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| About this Lesson |
| Students will gain an understanding of what cryptocurrency is and its use as an investment option. |

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| **Grade Level** | **Course(s)/subject(s)** | **Learning Goal(s)** | **Suggested**  **Timing** |
| 9-12 | **BBI1O/BBI2O** Introduction to Business  **MBF3C** Foundations for College Mathematics  **GWL3O** Designing Your Own Future  **GLS4O/GLE4O/GLE3O** Advanced Learning Strategies: Skills for Success After Secondary School | By the end of this lesson, students should understand common terms associated with Bitcoins and how Bitcoins work. Students should also understand and appreciate the risks and rewards associated with Bitcoins.  **Big Idea:** Before diving into cryptocurrencies, you need to understand how they work, the advantages and disadvantages they offer, and determine if they meet your goals and match with your investor profile. | 2nd of 3  75-minute periods |

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| Curriculum Links |
| Grades 9 and 10, Business Studies (2006) **Introduction to Business (BBI1O/BBI2O)  Finance**   * Demonstrate an understanding of effective investment practices * Gather and interpret information about investment alternatives (e.g., stocks, mutual funds,  real estate, GICs, savings accounts), and compare the alternatives by considering the risk and  the rate of return   Grades 11 and 12 Mathematics (2007) **Foundations for College Mathematics (MBF3C)  Personal Finance**   * Gather and interpret information about investment alternatives (e.g., stocks, mutual funds,  real estate, GICs, savings accounts), and compare the alternatives by considering the risk and  the rate of return |

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| Curriculum Links (cont’d.) |
| Grades 11 and 12 Guidance and Career Education (2006) **Designing Your Own Future (GWL30)  Personal Knowledge and Management Skills**   * Describe the range of individual differences in how people manage themselves in dealing with issues such as risk, stress, change, time, planning and personal finance in various settings (e.g., school, workplace, community)   Grades 11 and 12 Guidance and Career Education (2006)  **Advanced Learning Strategies: Skills for Success After Secondary School, (GLS4O/GLE4O/GLE3O) Planning for Transition**   * Demonstrate an understanding of the personal financial skills that will be required for the future (e.g., budgeting, banking, saving, borrowing money) |

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| Inquiry Question |
| Why is setting goals critical to understanding investment? |

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| Materials List |
| * **Appendix B: Bitcoin Terminology** * **Appendix C: Is it a good investment for you?** * Internet |

| **Timing**  (Mins.) | **Lesson Sequence** | **Assessment for and as Learning Opportunities** (self/peer/teacher) |
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| MINDS ON | | |
| 5 minutes | **Class: Discussion: Review**   * Answer any outstanding questions from  Exit Cards/Discussion Posts from Lesson 1   **Teacher Prompt:** One of the newer forms of investment is cryptocurrency or altcoins, best known of which is Bitcoins. How many of you have heard about Bitcoins? What do you know about them? How do they work? Are they a good investment? Do they work? Are they a good investment? | Assessment for Learning: Discussion |
| MINDS ON (cont’d.): | | |
|  | According to a recent study by the Bank of Canada (https://www.bankofcanada.ca/2017/12/staff-working-paper-2017-56/, most Canadians are aware of Bitcoins (85%), but only a small number (5%) own them. Most who have purchased them have done so for investment purposes (58%), while others have purchased, as a result of friends, interest in technology and for transactions. The least often cited reason in Canada appears to be for transactions.  “A wise investment strategy is never to invest in something you don’t understand” (Warren Buffett). So, before we can determine if this is a good investment or simply too big of  a risk, we need to understand some of the common terms associated with Bitcoins (and by extension any other cryptocurrencies and how they work).  (**Teacher Note:** If your class is unaware of who  Warren Buffett is, watch the following short video <https://www.youtube.com/watch?v=JfcgNPSGzKA>,  provide a short bio, or have students investigate and  report back the next day.) | Assessment of Learning: Discussion, Observation |
| ACTION: | | |
| 20 minutes | **Think-Pair Share: Terminology**  **Teacher Prompt:** We are going to focus on one type of cryptocurrency – Bitcoins – since it is most well-known and the standard of the cryptocurrencies.  (Optional: explore or name the other types.)  Distribute a hard copy or electronically post  **Appendix B: Bitcoin Terminology**.  Have the students individually complete the answer sheet and then compare answers with partner and share results.  Have results taken up as class discussion.  It is important that the terms are understood before moving on to the next topic.  **Class Discussion:** Teacher-led or distributed as handout (paper or digital).  (**Teacher Note:** Depending on class ability and interest,  you may wish to skip to the Putting it all together section of the lesson.) | Assessment for Learning: Peer Discussion  Assessment for Learning: Observation |

