Advanced Excel-2019

Teaching Advanced Excel to Students in Grade 10-11

Xinying Hou | EGIA 2019 Fall
13th December 2019

Table of Contents

Teaching Advanced Excel

1 Project Focus and Learning Challenge

My project chooses the computer domain and focuses on Excel learning. I decided to do this as my topic partly because Excel is a handy tool when doing some necessary data-analytic work, which it's pretty useful. Also, advanced Excel teaching is challenging for both students and instructors.

For students, NAEP showed that for twelfth-grade students attending public schools, the average score of mathematics in 2015 was lower compared to 2013[1]. Decreasing math scores might reduce their motivation to learn technical-related and STEM skills[2]. But learning Excel can help them improve their math (especially high school algebra), logic-thinking and problem-solving skills. Also, many students don't have access to higher-level functions of Excel until finding a job, let alone accurately applying these formulas to problems in their life and work. This project aims at giving them the entry to advanced Excel learning in the earlier stage.

For teachers, prior research found that "some self-motivated learners can be fairly proficient in Excel after self-learning, but they may still lack a sense of how Excel can be applied to the real world."[3] Even if some schools have such courses, fewer teachers pay attention to apply the Excel skills to real-life situations[4], which is a target goal of the NAEP (TEL) assessment yet. They often use some out-of-date and abstract examples without thinking about high school students' life.

2.1 Grade Level

My students are national students in Grade 10-11 in a suburban American public high school.

---

[1] NEAP 2015: https://www.nationsreportcard.gov/reading_math_g12_2015/
[2] Simpson, A., & Maltese, A. (2017). "Failure Is a Major Component of Learning Anything": The Role of Failure in the Development of STEM Professionals. *Journal of Science Education and Technology, 26*(2), 223-237.
[3] Zhang, C. (2014). Incorporating powerful Excel tools into finance teaching. Journal of Financial Education, 87-113.
[4] NEAP 2018: https://nces.ed.gov/nationsreportcard/tel/

2.2 Central Knowledge, Skills, and Disposition Goals

Knowledge	Skills When given a data-related life problem, students should learn to	Disposition:
CK1. Students will know what is Excel formulas and functions. CK2.Students will know the definitions of most popular chart types: Column Chart, Line Chart, Bar Chart, Pie chart. (15.4.12.A) CK3.Students will know different kinds of basic Excel formulas. (15.4.12.A) CK4.Students will know what is a Pivot table and when to use it. (15.4.12.A) CK5.Students will know the impact of Excel on various career paths. (15.6.12.M.)	PS1. Students will be able to adjust worksheet layout and data: inserting, deleting and merging rows and columns based on their needs. (15.4.12.A) PS2. Students will be able to adjust row heights and column widths, borders, formatting based on their needs. (15.4.12.A) PS3. Students will be able to choose and use appropriate basic formulas: applying appropriate formulas and functions to extract the information they need. (15.4.12.A) PS4. Students will be able to use charts and graphs to visualize: choosing the suitable graphs, and then inserting, adjusting, improving, combining them. (15.4.12.A) PS5. Students will be able to use Pivot table to do some basic analysis: calculating tables and choosing suitable pivot charts. (15.4.12.A) PS6. Students will develop a plan and a procedure for solving the problem. (15.4.12.G) PS7. Students will be able to evaluate the impact of Excel on various career paths and provide	DS1. Students will think in a creative way. (15.4.12.A) DS2. Students will be able to measure whether they find an effective way when using Excel. (15.4.12.A) DS3. Students will have a confidence of finding a career path after this module. (15.4.12.M)

	examples of industry certifications within the field. (15.4.12.M.)	

2.3 Importance

Undoubtedly, Excel is widely used in our daily life. But I knew from my friends that Excel is only offered as an optional class in a small number of good schools. For students of grade 10-11, on the one hand, learning excel can help them review their previous math knowledge, logical thinking abilities, and enrich their skill packages. On the other hand, for those who cannot enter college, learning Excel at this grade level is beneficial for them to find jobs in the future.

What's more, for personal goals, being able to use Excel in an advance way can help students build well-organized plans as well. If you can clearly organize your life in excel such as managing your life schedule, recording your income and cost, etc.

This course should be taught in school and especially in THIS school because this school currently has low STEM performance and but I think learning life-related Excel will smoothly motivate their students to learn more about STEM things. Also, there are indeed a lot of online resources, but students are not able to find the optimal resources or lose their learning enthusiasm due to almost all the learning materials are designed for adults, which might include salary calculation or some content that far away from high school students' life.

2.4 Goals Matching and Motivation Tapping

I can maximize the continuity between my goals and learners' goals by:

1. Connecting the importance of advanced Excel skills with their academic and career life.

E.g., show their potential career path and working types if they are Excel experts. For example, students can identify what jobs need Excel such as Customer support, Data entry sImple project, Data entry clerk, Data entry project manager, Business Analyst and so on[5].

---

[5] Jobs Requiring Excel Skills: https://study.com/articles/jobs_requiring_excel_skills.html

2. Illustrating the importance of logical thinking ability in their growth.
E.g., Logical thinking ability is important, which will increase students' capability of being creative when they tend to make as many logical connections, across subjects, as possible. They can practice especially using Logical functions in Excel.

I can improve their motivation by:
1. Designing tasks to show them Excel formulas can help them save a lot of time.
E.g., using VLOOKUP is more efficient than finding manually. But how to choose between VLOOKUP and the combination of INDEX and MATCH?
2. Putting some real-world examples into my instruction part.
E.g., using Excel to build an automatic learning schedule form, a family tally book, etc.

Learners in Context

3.1 Community, Value and Learners

Penn Trafford High School

As you can see in Part1, I will teach high school students in grades 10-11 in a suburb American public school near a middle-level city (Pittsburgh). This school is an above average public school located in Harrison City, PA. It has 1,297 students in grades 9-12 with a student-teacher ratio of 15 to 1[6]. According to state test scores, 76% of students are at least proficient in math and 82% in reading. The rank of Best High Schools for STEM in Pennsylvania is 208 of 255, which means it's not a school good at STEM field.

It's a suitable place for students to learn and study, with an A in health & safety and good for families.[7]

3.1.1 Community values

Most students here value education and have the motivation to learn well.

The average graduation rate of this high school is 98%, the Average SAT is 1180 with 250 responses, and the AP Enrollment is 21%. Students here are willing to study and live positively.[8]

Also, based on some real polls, around 80% of students and parents agree that students at this school are competitive, and around 75% of students and parents agree that students at this school are creative and artsy. [9]

3.1.2 Norms

1. Appreciate other classmates' ideas[10]
2. WIlling to find ways to solve problems.[11]
3. Every student is special and should be respected[12]

3.1.3 Priority

1. Students have low-level STEM education now but want to learn more in this area.

---

[6] High School Teachers: https://www.niche.com/k12/penn-trafford-high-school-harrison-city-pa/
[7] High School Overview: https://www.niche.com/k12/penn-trafford-high-school-harrison-city-pa/
[8] High School Academics: https://www.niche.com/k12/penn-trafford-high-school-harrison-city-pa/
[9] High School Students: https://www.niche.com/k12/penn-trafford-high-school-harrison-city-pa/
[10] ECS middle school
[11] ECS middle school
[12] ECS middle school

As I mentioned before, the percent proficient in math in this high school is lower than reading. Also, the overall ranking of this school (best public high schools in Pennsylvania: 159/672) is much higher than its ranking of STEM education (208/255).[13]

2. Students want more engaging and organized lessons.

The survey of this school showed that only 63% of students and parents agree that the teachers give engaging lessons and only 57% of students and parents agree that the teachers adequately lead and control the classroom.[14]

3.2 Where I Will Teach

I will teach my students in Penn Trafford High School, a suburb American public school in PA. My subject area is in computer and information technology.

we can find that the criteria for Grade 9-12 from Academic Standards for Business, Computer and Information Technology of PA and my main target will be on 15.4.12.A.. 15.4.12.G., and 15.4.12.M..

15.4.12.A. Apply the creative and productive use of emerging technologies for educational and personal success.

15.4.12.G. Create an advanced digital project using sophisticated design and appropriate software/applications.

15.6.12.M. Evaluate the impact of emerging technologies on various career paths and provide examples of industry certifications within the field.

3.3 When I Will Teach

I will teach this module in the middle of the computer and information technology program in their grades.

As I showed in this graph, in the sequence of lessons about computer and information technology (this course structure comes from www.k12.com), my module will be under the course named Microsoft Office 2 and in the fourth part.

Before entering my module, students have already known some basic knowledge of computer and Excel.

---

[13] High School Report Card: https://www.niche.com/k12/penn-trafford-high-school-harrison-city-pa/
[14] High School Clubs & Activities: https://www.niche.com/k12/penn-trafford-high-school-harrison-city-pa/

Content Standards													
Programs	Science and Technology and Engineering	Environment and Ecology	Civics and Government	Economics	Geography	History	Arts and Humanities	Health, Safety and Physical Education	Family and Consumer Sciences	World language	Career Education and work	Driver's Education	Business, Computer and Information Technology

Courses

Computer Science *	Game Design 1*	Web Design*
Computer Fundamentals	Green Design and Technology*	Introduction to Computer
Computer Literacy*	Programming Logic and Design*	C++ Programming*
Microsoft Office 1	Microsoft Office 2	

The course list come from: www.k12.com

Units

Access 1	Access 2	Excel 1	Excel 2	Outlook 1	Outlook 2

The courses in the form above are offered in an online school, but I cannot find any real curriculums from the official school website of my targeted school[15].

3.4 How I Connect

The learning experience of this advanced Excel module can help students in both academic and non-academic way. This module will guide students to build their data analytical, planning and visualization capability, which will prepare them as a good presenter and problem-solver. After learning this module, students can do analytical tasks of different genres and show them in a clear way.

---

[15] Official website: https://pths.penntrafford.org/

On the one hand, Advanced Excel can be build fundamental ability to their future computer and economics courses such as business analysis, dashboard design(part of web design), programming logic and so on. Also, in a more general level, students will improve their logical and problem-solving ability when thinking about use formulas and organize the messy data. Expressing their results is also an effective training to improve their expression skills. These abilities can be transferred to all the other domains such as Arts, Science and so on.

On the other hand, it will help students increase their working efficiency in other situations. For example, they could use it in their school clubs including making their club schedules and calculating activity registration information, put it into their family by organizing their family cost, etc.

3.5 Learner Characteristics

Developmental Level	Age : more than 15 years old Learning predispositions: Learners in this age are willing to combine what they learned with their real life and want to solve problems. Processing capacity: Learners have processing capacity of that education level, which means they have the ability to judge the priority of information and extract them from messy data.[16] Metacognitive abilities: Their metacognitive abilities is enough to help them know what they are learning and check their steps regularly. [17] Physical development: They are able to use computer, type words, and have a basic knowledge of shape and math. Social development: They are comfortable with teamwork and project based learning.[18] Cognitive development: They have the patience to deal with puzzles and debug in their practice. They are able to follow the hints and continue doing until finish it.

---

[16] Beyond the Methods Fetish: Toward a Humanizing Pedagogy (Bartolomé, L., 1994)
[17] Big Idea: L2.1 Follow Natural Development Sequence
[18] https://web.tech4learning.com/project-based-learning-what-age-is-best

Prior Experience/ Knowledge	Pre-existing knowledge:
	Students have already been through the programs in the same context for their early childhood, elementary, and middle school years.
	Skills:
	They have used computers before and have learned some computer basic knowledge(both computer itself and Microsoft Office software).
	They already knew the basic functions of Excel.
	Dispositions related to the domain:
	Also they knew some basic knowledge, they are struggling with use it into everyday problems, they also don't know how to improve their working efficiency with Excel.
	Possible misconceptions:
	They might have the misconception that Excel is only a tool to build simple tables so they don't pay attention to other powerful functions such as Pivot table.
	Cultural and social norms:
	Some students have under average math skills and omit it because their school is not good at STEM education.
Individual Differences	Unique interests:
	Some students have interests in business and statistics. They have more learning motivations and more scenes to use Excel.
	Abilities:
	They are different in math, reading, writing,computer skills.[19]
	Disabilities: No
	Temperament:
	Some students are more patient and careful when working cells. But some are careless and lose attention soon. [20]
	Some students just want to finish the task on time but don't care about the quality.

