

Teaching Mathematics with Technology (TMT)

Video Creating a sequence - use of checkboxes

Opening webcam

Hello and welcome back to our video explorations of Geogebra. You have so far seen how to create objects, label them, format them, describe the construction using a *textbox*, or use the *input bar* for calculating variables. We have also seen how to use *sliders* and *input boxes* for changing the parameters of a given construction.

In this video, we will be looking at the use of a *check box* which will allow you to display or hide an object that has been used in the Geogebra construction. This is a very powerful tool for lesson planning and allows the teacher to pause the file that has been constructed at a particular step in the construction, and allow for explorations and conversations around the concept.

Geogebra construction

We will now look at the creation of *checkboxes* using this file that we have already created of a triangle with two given sides and an included angle. When I click on this checkbox called *Show side1*, you will notice that the *slider* appears, as well as the *segment AB* and *the points* which define the segment AB. When I click on *Show Base angle1*, the ray that defines the angle at *vertex A* appears along with the slider. When I click on the *checkbox Show side2*, the circle that determines the second side appears, including the point of intersection with the ray. And when I say *Show triangle*, the entire triangle appears.

To see how this works we will look at the *algebra view*. In the algebra view you will notice that there are new variables here that have been defined called *a*, *b*, *d*, *e*, and so on. And these are all having a value *true*, so these are *Boolean variables* which have been created when we created a *checkbox*. As the name suggests the Boolean variable can take a value of *true* or *false* depending on whether the checkbox is checked or not. When the checkbox is *checked*, the Boolean variable takes a value *true*, when it is left *unchecked* the Boolean variable takes a value *false*. When we create a checkbox to determine the display of objects in the construction, what we are doing is linking the display of the objects to the Boolean variable being true. We will now be looking at how to create a *checkbox* to direct the flow of a lesson through the display of the construction of objects.

This is the file that we were looking at; now we want to display the *side1*, the *angle*, and the *side2*, based on the inputs that we give for the display. So for that, I go here and select an option here called the *checkbox*, and I will say *Show side1*. It's a good idea to keep the *Algebra view* open

when we work with checkboxes because it is easy for us to see the construction of objects in the *Algebra view*, where we want to include them and link them to the *checkbox*. So we want to be displaying the slider, the first slider- *number side 1*, the *point A* and the *point B* and the segment that defines - *segment AB*. So the segment that defines *segment AB* is this, it is *f*, which is *segment f - A, B*. So you select the segment from here, so that is our first *checkbox*. Like in all other objects that we constructed, this also can be moved around on the screen.

Now we want to display the angle and the ray that defines the angle. For that we create another *checkbox* we call it- *Show Base angle* and select the *slider* which defines the base angle. Select the angle itself, and select the ray that is actually marked the angle *ray g*, then say *Apply*. I am trying to move the checkbox here. Now we noticed that when I *uncheck* the *base angle*, the ray and the angle do not appear. When I *uncheck* the *side1*, the points *A* and *B* do not appear and you will notice that the segment here has also become *unfilled*, that means it is not appearing; however we are seeing the triangle because the polygon was constructed on the top of three segments and the polygon continues to be displayed. But notice that the points *A, B*, and the segment no longer appear. The slider doesn't appear as well. Now if I *uncheck* this, the slider for the base angle disappears as well as the ray and the angle. We will now do the same, one for each one of the objects that we have constructed.

Now we will look at creating a *checkbox* for the second side. I will call it *Show side2* and we will choose the slider for *side2*, the circle that is used to mark out the second side, then the point of intersection as you can see here *point C = {6,2}*. Now you will notice that the circle appears and the intersection point appears. Now we also want this polygon to be linked to a *checkbox*, so I will create one more and say *Show triangle*, and we go here and select the objects that define the polygon. We have already seen that the polygon is a distinct entity and the segments are distinct entities in Geogebra.

We have so far chosen only to show the segment that we have constructed. Now we want to *hide* the polygon also or *display* the polygon also based on the inputs received. So now we will link the polygon objects. We will notice that the triangle disappears. However, we still have one segment that is still visible, that means we have not yet linked it to any checkbox, logically, that needs to be linked to the last checkbox called *Show triangle*.

Now let me show you one another way of linking objects to an already created Boolean variable. Now we have forgotten, let us say, how to link the last side to a *checkbox*, and we want to add it to a checkbox. We have so far seen, how we add objects when we were defining the *checkbox* itself but now I will show you how you can go to the *Algebra view* and add an object as well. So now, we know that this is the object that we want to add, which is *segment h*, which defines the third side of the triangle- namely *CB*. And we want to link it to the *checkbox* called *Show triangle*, which is

Boolean value - e . So, we go here and look at the third segment which is *segment h*, and right-click it, you see the object properties, and under the *Advanced* tab, under the *condition to show object*, you enter, $e = \text{true}$. So, now e is *not true*, the triangle, *Show triangle checkbox* is not checked. So, therefore, the third side doesn't appear. We don't show this as well and the circle also disappears.

So essentially, your entire construction is not visible. We also want to decide when to display the perimeter of the triangle, and we will actually create another *checkbox* called *Show perimeter* and link it to a *text*. So, not only can construction objects be linked to the *checkbox*, you can also add *descriptive text boxes* linked to a *checkbox*. So we will look at the checkbox here, which is saying *Textt1* which is the perimeter, and I will link it to this. So this is, *Show perimeter* and if I uncheck this, it does not appear anymore.

So now, let us look at the construction one more time - *Show side1*, the slider, and the segment, *Show the base angle*, *Show the side2*, *Show the triangle*, and *Show the perimeter*.

Ending Slide

To summarise, the *checkbox* is a feature by which you can *show* or *hide* objects in a Geogebra construction. It is very useful when you would like to direct the flow of a lesson by stopping and pausing, and asking questions around the constructions, or allowing students to explore how the construction should proceed from a particular point on. Every object in a construction that we make can be linked to a checkbox.

Closing webcam

This brings us to the conclusion of this video on the creation of checkboxes. Do check out the activities listed under week 3 and make sure you practice the Geogebra features that we have introduced so far in the course. Look forward to seeing you in week 4.