Integrating Projects In Liberal Arts Math Courses

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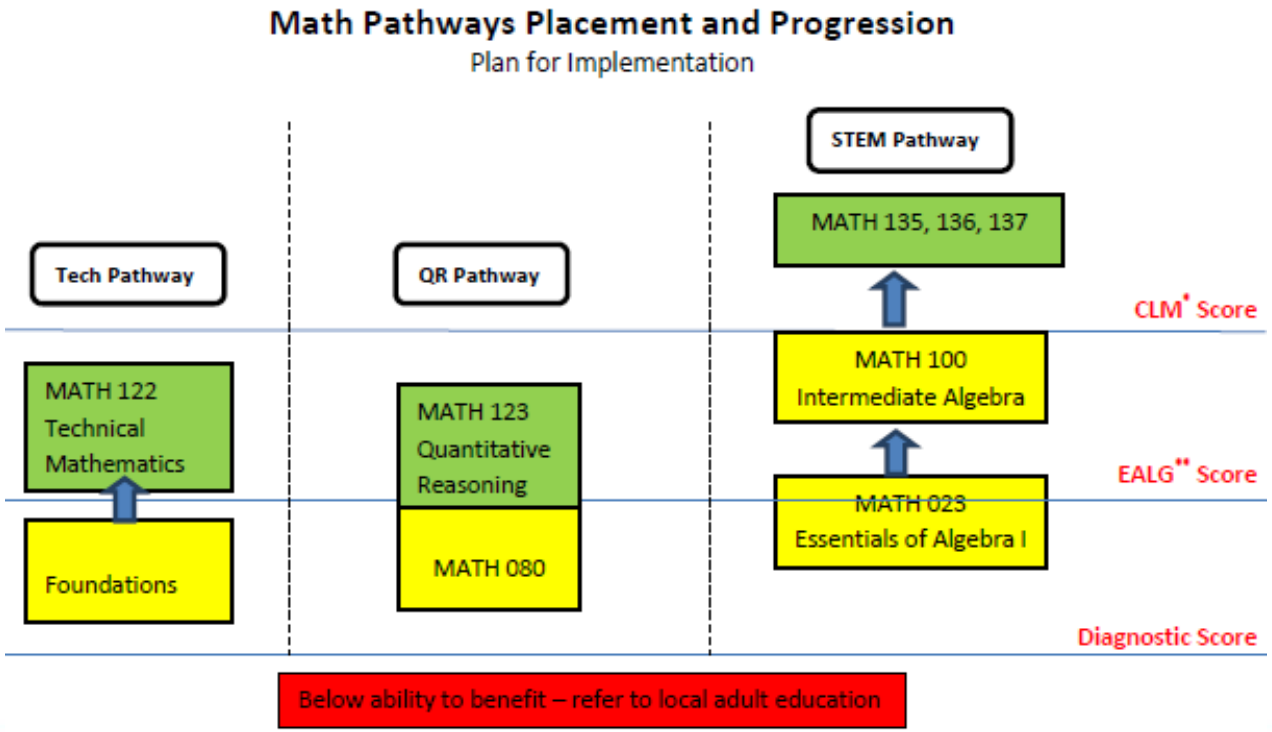
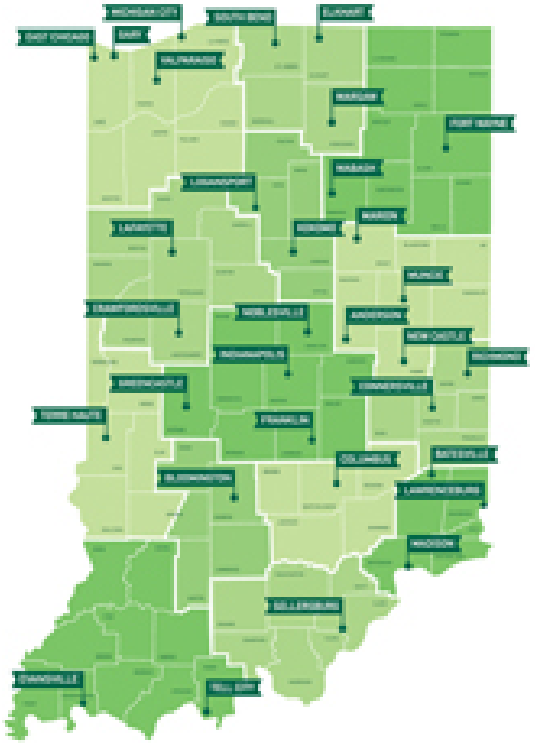
CHANGING LIVES

IVY TECH COMMUNITY COLLEGE

Ivy Tech Community College





CHANGING LIVES

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Why Projects?

Another Assessment Tool:

- Not timed
- More integrated and complex
- Opportunity to communicate with mathematics
- Problem Solving
- Creative outlet
- Process of drafts and revisions

Why Projects?

Connections:

- Applications to job and “real” life
- Opportunity for “Ah ha” moments
- Use other resources
- Collaboration

Why Projects?