[19] High School Academics: https://www.niche.com/k12/penn-trafford-high-school-harrison-city-pa/
[20] Guerin, D. W., Gottfried, A. W., Oliver, P. H., & Thomas, C. W. (1994). Temperament and school functioning during early adolescence. The Journal of Early Adolescence, 14(2), 200-225.

Target Explicit Goals

4.1 Goal Specification

4.1.1 Identify the appropriate standards

I will teach my students in Penn Trafford High School, a suburb American public school in PA so I use Pennsylvania Standards as my standards.

The criteria for Grade 9-12 from Academic Standards for Business, Computer and Information Technology[21] is here:

15.4.12.A. Apply the creative and productive use of emerging technologies for educational and personal success.

15.4.12.G. Create an advanced digital project using sophisticated design and appropriate software/applications.

15.6.12.M. Evaluate the impact of emerging technologies on various career paths and provide examples of industry certifications within the field.

I am targeting the 15.4.12.A.(Influence of Emerging Technologies), 15.4.12.G.(Software / Applications) and 15.6.12.M.(Emerging Technologies in Careers).

4.1.2 Goal Specification

Specify Module Goals to Self-defined Tasks:

Conceptual Knowledge:	Procedural Skills:	Dispositions:
CK1. Students will know what is Excel formulas and functions. CK2.Students will know the definitions of most popular chart types: Column Chart, Line Chart, Bar Chart, Pie chart. (15.4.12.A)	PS1. Students will be able to adjust worksheet layout and data: inserting, deleting and merging rows and columns based on their needs. (15.4.12.A) PS2. Students will be able to adjust row heights and	DS1. Students will think in a creative way. (15.4.12.A) DS2. Students will be able to measure whether they find an effective way when using Excel. (15.4.12.A) DS3. Students will have a confidence of finding a

---

[21] Pennsylvania Standards: http://exdev.pdesas.org/Standard/StandardsDownloads

CK3.Students will know different kinds of basic Excel formulas. (15.4.12.A) CK4.Students will know what is a Pivot table and when to use it. (15.4.12.A) CK5.Students will know the impact of Excel on various career paths. (15.6.12.M.)	column widths, borders, formatting based on their needs. (15.4.12.A) PS3. Students will be able to choose and use appropriate basic formulas: applying appropriate formulas and functions to extract the information they need. (15.4.12.A) PS4. Students will be able to use charts and graphs to visualize: choosing the suitable graphs, and then inserting, adjusting, improving, combining them. (15.4.12.A) PS5. Students will be able to use Pivot table to do some basic analysis: calculating tables and choosing suitable pivot charts. (15.4.12.A) PS6. Students will develop a plan and a procedure for solving the problem. (15.4.12.G) PS7. Students will be able to evaluate the impact of Excel on various career paths and provide examples of industry certifications within the field. (15.4.12.M.)	career path after this module. (15.4.12.M)
Meta-Level Conceptual	Meta-Level Procedural	Meta-Level Dispositions
M-C1. Students make judgements after choosing a function/formula, and	M-P1. Students will be able to know their process and check whether they use	M-D1. Students will be able to evaluate whether

make a reflection on whether they understand differences or are correctly discerning. M-C2. After choosing a way to achieve the result, students are able to judge it and make a reflection on whether they use it productively or not.	technologies in a creative and productive way. (15.4.12.A.) M-P2. Students will be able to evaluate whether they have enough Excel basis to find a new career path. (15.4.12.M.)	they try things in Excel in a creative way. (15.4.12.A.) M-D2. Students will be able to evaluate whether they have the confidence to put whey learned into practice. (15.4.12.M.)

4.2 Task Analysis

4.2.1 Conceptual Knowledge

CK1. Students will know what is Excel formulas and functions and why they need to use them.

- ❏ CK1.1 Definition of Excel formulas
- ● In Excel, a formula is an expression that operates on values in a range of cells or a cell. (From Microsoft Excel Document)
- ❏ CK1.2 Definition of Excel functions
- ● Functions are predefined formulas in Excel. They eliminate laborious manual entry of formulas while giving them human-friendly names. (From Microsoft Excel Document)
- ❏ CK1.3 Why use them
- ● Formulas can be used to perform many operations and tasks automatically.
- ● Formulas can be copied and pasted to different cells and even to different worksheets. So users don't have to recreate the same formula if they want to perform the same operations over several sets of data.

CK2.Students will know the definitions of most popular chart types: Column Chart, Line Chart, Bar Chart, Pie chart and when to use them.[22]

---

[22] Chart types: https://www.keynotesupport.com/excel-basics/excel-chart-types.shtml

Type	Image	Description	When to Use
Pie Chart		Displays the percentages of a whole for each member in a series.	Excellent chart for comparing values in a single series as percentages of a whole.
Column Chart		Using vertical columns, displays values for one or more series over time or other category.	Especially effective in comparing values for multiple series. The 3-D Column chart displays multiple series over three axes (X, Y, and Z).
Bar Chart		Displays values for one or more series using horizontal columns.	Though useful for single or multiple series, this chart type especially effective in comparing large quantity of values in a single series.
Line Chart		Displays values as equally spaced points connected with a line.	This chart is most useful displaying trends over time or other ordered category for single or multiple data series. © Keynote Support

CK3. Students will know the most popular Excel formulas.

❏ CK3.1 Data Cleaning (Numbers + Texts)
    ❏ CK3.1.1 Data Cleaning - Numbers
        ❏ CK3.1.1.1 Definitions [23]

- ABS: It returns the absolute value of a number. Negative numbers are converted to positive numbers, and positive numbers are unaffected.
- INT: It returns the integer part of a decimal number by rounding down to the integer.
- ROUND: It returns a number rounded to a given number of digits.

        ❏ CK3.1.1.2 When to use

- "Sometimes you want to make sure whether each column have their unique values, so you can use Exact to check it. When you want to absolute value from negative numbers, you can use ABS. When you want to gain an integer from a decimal number, you can use INT to round down it to an integer. When you only need to keep several number of digits, you can use ROUND function rounds a number to a specified number of digits."

    ❏ CK3.1.2 Data Cleaning - Text
        ❏ CK3.6.1 Definitions

- TRIM: Remove extra spaces
- LEN: Know the length of the value in a cell
- PROPER: Non-printable characters
- CLEAN: Fix the capitalization of words

---

[23] All definitions are from: https://exceljet.net/

- ❏ CK3.6.2 When to use
  - ● "When you want to know the length of the value in a cell, you are able to use LEN, TRIM is a useful tool to help you remove useless spaces and keep only a single space between words."

- ❏ CK3.2 Logical
  - ❏ CK3.2.1 Definitions
    - ● IFERROR: IFERROR returns a value you specify if a formula evaluates to an error; otherwise, it returns the result of the formula.
    - ● IF: IF function can perform a logical test and return one value for a TRUE result, and another for a FALSE result.
    - ● IFS: Runs multiple tests and returns a value corresponding to the first TRUE result.
    - ● AND: AND function is a logical function used to require more than one condition at the same time. AND returns either TRUE or FALSE.
    - ● OR: The OR function is a logical function to test multiple conditions at the same time. OR returns either TRUE or FALSE.
  - ❏ CK3.2.2 When to use
    - ● "Sometimes you want to check for an error in the formula, you can use IFERROR. When you want to make logical comparisons between a value and what you expect, you can use IF, and when you want to do multiple tests, you could choose IFS."

- ❏ CK3.3 COUNT
  - ❏ CK3.3.1 Definitions
    - ● COUNT: The count of values that are numbers, generally cells that contain numbers.
    - ● COUNTIF: It can be used to count cells with dates, numbers, and text that match specific criteria.
  - ❏ CK3.3.2 When to use
    - ● "When you want to count the number of cells that meet a criterion, you will choose COUNTIF but when only want to get the number of entries in a number field, you will choose COUNT."

- ❏ CK3.4 SUM
  - ❏ CK3.4.1 Definitions
    - ● SUM: It returns the sum of values supplied.
    - ● SUMIF: It returns the sum of cells that supplied criteria.
    - ● SUMIFS: It is a function to sum cells that meet multiple criteria.

❏ CK3.4.2 When to use

● "SUM means addition, when you want to do addition between numbers in several cells, you can use SUM. But we were able to subtract B1 by putting a minus sign in front of it. The SUMIFS and SUMIF supports logical operators in it."

❏ CK3.5 VLOOKUP

❏ CK3.5.1 Definitions

● VLOOKUP: It's a function to lookup and retrieve data from a specific column in table
● INDEX: It returns the value at a given position in a range or array.
● MATCH: MATCH is an Excel function used to locate the position of a lookup value in a row, column, or table.

❏ CK3.5.2 When to use

● "Use VLOOKUP when you need to find things in a table or a range by row. Also, combining MATCH and INDEX function is also a good way. The MATCH function searches for a specified item in a range of cells, and then returns the relative position of that item in the range. The INDEX function returns a value or the reference to a value from within a table or range."

❏ CK3.7 Date and Time functions

❏ CK3.7.1 Definitions

● DATE: It's a function to create a date with year, month, and day.
● DATEDIF: returns the difference between two date values in years, months, or days.
● WORKDAY: It takes a date and returns the nearest working day in the future or past, based on an offset value you provide.

❏ CK3.7.2 When to use

● "Whenever you want to get detailed information of a date or a time, use Date and Time functions."

CK4.Students will know what is a Pivot table and when to use it.[24]

❏ CK4.1 Pivot Table

● A PivotTable is a powerful tool to calculate, summarize, and analyze data that lets you see comparisons, patterns, and trends in your data. (From Microsoft Excel Document)

❏ CK4.2 When to use

---

[24] Office - Pivot Table:
https://support.office.com/en-us/article/create-a-pivottable-to-analyze-worksheet-data-a9a84538-bfe9-40a9-a8e9-f99134456576?wt.mc_id=otc_excel

- "Whenever you want to build good-looking reports for large data sets, you can build pivot tables with very little effort (and no formulas) and can look at the same data from many different perspectives. You can group data into categories, break down data into years and months, filter data to include or exclude categories, and even build charts."

CK5. Students will know the impact of Excel on various career paths.[25]

Students will know that certified Excel skills have been found to increase the likelihood of promotions and lift earnings, and quite a number of jobs require Excel.

4.2.2 Procedural Skills

PS1. Students will be able to adjust worksheet layout and data: inserting, deleting and merging rows and columns based on their needs.[26]

- ❏ PS1.1 Merge text in a cell
  The students can merge text in a cell by following these steps.
- Select two or more adjacent cells you want to merge.
  Important: Ensure that the data you want to retain is in the upper-left cell, and keep in mind that all data in the other merged cells will be deleted.
- On the Home tab, select Merge & Center.
- ❏ PS1.2 Wrap text in a cell
  The students can wrap text in a cell by following these steps.
- You can display multiple lines of text inside a cell by wrapping the text. Wrapping text in a cell does not affect other cells.
- Click the cell in which you want to wrap the text.
- On the Home tab, in the Alignment group, click Wrap Text.
- ❏ PS1.3 Change the format of a number
  The students can change the format of a number by following these steps.
- Click the cell that contains the numbers that you want to format.
- On the Home tab, in the Number group, click the arrow next to the Number Format box, and then click the format that you want.
- To select a number format from the list of available formats, click More Number Formats, and then click the format that you want to use in the Category list.

