circle,* I have got various options that automatically pop up one of them is *point and radius number,* in which I can give a centre point of the circle and specify the radius of the circle. So I am going to define *point C* as a *centre of the circle* and give the *radius* as *6.*You can see that as soon as I hit enter the circle with *centre C* and *radius 6* is created. In this way I can create different objects in Geogebra.

Now let's say I want to construct a point on the circle, so for that I need to see the name of the circle in the subject which I cannot see in the graphic perspective. So if I do the *view algebra* perspective I can see that the circle has been given the name *D.* So I can go to the *input bar* and say point and it has the option object; so I can say *point D.* Now you can see that on the circle a *point D* has been defined, which is a

point on the object. To construct *radius CD* I can say *segment {C,D}.* So radius is defined.

So in this way, we can actually create objects on the graphic perspective directly through the *input bar.* You can try out different objects using the *input bar* by yourself.

A third option that is available in the *input bar* is to define algebraic functions. So let me again move using the graphics view, to move out the objects that I have created so that I have a slightly empty screen. So if I were to type $y = x$ which is an equation of a straight line, I can see that geogebra has created a line on the screen. If I were to say $y = 0.5 x$, it will create another line with a slope different from the first line that I have created. So I can directly create algebraic functions using the *input bar.* I can do $y = x^2$, that's the *parabola*. (I will type the exponent sign by doing shift +6 and I have got a parabola now.)

I will just move the graphics view so that we can see the objects that are constructed . So here we are using an *input bar* for the purposes of creating objects on the screen on the graphics view- we created a circle, we created a point in the circle and we also constructed a segment which is the radius of the circle. In addition we also constructed a segment which is the radius of the circle. In addition we also constructed algebraic functions $y = x$, $y = 0.5x$, $y = x^2$.

We can also use the *input bar* to also define the algebraic functions. So I can go to the *input bar* and type $y = x$. We know that this is the equation of a line. Let me move the graphic view so that we can see the line clearly. Now $y = x$ is a line which will bisect the first and third quadrant in coordinate geometry. The graphic view has the coordinate available for viewing. For that I need to click on the sheet and you can see that the style bar now allows me to define additional options. So the first one is the *axis*, we can see the *x and y axis* are now visible. I can also click on the *grid* so now the entire grid is visible. And we can see that the line $y = x$, is actually bisecting quadrant 1 and quadrant 3. I can also create another line $y = 0.5x$, and we can see that it creates another line with the different slope from the first line that I have created. I can also type in $y = x^2$, we know that this will give us a parabola. So if I don't want to see the graph sheet again I can just *uncheck* the two options and I can hide the axis and grid. But the axis and grid are very useful for teaching coordinate geometry.

So what did we learn in this lecture ?

In this video we learnt how we can create *a textbox*. This *textbox* can be used to describe the construction that we have made. The textbox can refer to objects in the construction; so we referred to the angles α, β, γ We can also refer to static values as well as dynamic values from the construction. In addition we also learnt the use of input bar for computing derived values or variables. In our case it was the sum of the angles of the triangle. We can also use an input bar to define the objects in the graphic view, we can also define algebraic functions.

Closing Webcam

In this video, we explored how to create *a textbox* and how to use it to enrich the Geogebra construction that we made . We also learnt how to use the input bar for creating derived variables or constructing objects in a Geogebra screen. Thank you so much. Please practice these constructions in your own Geogebra.
Thank you.