Group input:

- Practice writing skills/ Excel or other skills
- Put more of self into it
- Encourages research
- Way to show different skills
- Helps to make life decisions
- Real life practical application

Why Projects?

Group input:

- Helping them to think quantitatively
- “I’m really going to use this”
- Can provide choices
- Personalize
- Hard to cheat
- Make a connection to community

Challenges

- Open ended problems can be difficult to grade
- Open to interpretation by students and teachers
- Managing appropriate student resources
- Online searches can lead in wrong direction
- Answers may be available on the internet
- Distinguishing between collaboration and cheating

Challenges

Group Input:

- Writing clear enough to get right answer, but not too restrictive.
- How to give an example without students repeating
- Time consuming
- Students repeating the course
- Creating new projects
- Collaborating with other instructors
- Supporting adjuncts

Ways to Support:

- Share examples, grade as a class
- Model excellence
- Provide feedback on rough drafts
- Project checklist
- Writing support document
- Videos
- *Co-requisite course support

Ways to Support:

Group Input:

- Require a personal meeting
- Check points
- Utilizing library resources
- Create a cover sheet with expectations
- Extra “quiz” on project questions

Sample Projects:

F:\Math 123\Project Examples

Grading Rubrics:

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Math 123 Using the Assignment Rubric

The Assignment:

Below are student responses to: Million Dollar Job –Would it be physically possible to take $1,000,000 in cash? Come up with a convincing argument as to whether this would be possible or not. Write a minimum one page explanation using complete and grammatically correct sentences and include diagrams, calculations, formulas, tables as necessary. Follow the syllabus guidelines for written work. **Reminder:** This assignment will be graded using the rubric in the syllabus.

Example 1:

Nowadays, you don't see very much cash. Normally, personal assets and wealth are streamlined into a bank account…….There are a variety of reasons as to why so many people are ditching traditional currency in lieu of electronic vaults. The most glaring and obvious reason is the safety and security that comes along with depositing in the bank……

But we've all seen movies (typically from the 80's) that utilize a black briefcase packed with stacks of hundred dollar bills….

Let's say all the bills are grouped in bundles of $1,000. In each of those bundles are 10 bills. Just because a $100 dollar bill is worth more than a $1 dollar bill doesn't mean they both don't look the same stacked…..So in the suitcase, there would be 1,000 bundles, bundles comprised of $1,000.

Now I have no idea WHY anyone would have a briefcase packed with Benjamins, but given the crazy nature….

Example 2:

The easiest scenario that I could come up with for taking $1,000,000 is if you took 10,000 $100 bills. The way I calculated how many $100 bills you would need to take is by figuring out how many $100 bills there are in $1,000,000. I figured out the number by dividing 1,000,000 by 100. The answer to this calculation was 10,000….

Taking 10,000 $100 bills would take quite some time. It would be fairly simple if there were large quantities of $100 bill in bags. I figured if we got 5 bags that each contain 2,000 $100 bills then we would have one million dollars….I calculated how many bags we would need by dividing 10,000 by 2,000. This gave me the number 5. Therefore we need 5 bags that each contain 2,000 $100 bills in order to have one million dollars.

Example 3:

In order to decide if it is possible to move $1 million dollars, it is necessary to determine if it is physically feasible to move $1 million dollars. The following tables provide the information necessary to develop a realistic conclusion.

Table 1: Information Constants

Approximate weight in grams	1
Number of grams per pound	454
Bill thickness (in inches)	0.0043
# of bills in a 1" stack	233
Bill length (in inches)	6.14
Bill width (in inches)	2.61
Carry- on Length (in inches)	22
Carry -on Width (in inches)	14
Carry -on depth (in inches)	9
Number of 9" stacks per carry-on	15

Table 2: Bill Denomination Variables

Denomination	$value /pound	Total pounds / $1 million	Approximate # of 9" stacks	Approximate # carry-ons required.
$1	$454	2202.6	476.9	32
$5	$2,270	440.5	95.4	6
$20	$9,080	110.1	23.8	2
$100	$45,400	22.0	4.8	Less than 1

- It would be physically impossible for one person to steal $1 million dollars in $5 bills; however, three people could move two carry-ons each.
- Stealing $1 million $10 bills would require two people to manage the three carry-ons necessary
- It would require only one individual to move $1 million in $20, $50, and $100 bills….

The easiest, most feasible method of stealing $1 million would be in bill denominations of $100. In this denomination, the total haul would weigh approximately 22 pounds and would be able to be carried in a satchel or backpack….

