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Video script: Encouraging Young Gender Minorities to Pursue Computer Programming and STEM

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Link: Coding in the Real World

About

The link above is for a short documentary-style video aimed toward your teen girls and non-binary students, to encourage more engagement within STEM, focusing on computer programming. Below is the transcript for the video, as well as acknowledgments and citations.

PSCL
UNIVERSITY OF ALBERTA
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WISEST
women in scholarship, engineering, science & technology

Video Transcript

Hi! I'm Sydney, a grade 12 student who was accepted into the WISEST SRP at the University of Alberta. Today I'll be taking about 15 minutes out of your time to talk about computer programming, which is much more exciting than one might think.

When you think about someone coding or computer programming you probably think of something from the Matrix, or a hacker in their basement, or some people in a government facility, but that's not really what coding looks like in reality. This is more akin to what I've experienced.

Sydney: Well, Krishna, how long have we spent on this program today?
Krishna: A solid hour
Sydney: A solid hour? And what was the problem? What was breaking it?
Krishna: Parentheses.
Sydney: Parenthesis? I'm going to cry

The media has not only skewed our perception of what a programmer is, and what they look like, but also what code is in it of itself. In movies like the Matrix you see binary numbers flying across the screen, all in green. However, that's not what it (coding) looks like today. Programming has evolved, just like any other field of STEM it changes over time, and each of these changes is called a language. Languages can serve different functions, as well as, be evolutions of what came before them. Some of the most common (computer) languages are: C, C++, Java, JavaScript, HTML, and Python, which is what I know most about! Not only that, code is literally everywhere in our world from these lovely lights that turn on at night time, to the cars that we see around us, to even the lamp posts and the stoplights.

The entire reason why I'm learning to code is because I was accepted into the WISEST Summer Research program at the U of A, but what is WISEST? and why do they want me to learn how to code? Well WISEST stands for: Women in Scholarship, Engineering,

Science, and Technology and the organization's entire purpose is to push women and non-binary people into STEM fields, because currently, STEM is very much overtaken by men, so WISEST is trying to push for more diversity in the STEM fields as a whole. Now, the summer research program is kind of a division of WISEST, and it's for students between the grades of 11 and 12, where over the summer if our accepted you are able to take part in mentor sessions, PD (professional development), networking sessions, and obviously working in a lab doing research. These lab placements can look like anything from paleontology, to biomedical, to what I'm doing which is electrical and computer engineering.

After Krishna and I learned the basics of how to use Python, the next thing we were tasked to do was create a calculator. This calculator would do a few specific things that I'll get into later. However the way it worked basically was that It would store a whole bunch of physics formulas, and then all the user would have to do is enter the units that they have, the formula that they want to use, and the units they want in the end. And then the calculator would do all that stuff for you and spit out your answer. This is super-duper useful because this code or calculator doesn't really exist already, at least not super openly to lots of people. So, Dr. Jason Myatt wanted us to create something that his grad students could use in the fall to help with their calculations, instead of having to pour over this booklet that has all of the physics formulas in it. Instead, it would be in a handy dandy little calculator.

This is a prototype of our calculator. It is not fully functioning yet because it IS a prototype, and we are still going through trial and error to make it as efficient and effective as possible because there is a lot of stuff we have to add on. First, you enter in the formula you want to use, and then your value that you are inputting, and your current units. Then what's going to happen is it takes your input units and it converts it into microns which are the units needed for the formula which is highlighted right now. And then you choose your output, which I believe I chose rad/min and then it calculates it for you. I don't believe that this is quite correct yet, however at least it's giving an output and not an error message *note that we did get this working* The Import at the

top is “numpy”, and this essentially gives you some math functions like pi (or √)- I did not write this. And then next is the class and the plasma class holds a bunch of things called methods. Each method starts with “def” or the definition key and these just hold all of our formulas that we are going to need to figure out how to solve any of our plasma questions. And they go on for quite a little while. And next we have our units class and there are several different classes that all involve units but all of them take from this parent class, and these classes hold all of the information needed to swap between units no matter what they are, if their length, if their time. We don’t have density yet, but that will be added on in the future. Next you can see something that says “go = true, while go:'' and while that sounds complicated it just tells the program to do the stuff underneath it as long as go = true. This section is what asks for the input and the output. This is called a dictionary it refers back to the methods (classes) above and makes stuff *calculations* happen. And then the “if” statements that are here decide how and when to change your units that you input, and what you want when you are done. And that's really it, that's pretty much how the program works. It's rather simple once you kinda know what to look for but it does look a little intimidating.