PS2. Students will be able to adjust row heights and column widths, borders based on their needs.[27]

---

[25] Career Path: https://www.goskills.com/Excel/Articles/Jobs-require-Excel
[26] Resize a Table:
https://support.office.com/en-us/article/resize-a-table-by-adding-or-removing-rows-and-columns-e65ae4bb-e44b-43f4-ad8b-7d68784f1165
[27] Adjust:
https://support.office.com/en-us/article/change-the-column-width-and-row-height-72f5e3cc-994d-43e8-ae58-9774a0905f46

❏ PS2.1 Set a column to a specific width

The students can set up a width by following these steps.
- Select the column or columns that you want to change.
- On the Home tab, in the Cells group, click Format.
- Under Cell Size, click Column Width.
- In the Column width box, type the value that you want.

❏ PS2.2 Set the column width to automatically fit the contents.
The students can set up a autofit width by following these steps.
- Change the column width to automatically fit the contents (AutoFit)
- Select the column or columns that you want to change.
- On the Home tab, in the Cells group, click Format.
- Under Cell Size, click AutoFit Column Width.

❏ PS2.3 Set the row height to automatically fit the contents.
The students can set up a row height by following these steps.
- Select the row or rows that you want to change.
- On the Home tab, in the Cells group, click Format.
- Under Cell Size, click AutoFit Row Height.

❏ PS2.4 Borders
The students can set up and change borders of cells and forms by following these steps.
- Select the rows on both sides of the page break.
- Click the arrow next to Borders, and then click More Borders.
- Under Presets, click the Inside button.
- Under Border, in the preview diagram, remove the vertical border by clicking it.

PS3. Students will be able to choose and use appropriate basic formulas: applying appropriate formulas and functions to extract the information they need.[28]

❏ PS3.1 Input a formula

The students are able to input a formula by following one of these ways.
❏ PS3.1.1 Method 1
- Select a cell.
- Type the =
- Select a cell or type its address in the selected cell.
- Enter an operator. For example, – for subtraction.
- Select the next cell, or type its address in the selected cell.
- Press Enter.

❏ PS3.1.2 Method 2
Using Insert Function Option from Formulas Tab

❏ PS3.1.3 Method 3
Selecting a Formula from One of the Groups in Formula Tab

---

[28] Basic Formulas:
https://corporatefinanceinstitute.com/resources/excel/study/basic-excel-formulas-beginners/

❏ PS3.2 Choose a formula
● When students see a problem need to be solved, they are able to recall the formulas they have learned before and try to apply them here.
❏ PS3.3 Change a formula
● When students find their formulas aren't work, they can think and find the appropriate one. STEP1, they need to read the problem again. STEP2, they need to make a detailed plan to find what purpose they want to achieve. STEP3, they need to check their formula list and try to change it to the specific formula.

PS4. Students will be able to use charts and graphs to visualize: choosing the suitable graphs, and then inserting, adjusting, improving, combining them.
❏ PS4.1 Choose a chart and insert it
● When students want to visualize their analytical results, they are able to recall the chart types and choose the appropriate one, then insert it.
❏ PS4.2 Adjust a chart
● The student can adjust their chart by adding or moving labels, changing colors and so on.
❏ PS4.3 Combine charts
● When students encounter a problem that need to combine 2 kinds of chart, they are able to recall the charts they have learned before and choose two suitable charts.
❏ PS4.4 Combine charts and forms
● When students encounter a problem that need to combine 2 kinds of chart and build some aided columns or forms, they are able to find a way to build that column and create the chart.

PS5. Students will be able to use Pivot table to do some basic analysis: calculating tables and choosing suitable pivot charts.[29]
❏ PS5.1 Create a PivotTable
❏ PS5.1.1 Recommended Pivot Table

The students can create a Recommended Pivot Table by following these steps.
● Click a cell in the source data or table range.
● Go to Insert > Recommended PivotTable.
● Excel analyzes your data and presents you with several options, like in this example using the household expense data.
● Select the PivotTable that looks best to you and press OK. Excel will create a PivotTable on a new sheet, and display the PivotTable Fields List.
❏ PS5.1.2 Manually create a PivotTable

---

[29] Use Pivot Table:
https://support.office.com/en-us/article/create-a-pivottable-to-analyze-worksheet-data-a9a84538-bfe9-40a9-a8e9-f99134456576

The students can create a PivotTable manually by following these steps.
- Click a cell in the source data or table range.
- Go to Insert > PivotTable.
- In Choose where you want the PivotTable report to be placed section, select New Worksheet, or Existing Worksheet. For Existing Worksheet, select the cell where you want the PivotTable placed.
- Click OK, and Excel will create a blank PivotTable, and display the PivotTable Fields list.

❏ PS5.2 Working with PivotTable

The students can work with PivotTable by following these steps.
- In the Field Name area at the top, select the check box for any field you want to add to your PivotTable.
- By default, non-numeric fields are added to the Row area, date and time fields are added to the Column area, and numeric fields are added to the Values area.
- You can also manually drag-and-drop any available item into any of the PivotTable fields, or if you no longer want an item in your PivotTable, simply drag it out of the Fields list or uncheck it.
- Being able to rearrange Field items is one of the PivotTable features that makes it so easy to quickly change its appearance

❏ PS5.3 Calculate values in a PivotTable[30]

The students can do basic calculation with PivotTable by following these steps.
  ❏ PS5.3.1 Calculated Items
  - Calculated Items are formulas that can refer to other items within a specific pivot field.
  - Students can create one or more calculated items.
  ❏ PS5.3.2 Calculated Fields
  - Calculated Fields are formulas that **can refer to other fields** in the pivot table.
  - Students can create one or more calculated items.you can create a new field that performs a calculation on the sum of other pivot fields.

PS6. Students will develop a plan and a procedure for solving the problem.[31]

When the goal is clear, students are able to develop a plan and procedure to address this real-life problem.

---

[30] Calculate with PivotTable: https://www.contextures.com/calculatedfieldcalculateditem.html
[31] Plan and procedure: https://edu.gcfglobal.org/en/excelformulas/solving-reallife-problems-in-excel/1/
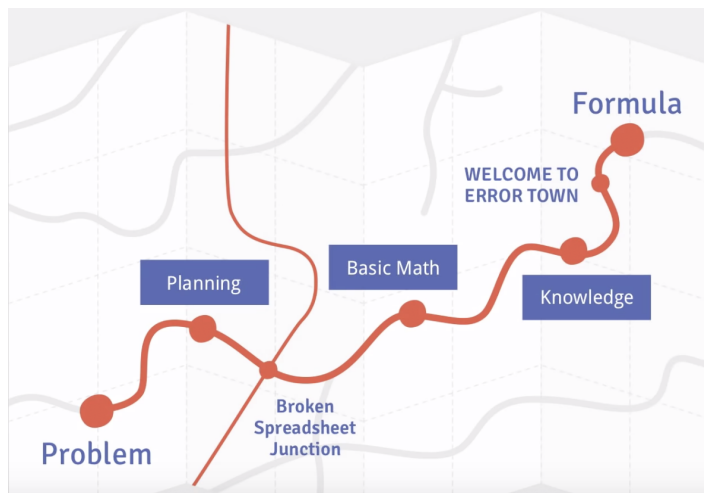
- Students can identify what job describing job categories need Excel skills such as Excel developers, Excel managers, Excel consultants, and Excel analysts.
- Excel developers need to be an expert in Excel and VBA, familiar with Excel object model, authoring of procedures, user defined functions, code refactoring, performance optimization. Excel managers need to have the ability to analyze data and provide recommendations, be flexible and able to adapt to changing business needs and demonstrate intermediate skills in Microsoft Excel and Access. Excel Specialists need to have the ability to Tracking inventory from the production floor to then create excel spreadsheets per the managers request and create Excel data forms based off of the inventory gathered. Excel Analysts needs to have Excellent Microsoft Excel skills.

4.2.3 Dispositions

DS1. Students will think in a creative way.

Students can participate mentally by showing ideas and find ways to solve problems differently during the lecture and lab. For example, when finishing an Excel behaviour, students will develop a habit to ask themselves these questions:
Does it prevent waste/conserve time/steps? Will it bring about desired improvement or results? Is it easy to understand/explain? Or, will you need to create some sort of visual schema or a useful metaphor to explain your idea to others? Is it an improvement over what is presently done or used?

---

[32] Linkedin: https://www.linkedin.com/jobs/search/?keywords=Excel

DS2. Students will be able to measure whether they find an effective way when using Excel.
Students can be motivated in using Excel to solve problems. They will avoid behaviors like doing a simple operation several times. Students will develop a habit to do a task first, then check whether they do it effectively, and consider whether they could finish it in a more effective way.

DS3. Students will have a confidence of finding a career path after the Excel module.

This Excel module helps students master some advanced Excel skills so they could have a high level of comfort with Excel and be experienced creating, modifying and checking large, complex spreadsheets using MS Excel. They will have expert knowledge in MS Excel, and a willingness to learn other programming languages. All these will have them build their confidence.

4.2.4 Meta–Level Conceptual

Meta-Level Conceptual:

M-C1. Students make judgements after choosing a function/formula, and make a reflection on whether they understand differences or are correctly discerning.
For example: After choosing a formula, students can judge it, and make a reflection on whether they understand differences or are correctly discerning.

M-C2. After choosing a way to achieve the result, students are able to judge it and make a reflection on whether they use it productively or not.
For example: After finding a way to find a targeted cell like use vlookup, students can judge it and make a reflection on whether they use it productively or not.

4.2.5 Meta–Level Procedural

Meta-Level Procedural:

M-P1. Students will be able to know their process and check whether they use technologies in a creative and productive way.
After finishing an operation, students will ask themselves following those steps:
Step1: Is the process of dealing with data correct?
Step2: Did I choose the right formula or chart?
Step3: Am I doing some repetitive work now? Am I trying to be effective by using formulas and functions? Or I just deal with these dirty data manually or in a time-consuming way. (Good example: use text to columns rather than modify data cell by cell)

> M-P2. Students will be able to evaluate whether they have enough Excel basis to find a new career path.
>
> After finishing homework or a project, students could ask themselves the following questions to be aware of their skills and skill-building related to enacting processes.
>
> Step1: In this part, do I have enough knowledge to use it when finding a job?
>
> Step2: Do I know how to use Excel to get new opportunities?
>
> Step3: Do I need to do some self-improvement and add knowledge in this part?

4.2.6 Meta-Level Dispositions

> Meta-Level Dispositions:

> M-D1. Students will be able to evaluate whether they try things in Excel in a creative way.
>
> Creative here means: prevent waste/conserve time/steps; bring about desired improvement or results; easy to understand/explain; an improvement over what is presently done or used.
>
> (Good example: use vlookup + if: based on the list in cells A1:B6, to find out if the name mentioned in cell D2 has a bonus which is based on sales over $2,500[33])

> M-D2. Students will be able to evaluate whether they have the confidence to put whey learned into practice.
>
> For example: Do I feel that I can apply well in Excel-related problems? Or I only learn it but forget it soon. (Good example: students can find whether they could finish assignments quickly with high accuracy)

---

[33] An example of VLOOKUP: https://www.got-it.ai/solutions/excel-chat/excel-tutorial/vlookup/if-function-and-vlookup

Focus Assessment On Progress

5.1 Overview of Assessment Evidence

My assessment approach includes three types: self-assessment surveys, weekly quizzes, and final project. The content can be divided into two parts. One is assessing students' understandings of **conceptual knowledge**, e.g., whether they understand the definition and purpose of a specific function in Excel. Students can use these assessments to measure their **meta-level skills**. The other is measuring their **procedural skills**, **dispositions**, and **meta-level skills** using different functions flexible to solve real-life related problems.

Here are the reasons why I chose these three types:

For **student self-assessment**, it involves students in evaluating their own work and learning progress and it is a valuable learning tool as well as part of an assessment process. Through self-assessment, students can identify their own skill gaps, where their knowledge is weak, see where to focus their attention in learning, revise their work and therefore, stay involved and motivated and encourages self-reflection and responsibility for their learning.[34]

For **weekly quizzes**, placing quiz at the end of each week's content as a norm signals a chance for students to reflect on what they have learned. This can reinforce their learning and help them extend their knowledge to a metacognitive level. In short, because I have metacognitive goals in my module, then this is a good opportunity to let students reflect on what they have learned at the end of each class with some well-structured objective quizzes.[35]

For the **final project**, it is a way to let students learn by actively engaging in real-world and personally meaningful projects[36]. Excel is a skill-oriented domain and it needs more practice and connections with real world.