| **Timing**  (Mins.) | **Lesson Sequence** | **Assessment for and as Learning Opportunities** (self/peer/teacher) |
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| ACTION (cont’d.): | | |
| 30 – 40 minutes | **How do Bitcoins work?**  **Getting Started**  An often-used analogy to understand how cryptocurrencies work is to compare it to email. To send and receive email, you need an email address. Similarly, to send a receive Bitcoins, you need a unique Bitcoin address (public key). Just like your email address, anyone can see it and send information (Bitcoins) to it. To check your email, you would need an email client program and likewise to check your Bitcoins, you need a Bitcoin client (program). To access your email, you need your email address and password, and to access your Bitcoin client, you need your Bitcoin address (public key) and private key. Where you stored your private key and Bitcoin address is called a Bitcoin wallet.  (Keys are blocks of information that can used to make mathematical guarantees that verifies who is sending and receiving.)  **Step 1: Create a Bitcoin wallet**  Without a Bitcoin wallet, you can’t send or receive Bitcoin payments. So, before you get Bitcoins, you’ll need to buy, download or create a Bitcoin wallet.  A Bitcoin wallet is loosely the equivalent of a physical wallet on the Bitcoin network. The wallet contains your Bitcoin address (public key) and your private key(s) which allow you to spend the Bitcoins allocated to it in the blockchain. Each Bitcoin wallet can show you the total balance of all Bitcoins it controls and lets you pay a specific amount to a specific person, just like a real wallet.  Like emails, receiving Bitcoins requires a unique personal address. This unique address is called your Bitcoin address, and – just like your email address – you can share it with anyone who wants to send you Bitcoins.  (This is why it called your “public” key.)  The final ingredient that’s missing is your password. With email, you choose your own password, while with Bitcoin, the wallet chooses it randomly for you. This password is called your “private” key and – similar to your email password – it should never be shared with anyone. |  |
| ACTION (cont’d.): | | |
|  | The most important thing to remember about your private key is **whoever knows your private key has control over your Bitcoins**.  **Steps:**   1. Download a wallet program to your computer,  tablet or phone. 2. The program randomly creates a private key. 3. A Bitcoin address is created by a mathematical algorithm. (An algorithm is a method for solving a problem on your private key.) This is a one-way process as there is no way to figure out a private key by looking at the Bitcoin address.   A Bitcoin wallet or digital wallet is used to facilitate the sending and receiving of Bitcoins and gives ownership to the user. Unlike physical currency, your wallet does not actually contain Bitcoins, but the private key needed to access them.  There are many different types of wallets to choose from:   * Online Bitcoin wallets – wallets that can be accessed on the web from any Internet-connected device * Bitcoin hardware wallets – physical devices designed to secure Bitcoins * Software wallets – wallet applications downloaded to your phone, computer or tablet * Paper wallets – Bitcoin private keys printed from an  offline computer   What is right for you depends on where you access the information, how often you access the information and amount you intend to keep in your wallet.  **Tips for Securing Your Wallet**  Like a physical wallet, the more you keep, the more secure it needs to be.   * Keep your wallet, and any backups, in a safe place  (the more valuable, the more backups you should have) * Back up on a regular basis * Encrypt online backups * Use multiple secure locations |  |
| ACTION (cont’d.): | | |
|  | * Encrypt your wallet using encryption * Use a strong password that contains letters, numbers and symbols (do not include any personal information in your password and do not store this password anyplace where a hacker can find it * A paper copy is wise (if it can be properly secured),  as there is limited password recovery, should you forget your password * Keep your software up-to-date, including your antivirus software on your computer * Use a multiple signature feature to protect against theft * Never connect to Bitcoin services through public  Internet connections * Be cautious of emails and websites pretending to be sent from Bitcoin service providers   (**Teacher Note:** These wallet tips offer a valuable opportunity to reinforce broader safe computer/Internet etiquette with students.)  Share the following information with students: Since Bitcoins are considered a commodity in Canada and NOT currency, you are not protected by CDIC. You alone are responsible for your wallet. Forget or lose your private key and there is no way to access your money. If you are hacked or fall victim to a scam, there is no mechanism or place to go for compensation. For more about Canada Deposit Insurance Corporation (CDIC), please check out the following website: <http://www.cdic.ca/en/about-di/what-we-cover/Pages/default.aspx>  **Step 2: Obtain Bitcoins**  **a) Buying Bitcoins**   1. **Exchanges**   You can purchase Bitcoins with a credit card or with your linked bank account using a registered exchange. Like any currency exchange, there will be fees attached to doing this, so check out the costs before you purchase as transactions are NOT reversible (to maintain the integrity of the blockchain). |  |