As someone who is completely self-taught and has become semi-fluent in Python within a few weeks, I have a couple pieces of advice that I have learned through my WISEST experience. The first of which is that you have access to a vast internet full of everything you need to know. From Reddit threads to Stacks overflow, to even Youtube, there is so much free information that will always have an answer to your problem no matter what they look like for you. Further- Plan. Things. Out. whether that's a storyboard like your in your English Class, or just a scribbled list on a sticky note. The ability to concisely plan your programming is super duper useful, and will help you figure out what you don’t know, in order to access your resources to figure it out, without crying at your laptop when everything stops working.

Now you might be saying, “Cool, but why should I even care?” Well, coding is everywhere just like I said at the beginning of the video. It is something that's ingrained into our everyday life. In the past, many of my teachers have told me that if I pursue

STEM or coding or anything like that I could go into video games (development), which is super cool, but never really something that appealed to me or piqued my interest. However code, just like any other field of STEM has so many different outputs, you can do so many different things, like building a plasma calculator. So, you can really find your own niche and what you want to work on. Furthermore, all the skills you learn in programming whether that's resilience, or perseverance *or patience!!*, can be used and applied later on in your life. It's not something that just strictly applies to Python or C++, and it helps you to explore the world around you. So many different scientists use code to help with their investigations and research because it is able to emulate stuff we can't see in the real world.

So, if you're interested in programming, you might be a little stuck as to where to start, and I have three suggestions that helped me in Jr High, and in my journey to figure out how to make anything work with code. The first of which is Scratch. It was created by MIT students and it is a website that you can access online, and you use blocks of code, so it doesn't look like the crazy lines I showed you earlier, to create video games and jazz like that. I have made many a game on Scratch. It is super easy to learn to use. The second of which is Alice. It teaches you how to make little animations with code, so it sneakily slips in how to use code and you can apply it (what you learned) to many different languages once you figure out how to use it. Third is Code Combat, which is my favourite. You do have to pay for it after you finish the first-kinda-level section, but it is free in the beginning and it's a great way to learn the basics of code. And you are typing out just plain strings of code so it does look a little bit more similar to later IEDs that you will be using to create larger and more effective programs.

After you become experts of Scratch and Code Combat or Alice, there are several other ways you can continue to expand your programming knowledge. I found w3schools, Udemy- which isn't free, but a fantastic resource- and a million things on Youtube to be super-duper useful and really help me expand what I knew about coding. Because we all have access to the internet now, you can really go anywhere with your programming as soon as you understand the basics.

A fun fact about: we need more women and non-binary friends in STEM. Computer was initially a term for people who computed things like math problems. Some of the most famous computers were Mary Jackson, Kathrine Johnson, and Dorthy Voghagen, who all worked for NASA during the space race. And these women worked really hard to get our astronauts up into space. After the 60s moving into the 70s, computers became actual devices that would take up entire rooms until what we know as a phone now. As that began to happen more and more men joined the (computing) workforce and eventually pushed women out. So, we need to bring back more diversity into this field and get more women and girls interested in code.

Just to recap! We have now debunked the idea that code is something that's exclusive or only for certain people, when in reality it can be very approachable, you just have to access the resources available to you and take it slow. Go at your own pace, no one needs to rush you, it's not a competition. And once you know the basics you can build really cool stuff, from a simple video game to a plasma calculator. Remember you are able to code, no matter what anyone else says- you just have to take a little bit of time as I said before. Coding is all about problem-solving and resilience so as long as you have those two traits, you will really be able to do anything. Just access your resources and take a deep breath and try again!

Basics Behind the Applications of the Plasma Calculator (seen at the end of the video)

Dr. Jason Myatt's research is in Plasma Physics and creating energy with nuclear fusion. Dr. J. Myatt (personal communication, August 4, 2021) ran a mentoring session with Krishna Patel and me, and that is where the following information is from. Essentially fusion in these terms means that two nuclei that have small masses are fused together to create a more massive nucleus, by means of heat and pressure. This is a process that naturally happens in stars, and it creates energy. So, to make this process happen on earth scientists must create similar conditions to what is seen in a star, so plasma is used. Plasma is the fourth state of matter, and to create it (plasma) particles need to be heated and ionized, then these particles can fuse together and release energy and power. As of August 2021 this has not been replicated on earth, however, there has been significant progress made by scientists over the past couple of decades! The reason why many scientists are pushing to know more about nuclear fusion is: when the process of nuclear fusion takes place the harmful radiation produced is significantly less than the nuclear fission that our world is currently using. The plasma calculator that I took part in building will hopefully make solving for some for the values more efficient and easier.

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