Firstly, my assessment approach is justified by Bloom's Taxonomy. For the knowledge dimension, my assessment focuses on the level of Conceptual Knowledge and

---

[34] Andrade, H.&Valtcheva, A. (2009). Promoting learning and achievement through self-assessment. Theory Into Practice, 48, 12-19.
[35] Big idea: Toolkit--Quiz
[36] Big idea: Toolkit--Project

Procedural Knowledge[37]. For the cognitive dimension, my assessment focuses on the level of remember, understand, apply and create level in a progressive relationship. Also, with the principle of making goals and assessments aligned, the assessments are aligned with the goals that are already identified by conceptual and procedural two levels. Therefore, it promotes us to make assessments in conceptual and procedural levels.

| Performance Tasks:

We can measure the accuracy of students' quiz answers of the following parts:
1.Recall definitions of specific functions and patterns
2. Classify different patterns such as different charts.
3. Implement functions and charts and pivot tables to an unfamiliar task.
4.Distinguish between relevant and irrelevant numbers in a mathematical word problem
5. Build a solution by using Excel for a specific purpose

We can measure the quality of their assessment by:
   1. Their time of finishing each task
   2. Their final solution of solving a problem
   3. Their accuracy of each question | Other Evidence:
1. We can observe students' motivation from their activeness in class, and their final work.
2. We can observe the proficiency of their Excel by seeing how much time they take to do the quiz.
3. We can make some surveys to know about their struggling points and general attitudes of the module.
4. We can see their final project to measure their creativity. |
| | Student Self-Assessment / Reflection:
Students will reflect on the feedback they got from assignments. |

Formative:
1. Pre-class self-assessment
2. Weekly quizzes

Summative:
1. The final project at the end of this module.

[37] Bloom's Taxonomy: https://en.wikipedia.org/wiki/Bloom%27s_taxonomy

5.2 Assessment & Feedback Timeline

5.2.1 Assessment, Feedback Timeline, and Goal Alignment

I plan to put this 10-hour module into 5 weeks, with 2 hours per week. Weekly quizzes will happen on second, third, fourth and fifth week after lectures and homework. And the final project will start at the end of the third week.

The self-assessment will be arranged at the beginning of Class Time 1 in each week. It is a formative assessment to help to build a bridge between instructor and students, and to understand what students think about this module.

Students will receive their feedback immediately after handing in the quiz, the self-assessments will take two days to give feedback, and the final project will take four days to grade and give feedback.

Alignment of Goal and Assessment

	Pre-class Assessment	Class Time 1	Class Time 2	After-class Assessment	Assignment Topic
Week 1	Self-assessment: Their motivation to choose this course	The whole working process of Excel The impact of Excel on career paths	Adjust worksheet		Adjust worksheet
Goal	CK5; DS3	CK5	PS1 PS2		
Week 2	Self-assessment: Where you are and your struggling point in Week1	Definition and Use of formulas and functions	Definition and Use of formulas and functions	Weekly Quiz: Week1	Excel Formulas and Functions
Goal	CK5; M-P2	CK1; CK3; PS3	CK1; CK3; PS3	M-C1 PS1-2 M-D1 PS7	
Week 3	Self-assessment: Where you are and your struggling point in Week2	Review the definition use of formulas, and functions; Definition and Use of charts	Review the definition use of formulas, and functions; Definition and Use of charts	Weekly Quiz: Week1 + Week2	Formulas, Functions and Use of charts
Goal	M-P2; M-D2	CK2; CK3; PS3; PS4	CK2; CK3; PS3; PS4	M-D1; PS1 PS2; PS3	
Week 4	Self-assessment: Where you are and your struggling point in Week3	Some preparing knowledge for final project - budget and family plans	Introduce Pivot table and brainstorm possible plans	1. Weekly Quiz: Week2 + Week3 2. Final Project: Warming up	1. Charts & Pivot table 2. Think about final project
Goal	M-P2; M-D2	PS6	CK4; PS5; PS6	CK1-3; PS1-4 DS1-2	
Week 5	Self-assessment: Where you are, problems for the final project, and suggestions for this module	Pivot table, Some examples of doing a family plan, and question time	Display and Feedback for the final project	Weekly Quiz: Week3 + Week4 + Week5	Final Project
Goal	M-C2; M-P1; M-P2 M-D1; M-D2	DS1-3; PS5; PS6	DS1-5	CK2-4; PS3-6	

Feedback Timeline

Week ID	Pre-class Class Time 1	Feedback	After-class Class Time 2	Feedback
1	Self-assessment: Their motivation to choose this course	In two days: Instructors' online feedback/Appointment: face-to-face	--	--
2	Self-assessment: Where you are and The struggling point in Wk1	In two days: Instructors' online feedback/Appointment: face-to-face	Quiz: Wk1	Instant : System Feedback
3	Self-assessment: Where you are and The struggling point in Wk2	In two days: Instructors' online feedback/Appointment: face-to-face	Quiz: Wk1+Wk2	Instant : System Feedback
4	Self-assessment: Where you are and The struggling point in Wk3	In two days: Instructors' online feedback/Appointment: face-to-face	Quiz: Wk2+Wk3	Instant : System Feedback
5	Self-assessment: Where you are and Ideas for the improvement of this module	In two days: Instructors' online feedback/Appointment: face-to-face	Quiz: Wk3+Wk4	Instant : System Feedback
other	Final Project	In four days: Instructors' feedback		

5.2.2 Justification of the assessment approach

In justification part, I use goal alignment; understand and transfer and formative assessment to justify my assessment approaches.

Goal alignment: The assessments are aligned with the goals shown above. And it covers all the goals of six levels. Also, the self-assessment will let instructors get close to students' goals, which build an alignment between learners and instructors[38].

Understand and transfer[39]: Understanding and transformation are pretty important in real learning. Weekly quizzes are good tools to check whether students understand what they learned and final project is a chance to find their transformation ability.

Formative[40] **and Summative**[41]: Self-assessments will track students' ideas and attitudes. Therefore, instructors are able to give them personal feedback and training in a cost-friendly way. And weekly quizzes will help students reflect on what they learned in the past week and check their weak points.

5.3 Specific Assessments

5.3.1 Self-assessment

5.3.1.1 Sample of Self-assessment (Week 1)

CK5.Students will know the impact of Excel on various career paths. (15.6.12.M.)

DS3. Students will have a confidence of finding a career path after this module. (15.4.12.M)

	Pre-class Assessment	Class Time 1	Class Time 2	After-class Assessment	Assignment Topic
Week 1	Self-assessment: Their motivation to choose this course	The whole working process of Excel The impact of Excel on career paths	Adjust worksheet		Adjust worksheet
Goal	CK5; DS3	CK5	PS1 PS2		

Sample Questions - Why did you register for this course.

1. What are the most important things you hope to learn?

2. What do you expect to gain from learning them?

3. How would you rate your current understanding of the topics in this module?

4. How do you hope this module will benefit your professional work?

---

[38] Big Idea: Connect instructional goals with learner's goals
[39] Understanding by Design (Wiggins & McTighe, 2005, Ch2, P39)
[40] Understanding by Design (Wiggins & McTighe, 2005, Ch7, P169)
[41] Understanding by Design (Wiggins & McTighe, 2005, Ch7, P190)

5. Do you have any specific questions you would like the instructor to cover? Any other special requests?

5.3.1.2 Assessment Triangle for Self-assessment

Cognition (Content) Which goals are the target of the assessment?	The self assessment can target the following goals: CK5. Students will know the impact of Excel on various career paths. M-P2. Students will be able to evaluate whether they have enough Excel basis to find a new career path.
Observation (Format) What will students do, say, and/or create? Is the assessment context natural or structured? What directions and scaffolds are given, and what recording techniques will be used?	In the self assessment, students will: Do: 1. Recognize their current feeling of this module, e.g., whether the content is what they want to learn. 2. Recognize their current struggling point of this module 3. Evaluate whether they make improvement in the prior courses. Say: Their moving attitude and idea of this module and themselves in words. The assessment context is structured, which means that students are asked to review themselves and find out their current status. Directions: Each single question has clear guidance. Scaffolds: Students are able to discuss a little bit with the instructor when finishing it. Recording techniques: Google form/Quiz function in the online learning system
Interpretation (Scoring, Reporting & Use of Results) What are the criteria for evaluating performance? How will the data be scored for each criterion in qualitative and/or	Criteria: IF <students' answers reflect on their weak points> THEN <book an appointment with the students and go deeper>

quantitative ways? What rubrics will be used for scoring?	IF <students' answers reflect on their strong points> THEN <give them positive and encouraging feedback> IF <students' answers reflect on their own module expectations> THEN <count and add some points from majority> and <collect materials for minority that you cannot add into module syllabus> IF <students' answers reflect on their own module expectations> THEN <count and add some points from majority> and <collect materials for minority that you cannot add into module syllabus> Reporting: If students don't need an appointment, then give them feedback including answering their questions, encouragement, some possible supplied materials via canvas or other course platforms.

5.3.1.3 Rubrics- Self-assessment

Category	Rudimentary 2 Points	Developing 4 Points	Satisfactory 6 Points	Accomplished 8 Points	Exemplary 10 Points	Percent
Improvement (CK5, DS3)	Show poor progress over the module	Show minimal progress over the module	Show sufficient progress over the module	Show above average progress over the module	Show Excellent progress over the module	60%
Attitude	Have finished 20% of the questions	Have finished 40% of the questions	Have finished 60% of the questions	Have finished 80% of the questions	Have finished all the questions	40%

5.3.1.4 Meeting Design Criteria–Self-assessment

Design Criteria	How to meet it
Validity	The main goal for this self-assessment is to instill a good sense of meta-thinking and engagement to students. If there's only one instructor, the instructor will use

	the criteria to evaluate students' performance and understand their students, so this assessment is valid. If there are several instructors, to make sure that their understanding of the results are the same, they need to sit together to see students' self-assessment results.
Reliability	These questions can understand students' explanations and evaluations which represent their real feelings and attitudes. This task is reliable in demonstrating students' dynamic feelings.
Equity for different learners	All the questions are about student themselves, so it's open to all the learners.