| ACTION (cont’d.): | | |
|  | Choosing an exchange is hard work. Each exchange has different rules, accepted payment methods, and fees,  along with other factors to consider.   1. Does the exchange accept users from Canada? 2. What payment methods are accepted by the exchange (e.g., credit cards, PayPal). 3. What are the fees you will pay  (deposit, transaction, withdrawal)? 4. What is the exchange rate? 5. What is the buying limit (based on payment method and verification level)? 6. What is the reputation of the exchange?   Remember that Bitcoin transactions are irreversible, so make sure to trust your exchange, double check the address before hitting send, and wait for at least six confirmations. It’s up to you to do your research and choose the exchange that best works for you.   1. **Peer-to-Peer (2P2)**   In a **peer-to-peer**network, the “peers” are computers which are connected to each other through the Internet. Files can be shared directly between computers and they work without the need of a central server or exchange.  People can send Bitcoins to each other using mobile apps or computers. It’s like sending cash digitally or e-Transfers, and often done to avoid transaction fees. You could use this method to acquire Bitcoins from someone else in exchange for currency, goods or services.  Finally, you’ll want to wait for the Bitcoin transaction to have at least two to three confirmations before considering the deal complete. Of course, this depends on the amount of money you’re exchanging. Smaller amounts can do with only one confirmation.  **Note:** In Canada, if you receive payment in Bitcoin for goods or services provided, you must include the sale as part of your income for tax purposes and collect GST/HST on the fair market value of the transaction and remit to the government (<https://www.canada.ca/en/revenue-agency/news/newsroom/fact-sheets/fact-sheets-2013/what-you-should-know-about-digital-currency.html>). |  |
| ACTION (cont’d.): | | |
|  | **iii. Bitcoin Kiosk or ATM**  Companies offer a physical kiosk like an ATM machine to buy and sell Bitcoins which lets you enter cash for Bitcoins or sell Bitcoins for cash.  To use a Kiosk, identification is scanned into the ATM, and then the user selects the type of transaction they want and amount of Bitcoin currency they wish to buy. The user feeds in some cash and generates a QR code from their wallet. Then the ATM sends the Bitcoins to the presented address. (Most ATMs generate a paper wallet – or offline wallet.)  (**Teacher Note:** This video on using Bitcoin ATMs <https://www.youtube.com/watch?v=xajKjxxRL04> is a good example of buying and selling, but neglects to mention the transaction fees.)  Bitcoin ATMs tend to have much higher transaction costs than exchanges and there are no set rates for transaction fees for buying or selling. For many machines, the rates vary according to supply and demand, as well as the rate at which the company (who owns the machine) purchased them. (Similar to the extra fees for using an ATM that is not part of your bank’s network.) It is always prudent to check out the rate that the ATM is selling Bitcoins to you (or buying from you) compared to an exchange.  **Tip:** When using a Bitcoin ATM for the first time, it is advisable that you purchase or sell only the smallest amount to ensure that the transaction works with your software (wallet) and is verified.  (Remember, transactions can’t be reversed.)  **b) Earning or Mining**  Recall that a transaction is a transfer of value between Bitcoin wallets that get included in the blockchain. The blockchain is a shared public ledger (sometimes referred to as a distributed ledger) on which the entire Bitcoin network depends. All confirmed transactions are included in the blockchain. The integrity and the chronological order of the blockchain are enforced with cryptography. Bitcoin mining is the process of adding transaction records to Bitcoin’s public ledger of past transactions or blockchain through a secure, tamper-resistant consensus. Miners use special software and compete to solve math problems, |  |
| ACTION (cont’d.): | | |