Sample Rubric for general problem solving tasks

	Level 0-1	**Level 2-3**	**Level 4-5**
Solving the Problem	Did not understand the problem and/or didn't show any work.	Understood the problem well enough to solve the task.	Solved the task and showed evidence that verified the answer.
Degree of Sophistication	Little or no attempt was made to actively explore the solution method.	A systematic approach was used that will produce a correct answer.	Solution method is efficient, and/or elegant and demonstrates mathematical sophistication.
Representations	Did not use any representations such as tables, diagrams, equations, organized lists, etc., to help explain the solution.	Made appropriate representations to help solve the task or help explain the solution, but more organization or explanation was needed.	Used appropriate and correct representations to solve the task.
Presentation	The presentation of the solution and reasoning was unclear to others.	The presentation of the solution was clear in most places, but others may have trouble understanding parts of it.	The presentation of the solution is clear and can be understood by others.

General question scoring rubric

6 Points:	Mastery
5 Points:	Conceptual Mastery with minor quantitative error
4 Points:	Conceptual Mastery with minor reasoning error
3 Points:	Attempt with multiple correct quantitative or reasoning findings
2 Points:	Attempt with conceptual errors
1 Point:	Attempt with no conceptual knowledge
0 Points:	Blank

Example of a Grading Rubric For a Term Paper in Any Discipline

Modeled after rubric used in the UC Davis English Department Composition Program

	The A paper	The B paper	The C paper	The D paper	The F paper
Ideas	Excels in responding to assignment. Interesting, demonstrates sophistication of thought. Central idea/thesis is clearly communicated, worth developing; limited enough to be manageable. Paper recognizes some complexity of its thesis: may acknowledge its contradictions, qualifications, or limits and follow out their logical implications. Understands and critically evaluates its sources, appropriately limits and defines terms.	A solid paper, responding appropriately to assignment. Clearly states a thesis/central idea, but may have minor lapses in development. Begins to acknowledge the complexity of central idea and the possibility of other points of view. Shows careful reading of sources, but may not evaluate them critically. Attempts to define terms, not always successfully.	Adequate but weaker and less effective, possibly responding less well to assignment. Presents central idea in general terms, often depending on platitudes or cliches. Usually does not acknowledge other views. Shows basic comprehension of sources, perhaps with lapses in understanding. If it defines terms, often depends on dictionary definitions.	Does not have a clear central idea or does not respond appropriately to the assignment. Thesis may be too vague or obvious to be developed effectively. Paper may misunderstand sources.	Does not respond to the assignment, lacks a thesis or central idea, and may neglect to use sources where necessary.
Organization & coherence	Uses a logical structure appropriate to paper's subject, purpose, audience, thesis, and disciplinary field. Sophisticated transitional sentences often develop one idea from the previous one or identify their logical relations. It guides the reader through the chain of reasoning or progression of ideas.	Shows a logical progression of ideas and uses fairly sophisticated transitional devices; e.g., may move from least to more important idea. Some logical links may be faulty, but each paragraph clearly relates to paper's central idea.	May list ideas or arrange them randomly rather than using any evident logical structure. May use transitions, but they are likely to be sequential (first, second, third) rather than logic-based. While each paragraph may relate to central idea, logic is not always clear. Paragraphs have topic sentences but may be overly general, and arrangement of sentences within paragraphs may lack coherence.	May have random organization, lacking internal paragraph coherence and using few or inappropriate transitions. Paragraphs may lack topic sentences or main ideas, or may be too general or too specific to be effective. Paragraphs may not all relate to paper's thesis.	No appreciable organization; lacks transitions and coherence.
Support	Uses evidence appropriately and effectively, providing sufficient evidence and explanation to convince.	Begins to offer reasons to support its points, perhaps using varied kinds of evidence. Begins to interpret the evidence and explain connections between evidence and main ideas. Its examples bear some relevance.	Often uses generalizations to support its points. May use examples, but they may be obvious or not relevant. Often depends on unsupported opinion or personal experience, or assumes that evidence speaks for itself and needs no application to the point being discussed. Often has lapses in logic.	Depends on cliches or overgeneralizations for support, or offers little evidence of any kind. May be personal narrative rather than essay, or summary rather than analysis.	Uses irrelevant details or lacks supporting evidence entirely. May be unduly brief.
Style	Chooses words for their precise meaning and uses an appropriate level of specificity. Sentence style fits paper's audience and purpose. Sentences are varied, yet clearly structured and carefully focused, not long and rambling.	Generally uses words accurately and effectively, but may sometimes be too general. Sentences generally clear, well structured, and focused, though some may be awkward or ineffective.	Uses relatively vague and general words, may use some inappropriate language. Sentence structure generally correct, but sentences may be wordy, unfocused, repetitive, or confusing.	May be too vague and abstract, or very personal and specific. Usually contains several awkward or ungrammatical sentences; sentence structure is simple or monotonous.	Usually contains many awkward sentences, misuses words, employs inappropriate language.
Mechanics	Almost entirely free of spelling, punctuation, and grammatical errors.	May contain a few errors, which may annoy the reader but not impede understanding.	Usually contains several mechanical errors, which may temporarily confuse the reader but not impede the overall understanding.	Usually contains either many mechanical errors or a few important errors that block the reader's understanding and ability to see connections between thoughts.	Usually contains so many mechanical errors that it is impossible for the reader to follow the thinking from sentence to sentence.