5.3.2 Weekly Quiz

5.3.2.1 Sample of Weekly Quiz (For Week 1)
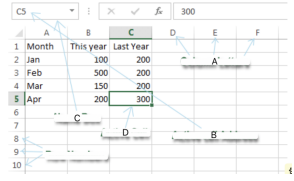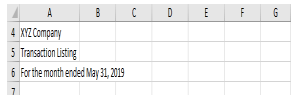
Week 1 - Instructions and Goal Alignment

	Pre-class Assessment	Class Time 1	Class Time 2	After-class Assessment	Assignment Topic
Week 1	Self-assessment: Their motivation to choose this course	The whole working process of Excel The impact of Excel on career paths	Adjust worksheet		Adjust worksheet
Goal	CK5; DS3	CK5	PS1 PS2		
Week 2	Self-assessment: Where you are and your struggling point in Week1	Definition and Use of formulas and functions	Definition and Use of formulas and functions	Weekly Quiz: Week1	Excel Formulas and Functions
Goal	CK5; M-P2	CK1; CK3; PS3	CK1; CK3; PS3	M-C1 PS1-2 M-D1 PS7	

Quiz for Week 1:

With this quiz, you can review:
- Some Basic definition of Excel cells
- How to adjust the cells in Excel
- How to adjust worksheets in Excel

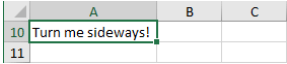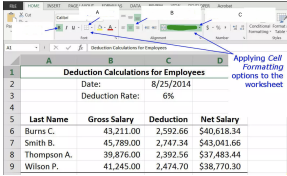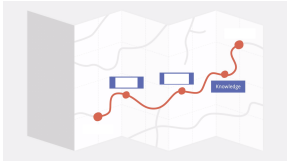| Question	Choice	Right Answer	Points
1. What is the name given to the intersection of a row and a column in a spreadsheet?	A Cube B Cell C Square D Block E None of these answers are correct.	B	1
2.In a spreadsheet formula which symbol is used to multiply ?	A & B X C x D * E None of these answers are correct.	D	1
3. A spreadsheet is a	A grid made of columns and rows B vertical space that goes up and down C area where columns and rows intersect D horizontal space going across E None of these answers are correct.	A	1
4. An active cell in Excel is 	A B C D	D	1
5.To copy the formatting of one cell to another you would use the	A Delete key B Copy and Paste C Format Painter D Chart Wizard E None of these answers are correct.	C	1
6.To keep the data in all cells joined together you would use the	A Merge B Combine C Join D Create E None of these answers are correct.	A	1
7. Suppose you want to center the title you have in cell A6 over the data table in A7:G40. Which method is the best?[42] 	A Select cells A6:G6 and click the "Merge and Center" button on the Home tab B Select cells A6:G6, right click, choose Format Cells, and set the horizontal alignment to "Center Across Selection C Select A6:G6 and click the Center	B	2

---

[42] https://www.goskills.com/Course/Excel/Lesson/35/Cell-Formatting/Quiz

	icon on the Home tab D Select cells A6:G6 and click the Center icon on the Home tab E None of these answers are correct.		
8. Suppose cell A10 contains text and you want to display it rotated on its side and centered vertically over A10:A20. Which method is the best? 	A Select cells A10:A20, rotate the text 90 degrees and select Center Across Selection B Merge cells A10:A20, rotate the text 90 degrees and select Center Vertically C Select cells A10:A20 and select the Merge and Center button D None of these answers are correct.	B	2
9. Fill in the blank in this picture: 	A ———— B ———— C ————	A Borders B Center Align C Merge and Center	3
10. Fill in the blank in this procession picture: 43 	A———— B———— C———— D————	A Problem B Planning C Basic Math D Formula and Functions	4

5.3.2.2 GRASPS Technique in Weekly Quiz

Goal	Your task is:	By doing this quiz, Students will be able to demonstrate their mastery of the contents, for example, in Week1, adjust worksheet and data.
	The goal is:	To get the right answers which shows that you have understood the definition and could apply it.
	The problem or	Some definitions are similar and easy

---

43 https://edu.gcfglobal.org/en/excelformulas/solving-reallife-problems-in-excel/1/

	challenge is to:	to be mixed like Q1 and Q4. Some outcomes can be achieved in several ways so they need to find the optimized one.
	The obstacles to overcome is to:	Distinguish the similar definitions clearly and find the most effective way to get to the right outcome.
Role	You are:	A students in Grade 10 or 11
	You have been asked to:	Do the weekly quiz
	Your job is:	Distinguish the similar definitions clearly and find the most effective way to get to the right outcome.
Audience	Your clients are:	High school computer science teachers
	The target audience is:	High school computer science teachers
	You need to convince:	High school computer science teachers that your quiz has included the vital points
Situation	The context you find yourself in is:	Structured Quiz
	The challenge involves dealing with:	Finish each quiz with high accurate rate in limited time.
Product, Performance, and Purpose	You will create	A quiz answer list
	In order to	Show why you think your answers are right
	You need to develop	Understanding and transfer ability after listening to lectures and doing assignments.
	So that	You are able to finish the quiz with high

		accurate score.
Standards and Criteria for success	Your performance needs to:	Show your instructors that you already understand, and are able to transfer and apply the ability to other unfamiliar questions.
	Your work will be judged by:	Your computer instructors in your high school
	Your product must meet the following standards:	Reach the reasonable accuracy (80%) to show that you have grasped the knowledge.

5.3.2.3 Assessment Triangle for Weekly Quiz (For Week 1)

Cognition (Content) Which goals are the target of the assessment?	This weekly quiz for week 1 can target the following goals: PS1. Students will be able to adjust worksheet layout and data: inserting, deleting and merging rows and columns based on their needs. PS2. Students will be able to adjust row heights and column widths, borders, formatting based on their needs. DS2. Students will try to save time by using Excel. M-C1. Students will be able to judge the difference between different definitions and explain it explicitly. M-P2. Students will be able to evaluate whether they have enough Excel basis to find a new career path.
Observation (Format) What will students do, say, and/or create? Is the assessment context natural or structured? What directions and scaffolds are given, and what recording techniques will be used?	In the weekly quiz, students will: Do: 1. Recognize the right definitions of important concepts. 2. Exemplify the specific example of using a function. 3. Apply the procedure learned to an unfamiliar task Say: No saying here

	Create:
	No creation this time The assessment context is structured, which means that students are actually asked to review what they learned before and finish the quiz in limited time and attempts. Directions: Each single question has clear guidance Scaffolds: No scaffolds in quizes. Recording techniques: Simple interaction tools like Google Form or Canvas Quiz, even Paper-based test is ok.
Interpretation (Scoring, Reporting & Use of Results)	They are all multiple choice questions, with objective answers in the third columns. Each question has some points, and data will be collected automatically by the system.

5.3.2.4 Rubrics- Weekly Quiz

Category	Rudimentary 2 Points	Developing 4 Points	Satisfactory6 Points	Accomplished8 Points	Exemplary10 Points	Percent
Accuracy (M-C1 PS1-2 PS7)	Got less than 60% of the questions right	Got more than 60-70% of the questions right	Got more than 70-80% of the questions right	Got more than 80-90% of the questions right	Got more than 90% of the questions right	70%
Attitude (M-D1)	Have finished 20% of the questions	Have finished 40% of the questions	Have finished 60% of the questions	Have finished 80% of the questions	Have finished all the questions	10%
Punctual	Hand in his quiz after 2 days	Hand in his quiz after 1 days	Hand in his quiz after class but in 8 hours	Hand in his quiz after class but in 2 hours	Hand in his quiz on time	20%

5.3.2.5 Meeting Design Criteria- Weekly Quiz

Design Criteria	How to meet it

Validity	It is valid the test items are representative of all types of problems with what we taught in Week1[44]. And the test use simple English so we can see only students' Excel ability. A student cannot do well on this performance task without master the content. Also, a student cannot perform poorly on this task, but still have significant understanding of the ideas and show them in other ways[45]. So it's valid.
Reliability[46]	For reliability, we want the judgments of multiple judges to form a consistent pattern. Firstly, all the questions are objective and the answers won't change. So their knowledge components are consistent. Secondly, there is a mix of different types of questions in each quiz, which makes the assessment more reliable. Thirdly, the quizzes are weekly so it can test students' changes over time.
Equity for different learners	Before taking the quiz, learners are expected to have learned these definitions and skills in detail, finished all the assignment, reviewed what they learned regularly. Under this circumstance, the assessment is equal to each learner. Also, there are only objective multiple choice questions in each time-limited quiz so there's no technical limitations for students without disability.

5.3.3 Final Project

5.3.3.1 Sample Final Project

Warming-Up[47]:

You are a high school student who are 16 years old now. One day, you see a fancy jacket in the mall which costs $500. You're planning to raise money by doing part-time jobs

---

[44] Understanding by Design (Wiggins & McTighe, 2005, Ch8, P182)
[45] Understanding by Design (Wiggins & McTighe, 2005, Ch8, P184)
[46] Understanding by Design (Wiggins & McTighe, 2005, Ch8, P188)
[47] GCF: https://edu.gcfglobal.org/en/excelformulas/solving-reallife-problems-in-excel/1/

which gain $8 per hour and save $10 per week. Use Excel to show how many months will it take you to save the full amount.

Direction: Students will do a basic connection between Excel and financial-related things.

Family Budget Plan[48] [49]:

In this problem, you will build a Family Budget Plan on your own. You need to cover all the data and functions in dataset and sample.

Your final Excel spreadsheet should be readable to instructors and students as soon as they open it, without running any cells. Your final product should contain your Excel spreadsheet and a doc file that includes your ideas of how to do it and important skeps.

Required dataset is here: XXX.csv

Sample:

https://docs.google.com/spreadsheets/d/1MKadGZ8NMSTLfR2g56xwS1BG0Kh4pQXNi6s60V75m3s/edit?usp=sharing

5.3.3.2 GRASPS Technique in Final Project

Goal	Your task is:	To accomplish the task and create their own Family Budget Plan in Excel. It will show their degree of understanding and Integration of what they have learned in this module.
	The goal is:	Using Excel to show your family budget plan concise and clearly
	The problem or challenge is to:	Understanding the outcome of final project and know the way to achieve. Construct your idea and make your product in the right direction.
	The obstacles to overcome is to:	Build your own family budget plan clearly and put what you have learned into this planning sheet group.
Role	You are:	A students in Grade 10 or 11

[48] NJPF Budget:
https://www.ngpf.org/curriculum/budgeting/?gclid=EAIaIQobChMI_tzn6K6s5QIVFJSzCh1TewsNEAAYAiAAEgLicfD_BwE
[49] Sample Budget for Teens: http://moneyandstuff.info/wp-content/uploads/2017/01/SampleBudgetforTeens-2.pdf

	You have been asked to:	Make a family budget plan by Excel
	Your job is:	Make the budget plan clear and find the most effective way to get to the right outcome.
Audience	Your clients are:	High school computer science teachers
	The target audience is:	High school computer science teachers
	You need to convince:	High school computer science teachers that your final project has included the vital points and can put into practice.
Situation	The context you find yourself in is:	Structured Project
	The challenge involves dealing with:	Make your budget plan clear, concise, and creative in a limited duration (1 week).
Product, Performance, and Purpose	You will create a	A family budget plan step by step. The rubric is in 5.3.3.4
	In order to	Show that you have understood and could transfer and create things you want based on your Excel abilities.
	You need to develop	Understanding, transfer and creativity ability after listening to lectures, doing assignments, and doing warm-up questions.
	So that	You are able to finish the quiz with high accurate score.
Standards and Criteria for success	Your performance needs to:	Show your instructors that you already understand, and are able to transfer and apply the ability to other unfamiliar questions.
	Your work will	Your computer instructors in your high

	be judged by:	school
	Your product must meet the following standards:	Your final product should include a labeled Excel file with detailed family budget plan using the data in the requirement. Also, you need a list of the important steps when making this plan in Excel.

5.3.3.3 Assessment Triangle for Final Project:

Cognition (Content) Which goals are the target of the assessment?	This final project can target the following goals: PS1. Students will be able to adjust worksheet layout and data: inserting, deleting and merging rows and columns based on their needs. PS2. Students will be able to adjust row heights and column widths, borders, formatting based on their needs. PS3. Students will be able to choose and use appropriate basic formulas: applying appropriate formulas and functions to extract the information they need. PS4. Students will be able to use charts and graphs to visualize: choosing the suitable graphs, and then inserting, adjusting, improving, combining them. PS6. Students will develop a plan and a procedure for solving the problem. DS1. Students will think in a creative way. DS2. Students will be able to measure whether they find an effective way when using Excel. M-P1. Students will be able to know their process and check whether they use technologies in a creative and productive way. M-P2. Students will be able to evaluate whether they have enough Excel basis to find a new career path.

	M-D1. Students will be able to evaluate whether they try things in Excel in a creative way. M-D2. Students will be able to evaluate whether they have the confidence to put whey learned into practice.
Observation (Format) What will students do, say, and/or create? Is the assessment context natural or structured? What directions and scaffolds are given, and what recording techniques will be used?	In the final project, students will: Do: 1. Recognize the important steps and structure in sample example 2. Apply the procedure learned to an unfamiliar task Say: Communicate with instructors and students when facing difficulties. Create: Make a family budget plan of their own by Excel The final project context is guided, which means that students are actually asked to review what they learned before and finish the project in a limited duration(1 week). Directions: The instruction of the final project shows clear guidance and display the final sample. Scaffolds: Have scaffolds in lab class time. Recording techniques: Students will hand in their mid draft (an Excel file) using Email
Interpretation (Scoring, Reporting & Use of Results) What are the criteria for evaluating performance? How will the data be scored for each criterion in qualitative and/or quantitative ways? What rubrics will be used for scoring?	For the final project, it will be graded according to the rubrics combined by iRubric[50]and Wagner College[51] (My combination is attached in 5.3.1.3 Rubric) , to see if the final product is clear, concise, and creative.