|  | and are issued a certain number of Bitcoins in exchange for proof of work (proof of work is a method to ensure that the new block was difficult and both costly and time-consuming to create). Miners are paid any transaction fees as well as a ‘subsidy” of newly created Bitcoins.  “Bitcoin mining is the largely automated process (although it can be done by hand) of finding a particular hash value that “solves”" a block of transaction data, adding it to an ever-growing chain of blocks that is referred to, appropriately, as the blockchain. Mining secures this distributed ledger of transactions, but it isn’t cheap: The most successful miners operate warehouses full of specialized machines constantly crunching numbers. Solving a block releases some new Bitcoins to the miner as a reward for their work, making it a potentially lucrative venture, but what’s the environmental cost?”  Source:<https://motherboard.vice.com/en_us/article/ywbbpm/bitcoin-mining-electricity-consumption-ethereum-energy-climate-change>  The amount of electricity used is staggering, according  to an article by Digiconomist. The chart below shows  the cost:    <https://digiconomist.net/bitcoin-energy-consumption>  **Class Debate (Optional)**  You may wish to debate whether the benefits of this digital currency outweigh the environmental concerns.  Is mining profitable? Probably not due to the energy and equipment costs just to get started upon which it depends. |  |
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|  | Should you decide to move forward, here is a basic overview of the steps to follow:   * Get your miner (this is hardware required) – for more details, see <https://99bitcoins.com/best-bitcoin-miners-2016-hardware-reviews/> * Make sure you have a wallet * Join a mining pool * Get mining software * Start mining\*   \*The term “mining” borrows from commodities such as  gold and silver that are extracted or mined from the ground, which are slow to produce and require time and effort to obtain.  **c. Putting it all together**  Show one or both of these videos to students:   * <https://bit.ly/1UE8Oav> * <https://www.youtube.com/watch?time_continue=66&v=adDTkjffN1U>   **Is it a good investment for you?**  Earlier in the class, we learned that most people in Canada who hold Bitcoins do so for an investment, but is it a smart investment for you?  Those who promote Bitcoins as an investment often cite the following reasons:   * Investors have actual ownership of their investments * Volatility can lead to big profits for smart investors * Low supply helps to avoid inflation, offering a store  of value * It can never be confiscated from you if it’s privately stored * The most popular base currency which nearly all altcoins trade against   But before you determine whether this fits your investment style and personality, we need to understand some of the risks with Bitcoins or the cryptocurrency market. These are: |  |
| ACTION (cont’d.): | | |
|  | * **High Volatility** – Cryptocurrencies are prone to large swings in market value. This is not an investment you can buy and just forget about. To check out the market – [https://coinmarketcap.com](https://coinmarketcap.com/) * **Fewer Protections** – The system is decentralized so you don’t have the same access to help should you have a problem with your digital wallet or Bitcoin transactions. Since it is digital in nature, you must be vigilant in protecting your assets from scammers, and investors must be diligent to avoid phishing sites or malware which could result in their wallets being compromised. * **Regulations** – Currently there are few regulatory rules regarding these currencies and exchanges and those could change how Bitcoins are used and even if they exist. In Canada, you are required to report any capital gains or losses from buying or selling any cryptocurrencies, such as Bitcoins, on your income tax. * **It is a Non-Productive Asset or Intangible Asset** – “Bitcoin is a mathematical algorithm. It’s not something you can hold in your hand. Its value is based entirely on your trust in the math, the exchange and the willingness of the market to accept it.” (<https://bit.ly/2LTp5cy>)   Watch Warren Buffett discussing Bitcoins (<https://www.youtube.com/watch?v=LtITDtZPYEw>)   * **Prone to use for Illegal Activities** – The anonymity and lack of government oversight and control makes it attractive to those who engage in criminal activities. (<http://bit.ly/2MrkEFA>)   So, you know what it is, how it works, and some of the pros and cons associated with it as an investment opportunity, but is it a good investment for you?  **Individual: Appendix C**  Distribute a hard copy or provide access to a digital copy of **Appendix C: Is it a good investment for you?**  Ask each student to complete it and submit it prior to leaving class. |  |
| CONSOLIDATION/DEBRIEF: | | |
| 10 minutes | Review key learnings from the lesson.  This video helps to reinforce some key ideas: <https://www.youtube.com/watch?v=t5JGQXCTe3c>  Offer this closing thought: Warren Buffett said of Bitcoin: “You can’t value Bitcoin because it’s not a value-producing asset. Stay away from it. It’s a mirage – basically,  the idea that it has some huge intrinsic value is just a joke, in my view.”  So what props up the value of Bitcoin? Too many people are driven to purchase Bitcoins from “Fear of Missing Out” or FOMO and not basing it on whether they have done the research, or whether it matches their financial/investment goals or investment profile.  Review any questions regarding **Appendix C** .  (**Note:** Teachers may wish to view the FOMO lesson for additional information.) | Assessment as Learning: **Appendix C** |

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| Bitcoin Terminology |
| Define the following terms   |  |  | | --- | --- | | **Term** | **Definition** | | Address |  | | Block |  | | Blockchain |  | | BTC (and  current value) |  | | Cryptography |  | | Depositor Insurance |  | | Digital Currency |  | | Double Spend |  | | Fiat Currency |  | | Hash Rate |  | | Mining  (for Bitcoins) |  | | P2P |  | | Private Key |  | | Public Key |  | | Satoshi |  | | (Digital) Wallet |  | |

**APPENDIX B**

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| Bitcoin Terminology (Sample Answers) |
| Define the following terms   |  |  | | --- | --- | | **Term** | **Definition** | | Address | A Bitcoin address is similar to a physical address or an email. It is the only information you need to provide for someone to pay you with Bitcoin. | | Block | A block is a record in the blockchain that contains and confirms many waiting transactions. | | Blockchain | The blockchain is a public record of Bitcoin transactions in chronological order. The blockchain is shared between all Bitcoin users. It is used to verify the permanence of Bitcoin transactions and to prevent double spending. | | BTC (and  current value) | BTC is a common unit used to designate one Bitcoin. Rate will vary. | | Cryptography | Cryptography is the branch of mathematics that lets us create mathematical proofs that provide high levels of security. | | Depositor Insurance | CDIC insure eligible deposits at each member institution up to a maximum of $100,000 (principal and interest combined) per depositor per insured category. To be eligible for deposit insurance, deposits must be payable in Canada and in Canadian currency. GIC and term deposits are eligible deposits  insured for up to $100,000 within a TFSA. CDIC does not insure stocks, bonds or mutual funds or foreign currency deposits including US dollars. | | Digital Currency | Digital currency is a type of currency available only in digital form, not in physical. It exhibits  properties similar to physical currencies but allows for instantaneous transactions and borderless transfer-of-ownership. | | Double Spend | A user tries to spend their Bitcoins to two different recipients at the same time  (this is double spending). | | Fiat Currency | Fiat (Latin) money is currency that a government has declared to be legal tender, but it is not backed by a physical commodity. The value of fiat money is derived from the relationship between supply and demand rather than the value of the material from which the money is made. | | Hash Rate | The hash rate is the measuring unit of the processing power of the Bitcoin network. | | Mining  (for Bitcoins) | Bitcoin mining is the process of making computer hardware do mathematical calculations for the Bitcoin network to confirm transactions and increase security. As a reward for their services, Bitcoin miners can collect transaction fees for the transactions they confirm, along with newly created Bitcoins. | | P2P | Peer-to-peer refers to systems that work like an organized collective by allowing each individual to interact directly with the others. | | Private Key | A private key is a secret piece of data that proves your right to spend Bitcoins from a specific wallet through a cryptographic signature. | | Public Key | A public key is a cryptographic code that allows a user to receive cryptocurrencies into their account. The public key coupled with the private key are significant tools required to ensure the security of the crypto economy. | | Satoshi | The satoshi is currently the smallest unit of the Bitcoin currency recorded on the blockchain. It is a  one hundred millionth of a single Bitcoin and is named after Satoshi Nakamoto, the creator of the protocol used in blockchains and the Bitcoin cryptocurrency. | | (Digital) Wallet | A Bitcoin wallet is loosely the equivalent of a physical wallet on the Bitcoin network. The wallet actually contains your private key(s),  which allow you to spend the Bitcoins allocated to it in the blockchain. | |

**APPENDIX B**

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| Is it a good investment for you? |
| **Is it a good investment for you?**  1. Sum up what you think was the Big Idea of the lesson.  2. Does holding Bitcoins as an investment match your risk tolerance personality? Explain.  3. Would you personally buy Bitcoins?   * + - 1. If so, why would you buy them? How much would you buy?       2. If not, why would you not buy them?   4. Create three review questions based on this lesson: one True or False, one Multiple Choice, and one Short Answer or Fill-in-the-Blank.  (**Teacher Note:** Math teachers may wish to substitute math review questions instead.)   1. Answer either a) or b) 2. What did I find most interesting? 3. What am I still confused about? |

**APPENDIX C**