---

[50] iRubric https://www.rcampus.com/rubricshowc.cfm?sp=yes&code=S98785&
[51] Excel Project Rubric:
http://webcache.googleusercontent.com/search?q=cache:us3sSpNX7MwJ:wagner.edu/business-admin/files/2017/03/Excel-Project-Rubric.docx+&cd=1&hl=en&ct=clnk&gl=us

5.3.3.4 Rubrics – Final Project

Category	Rudimentary 2 Points	Developing 4 Points	Satisfactory 6 Points	Accomplished 8 Points	Exemplary 10 Points	Percent
Data Entry	Several errors. Some required data may be missing.	Some data required is missing.	All data required data is entered correctly.	Most data required is entered with 100% accuracy.	All data required is entered with 100% accuracy.	15%
Computations, & Formulas	No formulas are used.	Several errors in formula calculations	Minor errors in correct formulas used.	Most formulas used are correct applicable formulas as required	100% use of correct applicable formulas as required.	15%
Graph	There were graphs present, but graphs or data were incorrect.	There are graphs present but only most elements were missing.	The graphs required for the project were correct. Some elements were depicted.	The graphs required for the project were correct. Most elements were depicted.	The graphs required for the project were correct. All elements were depicted.	15%
Neatness, Organization, and Formatting	Information is poorly organized. Appropriate formatting such as appropriate labels & column/row widths & heights are not used. Spreadsheet information is not readable.	Some Information is organized, using standard formatting tools. Some labels or other important formatting tools are missing. There is great difficulty in interpreting information	Information is mostly organized, using appropriate standard formatting tools, such as labels and bolding.Data can be read and interpreted, but with some difficulty.	Information is organized by using appropriate formatting, including shading, alignment tools, borders, special fonts, appropriate labels, appropriate column/row height & width. Data can be read and interpreted.	Information is very well organized by using appropriate advanced formatting, including shading, alignment tools, borders, special fonts, appropriate labels, appropriate column/row height & width.It's easy to read	15%
Visual Appearance & Output	Spreadsheet is VERY difficult to read and locate information. Major information has been omitted.	Spreadsheet is somewhat difficult to read. A few pieces of important information are omitted.	Spreadsheet is clear & easy to read. Minor information has been cut off when printed.	Spreadsheet is visually esthetic, mostly easy to read & most of the required information was printed (nothing is cut off).	Spreadsheet is attractive, easy to read & all required information printed (nothing is cut off).	15%

Followed Directions	None of the directions were followed.	Most of the directions were followed accurately.	Most of the directions were followed somewhat accurately.	Some of the directions were followed.	All directions were followed accurately and completely.	25%

5.3.3.5 Meeting Design Criteria– Final Project

Design Criteria	How to meet it
Validity	It is valid because it is it has a right criteria for judging their understanding and behaviours.[52]So each instructor can make their judgement based on the rubric.
Reliability	For reliability, we want the judgments of multiple judges to form a consistent pattern.[53] The final project may not be reliable enough in assessing students' Excel ability because some other factors will influence the final product. For example, we have no idea if students find the online tutorial of the same project or finish it dependently. Although it can be a signal to show students' learning motivation, transfer ability, problem-solving ability and creativity in Excel, it's hard to measure his other abilities reliably. Therefore, multiple Excel assessment tasks are required to reach the final assessment results.
Equity for different learners	Before doing the final project, learners are expected to have learned these definitions and skills in detail, finished all the assignment, reviewed what they learned regularly. Under this circumstance, this project is equal to each learner. Also, they have the chance to make up their weakness during this procession to reach the same page at the end of the module.

---

[52] Understanding by Design (Wiggins & McTighe, 2005, Ch8, P188)
[53] Understanding by Design (Wiggins & McTighe, 2005, Ch8, P188)

Design Instruction to Reach Goals

6.1 General Description

6.1.1 General Classroom Climate

Aspect	Key Features
Physical space	In order to let everyone see the projection screen and hear the lecture clearly, students will sit like an arc. Lecture theatres are unrecommended in this course. Students will sit in movable and flexible chairs so that they are able to do group discussion easily.
Cognitive tools	It is an Excel course so undoubtedly every one will have a computer with them[54]. However, Desktop PC will hinder their communication. So in order to enhance their engagement, they should use public laptops. Instructor could broadcast her/his screens to each student laptops so they could see the guided manipulation and avoid their distraction or using laptops to do unrelated things.
Resources	In the corner of the classroom, there are several computer monitors so students could come to this classroom to finish their homework. In this way, we won't require each student has their own laptops[55]. Also, in order to decrease the computation atmosphere in this course, each student could only see their own degree of completion of in-class activities.
Belonging	1.Students will be divided into pairs and groups depends on the course contents. Each pair will responsible for bringing snacks at least one time duirng the semester. 2.Pairs will help each other to do homework and they will have group discussions[56]. 3.Students will have many opportunities to share their ideas with the class. Each group will have a chance to be in charge of one small session and teach to other classmates.[57]

---

[54] The ABC's of How We Learn (Schwartz, Tsang & Blair, 2016, M Chapter)
[55] Big idea: Accept Learner Social & Cultural Differences
[56] The ABC's of How We Learn (Schwartz, Tsang & Blair, 2016, S Chapter)
[57] The ABC's of How We Learn (Schwartz, Tsang & Blair, 2016, T Chapter)

6.2 Session and Weekly Routines

6.2.1 Session Routines

Note: Guide the flow of each session and each week.

Time	Routines	Content
2 mins	1 Greetings	Hi friends! I hope you enjoyed the contents in the last class. Does anyone have any Excel tips want to share?
5 mins	2 Review of the last topic	Okay, so last time we learned the definition of Excel formulas and functions, and logical, count and sum families. Can anyone give me some examples about when to them based on the homework and the contents of last class?
12 mins	3 Introduction of the new topic	Today we are starting the second part of Excel function. And we are going to talk about an important search function in Excel: Vlookup. Did anyone face a problem when trying to match a club member with their attendance? Vlookup could help you to solve that problem!
7 mins	4 Learn by doing time	Now use Vlookup to solve the club problem (match ID with their email address) on your screen! Try them by yourself first!
3 mins	5 Discussion	Now share your ideas with your partner. You have 4 minutes to discuss and try to come up with some solutions about this problem.
10 mins	6 Student-teaching time	Group 2 has prepared to teach us how to deal with that learn-by-doing problem. Now let's welcome them to show how to do it! And they will introduce more examples that could

		use vlookup function. Note: Each student in the group 2 is also a member of one team, so they will teach what they prepared to the remaining students of that team. So the group here is the "expert" group in jigsaw, and team here is the "jigsaw"group.
7 mins	7 Conclusion	This is the end of our vlookup function today. Next time we will go to the Chart world, and group 3 will display their ideas about Excel charts. Thanks for your participation! See you next time!

6.2.2 Weekly Routines

Note: Guide the flow of each week.

	Pre-class Assessment	Class Time 1	Class Time 2
Week 1	Self-assessment: Their motivation to choose this course	The whole working process of Excel The impact of Excel on career paths	Adjust worksheet
Goal	CK5; DS3	CK5	PS1 PS2
Week 2	Self-assessment: Where you are and your struggling point in Week1	Definition and Use of formulas and functions	Definition and Use of formulas and functions
Goal	CK5; M-P2	CK1; CK3; PS3	CK1; CK3; PS3
Week 3	Self-assessment: Where you are and your struggling point in Week2	Review the definition use of formulas, and functions; Definition and Use of charts	Review the definition use of formulas, and functions; Definition and Use of charts
Goal	M-P2; M-D2	CK2; CK3; PS3; PS4	CK2; CK3; PS3; PS4
Week 4	Self-assessment: Where you are and your struggling point in Week3	Some preparing knowledge for final project - budget and family plans	Introduce Pivot table and brainstorm possible plans
Goal	M-P2; M-D2	PS6	CK4; PS5; PS6
Week 5	Self-assessment: Where you are, problems for the final project, and suggestions for this module	Pivot table, Some examples of doing a family plan, and question time	Display and Feedback for the final project

6.3 Class Norms

Norms of intellectual engagement shape what people learn and what they value. And an important task of instruction is to help novices learn the norms appropriate to a particular topic of learning.[58]

6.3.1 Class Norms

In this class, we will make the following norms with our students.
1. Come to class on time, ready to learn and prepared[59]
2. Make everything you do in class as a learning experience[60]
3. Ask questions any time and seek clarifications together.[61]
4. Using mathematics and computational thinking
5. Try multiple strategies and commitment to solving the problem.[62]

6.3.2 How to Establish

(1) The instructor can organize students to come up with their own norms before the second class(I thought that the first class instructors need to do some introduction and let students be familiar with Excel) and make an agreement on their course norms.

(2) The instructor can use motivating when introducing a new norm. For example, explain the reasoning behind the norm(to improve their engagement and help them do deep learning).

(3) The instructor can use motivating when introducing a new norm. For example, to help them understand norms, instructor should practice and emphasize them regularly, and even penalize himself/herself when violating some norms.

(4) The instructor can make the norms explicit, for example, make a poster and paste it on the wall.

(5) The instructor should record students' performances as well as their general behavior in class, including whether or not they obey the class rules and norms. And tell them explicitly.

---

[58] The ABC's of How We Learn (Schwartz, Tsang & Blair, 2016, N Chapter)
[59] ECS Middle School 8th Grade Prime Time
[60] ECS Middle School 8th Grade Prime Time
[61] ECS Middle School 6th/7th Community Agreement
[62] ECS Middle School Group Expectations Form

(6) Peer evaluation and reflections can be used after student-teaching time, and in Week 5 Class 2 when doing display.

6.4 UBD Learning Plans

Note: The form includes WHERETO, aspect clarification and alignment between Goals and Instruction.

Teaching Approaches	Key design elements (WHERETO)	Goal Alignment
Direct Instruction (DI)	Where & Why Equip	CK1--CK5, MC-1 and MC-2
Guided Discovery (GD) / Open Exploration (OE)	Where & Why Hook Organize to Optimize Tailor to Context & Learner Characteristics	PS1--PS7; DS1--DS3;
Coaching to support practice with feedback (PF)	Where & Why, Rethink, Evaluate Organize to Optimize	M-P1 and M-P2, M-D1 and M-D2

6.5 Lesson Content, Format & Timing

6.5.1 A Detailed Schedule of the 10-hour segment

	A Pre-class Assessment	Class Time 1	Class Time 2	B After-class Assessment	Assignment Topic
Week 1	Self-assessment: Their motivation to choose this course	The whole working process of Excel The impact of Excel on career paths	Adjust worksheet		Adjust worksheet
Goal	CK5; DS3	CK5	PS1 PS2		
Week 2	Self-assessment: Where you are and your struggling point in Week1	Definition and Use of formulas and functions	Definition and Use of formulas and functions	Weekly Quiz: Week1	Excel Formulas and Functions
Goal	CK5; M-P2	CK1; CK3; PS3	CK1; CK3; PS3	M-C1 PS1-2 M-D1 PS7	
Week 3	Self-assessment: Where you are and your struggling point in Week2	Review the definition use of formulas, and functions; Definition and Use of charts	Review the definition use of formulas, and functions; Definition and Use of charts	Weekly Quiz: Week1 + Week2	Formulas, Functions and Use of charts
Goal	M-P2; M-D2	CK2; CK3; PS3; PS4	CK2; CK3; PS3; PS4	M-D1; PS1 PS2; PS3	
Week 4	Self-assessment: Where you are and your struggling point in Week3	Some preparing knowledge for final project - budget and family plans	Introduce Pivot table and brainstorm possible plans	1. Weekly Quiz: Week2 + Week3 2. Final Project: Warming up	1. Charts & Pivot table 2. Think about final project
Goal	M-P2; M-D2	PS6	CK4; PS5; PS6	CK1-3; PS1-4 DS1-2	
Week 5	Self-assessment: Where you are, problems for the final project, and suggestions for this module	Pivot table, Some examples of doing a family plan, and question time	Display and Feedback for the final project	Weekly Quiz: Week3 + Week4 + Week5	Final Project C
Goal	M-C2; M-P1; M-P2 M-D1; M-D2	DS1-3; PS5; PS6	DS1-5	CK2-4; PS3-6	

Feedback Timeline:
A In two days: Online detailed feedback / Appointment
B Instant : System Feedback
C In four days: Online detailed feedback

Teaching Approach:
1 Direct Instruction
2 Facilitation via Guided Discovery
3 Coaching to support practice with feedback
4 Facilitation via Open Exploration

6.6 Justification

6.6.1 Instructional Principles From ABC

The key points in the instruction part are supported by ABC[63].

ABC	Justification
Belonging	The instructor can follow 6.1.1 to improve students' belongings.
Contrasting	The instruction part decided to use contrast to teach some concept or set of concepts because students demonstrate greater understanding when they doing contrasting. Although they are of similar outcomes, they have different processes.
Deliberate Practice	The instruction part decided to do deliberate practice and arrange In-class activities because students demonstrate greater learning gains when they doing contrasting.
Feedback	The instruction part decided to give students feedback from both instructors and their classmates (after student-teaching) because feedback helps students identify a discrepancy and ideally points out what to fix.
Just-in-time telling	The instruction part decided to use a problem to guide the content each class. Students will first experience problems before they hear or read the solutions and explanations in the beginning of the class.
Listening and Sharing	The instruction part decided to use student-teaching and discussion part because students can learn to cooperate more effectively, and they will learn about the topic of governance more deeply.
Norms	The instructor can follow 6.3 to organize their norms.
Observation	When doing student-teaching, other classmates will do observations and learn from their tutor. Seeing the consequences of other people's actions allows them to determine which behaviors should be favored or avoided
Question Driven	Instructors will use questions and problems to lead his/her contents
Worked Examples	The instructor will show some worked-examples in every class to help initial students get familiar with each functions or formulas.

---

[63] The ABC's of How We Learn (Schwartz, Tsang & Blair, 2016)

Visualization	The instructor will use projector to show core ways to show the core steps of achieving a function.
eXcitement and Yes	The instructor will improve students' motivation by giving them middle-difficulty in-class tasks and give scaffolding.

6.6.2 ECS Middle School

The module followed ECS's norms and values to improve students' belongings and build the community.[64]
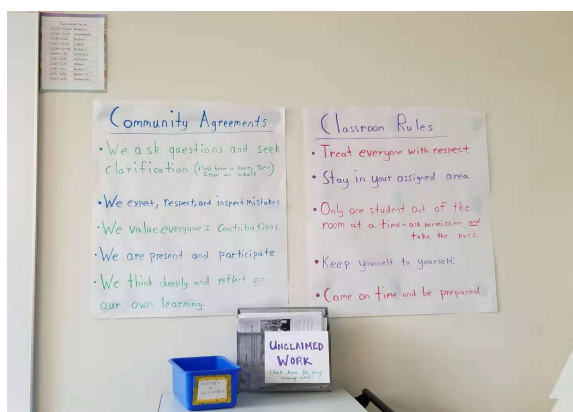
6.6.3 Team Big Ideas

Big Ideas	Instruction
L3. Know and Activate Learner's Prior Knowledge	Use learners' familiar examples to lead a new definition or function. Use learners' math knowledge to improve their understandings.
G2. Connect Instruction Goals with Learner's Goals	Build more life-related worked examples.
G3. Balance Academical and Social Goals	Add the student-teaching part and discussion part.
G4. Build Growth Mindset	The instructor will improve students' motivation by giving them middle-difficulty in-class tasks and give scaffolding.

---

[64] The ABC's of How We Learn (Schwartz, Tsang & Blair, 2016, N Chapter)

A3.1 Give Useful Feedback	In-class activities will gain feedback in class and assignments will gain feedback after 2 days.
I2. Ample Opportunities and Deliberate Practice	From the assessment and in-class activities, the instructor could build a lot of opportunities for students to practice.
I1. Create a Democratic Learning Environment	The student-teaching part allow students to change their role and build equal relationships with the instructor.

6.7 Specific Activities

Example of Instructional activity In Week 2–Class 2

The key teaching approach of this whole module: Direct instruction

For student tutors in this class, the key teaching approach in the student teaching part: Guided discovery and Opening exploratory;

For student tutees in this class, the key teaching approach: Coaching to support practice with feedback.

Category	
The slide link	https://docs.google.com/presentation/d/1xXta70zdB072MTLu6DX2AFOjeL4LiGOQW_YupbUuVg8/edit?usp=sharing
The class activity link	https://docs.google.com/spreadsheets/d/1SufHyZsvOxN9aOAse5fpCrM-uRXHSCtXFSEDeUqHKWo/edit?usp=sharing
Available resources	Laptop for every student, slides, projector, the educational system that linking instructor's laptop with students' laptops so instructor could broadcast his/her screen to each screen of student's laptop
Guidance provided	The instructor will raise up a warm-up question first and during the lecture, the instructor will also show a worked example to

	teach students how to implement the function. Warm-up questions mean some targeted problems to tell students why they need to learn this specific function. Worked examples mean some examples that instructors will show to students by projector. Note: For student tutors, instructors will share his/her slides to them before a week, and have discussions with them during their preparing week. Two day before the class, each student in the tutor group is required to do mock teaching with the instructor, and the instructor needs to give them some feedback based on their current circumstances.
Accommodations for different learners	Some learners might not fully understand the content. So the instructor could open their office-hour and allow students to make appointments with them. Different learners have different understandings about student-teaching. The instructor needs to make sure that they understand it.
Intermediate and final products	Intermediate products will be their learning-by-doing results. The final products are their weekly quiz results.

Conduct Evaluation Research

7.1 Active Ingredient

In my design, the treatment group have the student-teaching activity, and the control group doesn't have this in-class activity. However, the instructor will tell them the same content. What's more, to balance the after-class time of two groups, each student in control group needs to search for 2 examples with the same topic after the class.

This would ensure that the two groups spend approximately equal time in-class and after class for assignments and avoid the possibility because of different time.

Review of student-teaching activity:

Before class: For student tutors, instructors will share his/her slides to them before a week, and have discussions with them during their preparing week. Two day before the class, each student in the tutor group is required to do mock teaching with the instructor, and the instructor needs to give them some feedback based on their current circumstances.

In-class: Group 2 (student tutor group) has prepared about how to deal with that learn-by-doing problem. Now let's welcome them to show how to do it! And they will introduce more examples that could use vlookup function.

7.2 Research to Evaluate Educational Implementation

7.2.1 Fidelity[65] check of teachers

Fidelity: the degree to which, or level of adherence, actual programs, including their procedures, are delivered as intended by the developers and match the original protocol. Fidelity check of teacher following the proposed instruction and assessment design.

the data you plan to collect	the amount of time of treatment - student-teaching activity and control - instructors' lecture as assigned by the instructional design. the assignment in both two groups as assigned by the instructional design.

---

[65] William McKenna, J., & Parenti, M. (2017). Fidelity assessment to improve teacher instruction and school decision making. Journal of Applied School Psychology, 33(4), 331-346.

Form	Scoring	Yes/Not
Did the teacher follow the minute-by-minute schedule as in lesson plan?		
If it was the control group, did the teacher make sure that he gives the same content as the student-teaching team give?		
If it was the control group, did the teacher make sure that students finish their after-class searching homework?		
Did the teacher give approximately equal amount of feedback to students in class?		
Is the teacher passionate about the instructional content enough to motivate students?		

How are the scores on these instruments interpreted and used

Interpretation:

Researchers could interpret it as the levels instructors follow the research arrangement.

Use:

1. Given that the scores of above check-list is formative, so every time, after collected instructors' answers, researchers could use it to help refine the instruction as soon as possible.
2. Before doing the final research, researchers could use the scores to filter the non-compliant courses, which might be messy data.
3. After getting the results, researchers could use the scores to interpret the unreasonable part and see what could be improved next.

7.2.2 Fidelity check of students

Fidelity check of students participating in instruction and assessment as anticipated

Both

Question	Answer
How much time did I use to finish the homework last time?	
Did I finish the homework independently, if not, write the way you asked for help.	
Did I do review before today's class?	
How many times did I raise my hands up and answer teachers' questions?	
Did I finish the in-class activity successfully?	
How many notes did I write for today's class?	
How many percent of today's main lecture did I understand?	

Treatment group

From 1 to 5, how did today's student-teaching activity help you to learn this part?	
From 1 to 5, how did today's student-teaching part helps you to understand today's in-class activity?	
From 1 to 5, how do you think today's student-teaching part helps you to do today's homework?	
From 1 to 5, how do you think today's student-teaching part helps you to do today's homework?	
From 1 to 5, how do you think today's student-teaching part helps you to do your final project?	
From 1 to 5, how do you think today's student-teaching part is valuable?	
Do you find it interesting when listening to the student-teaching part?	
Do you find it inspiring when listening to the student-teaching part?	

Control group

From 1 to 5, how did today's complement part help you to learn this part?	
From 1 to 5, how did today's complement part helps you to understand today's in-class activity?	
From 1 to 5, how do you think today's complement part helps you to do today's homework?	
From 1 to 5, how do you think today's complement part helps you to do today's homework?	
From 1 to 5, how do you think today's complement part helps you to do your final project?	
From 1 to 5, how do you think today's complement part is valuable?	
Do you find it interesting when listening to the complement part?	
Do you find it inspiring when listening to the complement part?	

How are the scores on these instruments interpreted and used

Interpretation:

Researchers could interpret it as the levels students follow the research arrangement.

Use:

1. Before doing the final research, researchers could use the scores to filter the non-compliant student data, which might be messy.
2. After getting the results, researchers could use the scores to interpret the unreasonable part and see what could be improved next.

7.3 Research to Evaluate Educational Impact

Whether student-teaching activity will help students improve their Excel learning gains.

Pre-test:

An objective Pretest will arranged for each student to deal with the covariate influence of prior knowledge.

Post-test:

This is a blind experiment and the graders do not know which students come from control group or treatment group. Each student will do their weekly quizzes and their final project will be scored by 2 graders, the average score will be their final score.

Delayed Post-test (2 weeks later):

An objective Delayed Post-test will arranged for each student to see their delayed learning gains.

Evaluating Result:

If the treatment group outperformed the control group, then it can be shown that student-teaching is beneficial in improving their understanding and learning.

Whether student-teaching activity will help students improve their Excel efficacy[66].

Excel Self-efficacy

| I can do an excellent job on Excel assignments. |
| I can understand the most difficult material presented in Excel lessons. |
| I can master the skills being taught in Excel lessons. |

Pre-test: The Likert scale survey about the following three questions.

Post-test: The Likert scale survey about the following three questions.

Evaluating Result:

If the treatment group showed more positive changes of the average Excel efficacy than the control group, then it can be shown that student-teaching is beneficial in improving their Excel efficacy.

7.4 Basic Research Outline

Research Question(s)	Whether student-teaching activity will help students improve their Excel learning gains. Whether student-teaching activity will help students improve their Excel efficacy.
Experimental Design (experimental and control groups, independent and dependent variables, covariates related to individual differences, etc.)	Experimental Group: Receive the same main instruction and activities in lecture and homework. But each group(divided by teacher) will prepare about how to deal with the in-class learn-by-doing problem. And they will introduce more examples related to the content of that day. Control Group: Receive the same main instruction and activities in lecture and

---

[66] Pintrich, P. R. (1991). A manual for the use of the Motivated Strategies for Learning Questionnaire (MSLQ).

	homework. But the instructor will teach them how to deal with the in-class learn-by-doing problem. And they will have homework as find more examples related to the content of that day. Independent Variable: Whether or not writing have student-teaching activity. Dependent Variable: Their learning gains in Excel Their Excel efficacy. Covariates related to individual differences: Their prior knowledge Their prior Excel efficacy.
Method (subjects, procedure, materials, timeline)	Subjects: students in this module Procedure: Students do a pretest Students have the lectures Treatment group will have a student-teaching part while the control group will have an instructor complementary part. Students do a post-test. Students do a delayed post-test.
Data Collection & Scoring	For the learning gain, scores will be the objective scores and the subjective score of the final project given by two graders. For the Excel self efficacy, the score will be calculated based on the self efficacy form[67]
Hypotheses and Related Predictions	Student-teaching is positively correlated with students' learning gain and Excel self efficacy.
Assessment of Design Quality (sampling, validity, reliability, triangulation, possible confounds …)	**Sampling:** for the division of treatment and control group, it should be a random sample. **Validity:** The objective assessment questions, the experienced graders, the check, and the rubrics make sure that we use appropriate inferences drawn from the evidence, measures actually tapping their target, the evidence reflect

---

[67] Adapted from MSLQ, Pintrich et al., 1993

	what would happen in real life, and the evidence generalizable across populations, and domain.
	Reliability: the performance is repeatable and scores are consistent because it includes objective assessment scores, subjective scores with rubric, and scientific measurement forms supported by relative research.
	Possible confounds:
	Parents' levels of education and their interests in children's education[68]
	Group characteristics
	Students' pre-experiment motivation and expectations[69]
	For treatment group, students' different role in a specific class(tutor or tutee)

---

[68] Flouri, E. (2006). Parental interest in children's education, children's self–esteem and locus of control, and later educational attainment: Twenty–six year follow–up of the 1970 British Birth Cohort. British Journal of Educational Psychology, 76(1), 41-55.

[69] Ewert, A., & Sibthorp, J. (2009). Creating outcomes through experiential education: The challenge of confounding variables. Journal of Experiential Education, 31(3), 376-389.

Self-assessment

Self-Assessment of the Project PRODUCT

- **How well aligned are your goals, assessment and instruction?**

The assessment, instruction, and goals in my final project are clear-aligned. I designed my assessments based on my goals, and then designed my instruction part based on my assessment and goals. I considered different levels of goals when building up my assessment and instruction part.

- **How did your age level focus impact the design, compared to similar units that have been or could be designed for younger and / or older age levels?**

I focus on students in grades 10-11. Compared with Excel teaching in older age level, instruction materials I chose for them are closer to the real life of this age level. Also, I knew that high school students have already had a solid math foundation, and basic logical knowledge, so I feel comfortable to teach them the Excel formulas in this way.

- **In what ways does your design explicitly and thoroughly exemplify course principles (i.e., utilize the big ideas)?**

From norms to values, from assessment design to instructional design, I used a lot of big ideas from our teams big idea project and the course big ideas. I also used principles from textbooks to do justification. I could see how I use it in footnote or some parts in the body.

- **How clearly have you described all five sections of your design so that it would be practically applicable and user-friendly for an educator?**

Each section of my project is clear and easy to put into practice. I attached some sample assessment, instruction narration, and instruction slides to help them use. Also, my task analysis is detailed and painstaking. For the

- **What resources and/or prior knowledge would be required of an educator implementing your design?**

An educator needs to be an expert of Excel to implement my design. If the specific educator doesn't have the prior knowledge, they can go and learn from some external materials first such as Microsoft materials.

- **What are the innovative aspects of your design?**

    1. In my instruction design, I used student-teaching, which is novel in current Excel learning materials.
    2. In my final project, I chose the topic of "family budget plan" because I consider that my targeted learners are high school students.
    3. I added self-assessment to help students do self-reflection before each class time.
    4. In the physical environment of the classroom, I added that each classroom needs to have several public computers.

- **How did you incorporate peer feedback to enhance your project product?**

I read thoroughly about my peer feedback and discussed my meta-level goals with her a lot. Also, I learned how to connect official standards with my own module goals smarter when reading her work.

Self-Assessment of the Project PROCESS

What were the strengths and weaknesses of your individual project design process?

Strengths: I chose an appropriate topic for myself. I chose to use Google doc and started to do my format things early. I almost followed the official timeline, which made me feel less anxious in the final week.
Weaknesses: Goal specification! Need to understand meta-level goals more clear earlier.

- **What challenges did you face as you worked through the project this semester?**

Goal specification! Meta-level goals is the most difficult session for me to put into practice. The second one is validity and reliability.

- **How did you overcome them and/or why do some remain?**

I found that finding some representative words is a useful way to help understand these two things. Thanks to Lauren's appointment, I understood these things much better.

- **How did the experience of giving and receiving peer feedback impact your project process?**

I enjoyed giving feedback to my peers, which is also a good self-reflection process. However, the final poster part, my peer is way behind the timeline, so I cannot give valuable feedback to her, and cannot learn much from her poster.

- **What are your next steps, either with respect to this project if you plan to continue it, or with respect to other projects that could benefit from this approach?**

This project is effective experience to go through the whole backward design. I plan to use the principles I learned in this course to my capstone project.

- **The next time you have an opportunity to begin a new project, how do you plan to proceed differently than you have on this project?**

1. I will read the criteria and rubric more clearly, it's my first time to feel the power of these two things.
2. I will go through the whole picture first and try to build a structure before starting sub-steps.
3. I will do the layout early.
4. I will think more about the feasibility when thinking about the topics.

Bibliography

B.1 Instructional Materials

1. Excel 2016 Essential Training (Linkedin-learning)

https://www.linkedin.com/learning/excel-2016-essential-training/welcome?u=42257553

For All learners-This course includes severl Excel parts from the very basic parts to more difficult parts. Also, it uses Excel 2016, an updated version.

2. Excel Tips Weekly

https://www.linkedin.com/learning/excel-tips-weekly/accelerating-cut-copy-paste-and-insert-tasks?u=42257553

For Advanced learners-This course is a little bit longer than Excel 2016 Essential Training. It contains more productivity-boosting tricks, cool hidden features, need-to-know functions, and advanced content on subjects such as using PivotTables for data analysis.

3. Excel: Power Pivot for Beginners

https://www.linkedin.com/learning/excel-power-pivot-for-beginners/doing-more-in-excel-with-power-pivot?u=42257553

For beginners--This online course focuses on Pivot and explains what it is and the best way to use it. Make Pivot easier to beginners.

4. Windows-Excel training

https://support.office.com/en-us/article/excel-for-windows-training-9bc05390-e94c-46af-a5b3-d7c22f6990bb?wt.mc_id=otc_home&ui=en-US&rs=en-US&ad=US

A very practical article to show basic functions and the whole picture of Excel.

5. https://www.youtube.com/watch?v=9NUjHBNWe9M

6. https://www.youtube.com/watch?v=K74_FNnlIF8

7. Footnotes in targeted pages

B.2 Related Courses

1. Excel Essential Training --in learning

Learning Objectives:

      · Working with the Excel interface

      · Entering data

      · Creating formulas and functions

      · Formatting rows, columns, cells, and data

      · Working with alignment and text wrap

      · Adjusting rows and columns

      · Finding and replacing data

      · Printing and sharing worksheets

      · Creating charts and PivotTables

      · Inserting and deleting sheets

· Using power functions such as IF and VLOOKUP

　　· Password-protecting worksheets and workbooks

　　· Sorting data

　　· Analyzing data with Goal Seek and Solver

　　· Creating and running macros

Opinion:

The exercise files are helpful and specific(I cannot attach them here). It uses a lot of real-life-based examples, which is a useful way to answer Q4 in Design Focus.

2. A course in my undergrad school

Opinion:

It shows a complete picture of how to use Excel to solve data-driven problems. But as a syllabus, it is so generative and each week contains too many tasks. I'm quite curious about how to cover all the parts it mentions in this syllabus.

3. An online course in coursera

Week 1 Overview of Excel--4 hours to complete

In this module, you will learn the basics of Excel navigation and Excel basic functionality. You will learn how to navigate the basic Excel screen including using formulas, subtotals and text formatting. We will provide you an opportunity to perform a problem solving exercise using basic Excel skills. Note: We recommend viewing videos in full-screen mode by clicking the double arrow in the lower right hand corner of your screen.

Assessment:

4 practice exercises

Excel Basics and Navigation Quiz 8m

Basic Functionality Quiz 6m

Subtotal Quiz 2m

Week 1 project quiz 5m

Week 2 vLookups and Data Cleansing--4 hours to complete

In this module, you will learn about VLookup, value cleansing and text functions. We will also introduce you to PwC's perspective on the value in cleansing data and using the appropriate functions. Finally, we will provide you an opportunity to perform a problem-solving exercise using VLookup, value cleansing and text function. Note: We recommend viewing videos in full-screen mode by clicking the double arrow in the lower right-hand corner of your screen.

Assessment:

VLookup8m

Data Cleansing - Values Quiz 6m

Data Cleanse - Text Quiz 6m

Week 2 Quiz 5m

Week 3 Logical Functions & Pivot Tables--**3 hours to complete**

In this module, you will learn about logical functions and pivot tables. We will show you how to create and use pivot tables to solve business problems. We will give you an opportunity to practice creating and using a pivot table to solve a business problem.

Assessment:

Logical Functions Quiz 8m

Pivot Tables Quiz 8m

Week 3 Project Quiz 6m

Week 4 --5 hours to complete

More Advanced Formulas

In this module, you will learn more advanced Excel formulas. We will show you how to create statistical formulas, perform an index match, and lastly, build financial formulas. We will provide you with an opportunity to problem solve using statistical formulas. Finally, we will give you an opportunity to practice what you have learned through a final project. Note: We recommend viewing videos in full-screen mode by clicking the double arrow in the lower right-hand corner of your screen.

Assessment:

Statistical Forecasting Quiz 12m

Index Match Quiz 8m

Financial Functions 8m

Week 4 Project Quiz 10m

Opinion:

There are a lot of related courses in Coursera but I think this one is the clearest one. Its assessments are concrete and life-related, it also labeled the time learners need in each part clearly. A good example.

4. CMU Excel VLookups and Pivot Tables with Financial Data

https://www.cmu.edu/finance/training/catalog/instructor/excel/index.html

Problem Overview: Let's assume you work for the Zoology department at Carnegie Mellon. The Zoology department consists of 3 organizations: Zoology, Anthropology and Paleontology. The department head has asked you to analyze how the department's money was spent on operating expenses for Fiscal Year 2011.

B.3 Reference

NEAP 2015: https://www.nationsreportcard.gov/reading_math_g12_2015/

NEAP 2018: https://nces.ed.gov/nationsreportcard/tel/

Pennsylvania Standards: http://exdev.pdesas.org/Standard/StandardsDownloads

Andrade, H.&Valtcheva, A. (2009). Promoting learning and achievement through self-assessment. Theory Into Practice, 48, 12-19.

Bartolome, L. (1994). Beyond the methods fetish: Toward a humanizing pedagogy. *Harvard educational review*, *64*(2), 173-195.

Ewert, A., & Sibthorp, J. (2009). Creating outcomes through experiential education: The challenge of confounding variables. *Journal of Experiential Education*, *31*(3), 376-389.

Schwartz, D. L., Tsang, J. M., & Blair, K. P. (2016). *The ABCs of how we learn: 26 scientifically proven approaches, how they work, and when to use them*. WW Norton & Company.

Pintrich, P. R. (1991). A manual for the use of the Motivated Strategies for Learning Questionnaire (MSLQ).

Wiggins, G., Wiggins, G. P., & McTighe, J. (2005). *Understanding by design*. Ascd.

Guerin, D. W., Gottfried, A. W., Oliver, P. H., & Thomas, C. W. (1994). Temperament and school functioning during early adolescence. The Journal of Early Adolescence, 14(2), 200-225.

Zhang, C. (2014). Incorporating powerful Excel tools into finance teaching. Journal of Financial Education, 87-113.

Some references from other online materials are marked in each footnote