The SABES Mathematics and Adult Numeracy Curriculum & Instruction PD Team

# Using Digital Literacy to Open Up Math

The resource below provides some examples of how digital literacy can be used to open up traditional math problems to increase student engagement and deepen content knowledge. As you look across the columns, note how the traditional workbook problem is adjusted and the ways in which students can participate in the development of additional investigations on what currently is a relatively direct and limited problem.

Traditional workbook problem:

*John is interested in buying a used car for $15,000. He puts down 25% with the rest to be paid over a 5-year period. If his monthly payments are $197, how much will he pay altogether for the car?*

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| **Steps to open-up word problems** | **Closed (traditional) word problem** | **Opened-up word problem** |
| Limit the information provided to students and instead have them **find information** based on their own interests. | *John is interested in buying a used car for $15,000.* | *Check out the prices of vehicles at two different dealerships in the area. Decide on a vehicle that might suit your needs.* |
| Allow students to **make choices on figures**, when possible, or **recommend a range** of choices. | *He puts down 25% with the rest to be paid over a 5-year period.* | *Decide the amount you want to put down and the number of years you want to finance the vehicle. Decide the maximum monthly payment you can afford.* |
| Instead of having one answer, provide a way for students to **evaluate the information** they gathered, **organize and make meaning** of the information, and **communicate the reasoning** behind the choices they made **using a variety of methods, visuals, and models**. | *If his monthly payments are $197, how much will he pay altogether for the car?* | *Create a graph and/or in-out table to show the cost of the vehicle over the years that you have financed it for and be prepared to explain your choices.* |
| **Differentiate** the same problem **for multilevel classrooms** by providing conditions for the types of numbers to use. For example, using less-friendly numbers for more advanced students or more friendly and common numbers for less advanced students. Other options: provide more or less information, offer more or less decisions, provide more or less steps (each of these can provide a push for more advanced students or support for those needing greater assistance). | Use more ‘friendly’ numbers in the problem to make the problem easier.Use more challenging numbers in the problem to make the problem harder. | Conditions for more advanced students:*Estimate a reasonable answer first. Use two different down payment percents with a non-repeating fraction or decimal in each. Compare two different car deals on a trend graph.*Conditions for less advanced students:*Estimate a reasonable answer first. Use one of the following benchmark percents for the down payment: 10%, 15%, or 25%. Use the \*provided in-out table to track the cost of the vehicle after the down payment (Year 0) and for each of the next 5 years.*  |
| Suggested **digital literacy tools** can extend beyond the basic calculator functions. Encourage students to use more advanced functions on their smart phone calculator apps and/or to become familiar with spreadsheet and graphing functions found in programs like [Microsoft Excel](https://products.office.com/en-us/excel), [Google Sheets](https://www.google.com/sheets/about/), and [Desmos](https://www.desmos.com/). | CalculatorSmart phone (calculator) | CalculatorSmart phone (calculator)[Amortization calculator](https://www.amortization-calc.com/) or appWeb searchSpreadsheets and graphs* Excel
* Google Sheets
* Desmos

Word processing and presentations* MS Word
* Google Docs
* MS PowerPoint
* Google Slides
* Smart phone videos

[GCFLearnFree.org](https://edu.gcfglobal.org/en/) – training for the software/apps |

\*Decide how much detail to share with students in the in-out table to provide just enough support while still creating opportunities to challenge them. See example and sample answer on the next page.

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| **Year** | **Accumulated Total Cost Over Time** |
| 0 | Down payment |
| 1 | 12 months x car payment + down payment |
| 2 | 12 months x car payment + Year 1 total |
| 3 | 12 months x car payment + Year 2 total |
| 4 | 12 months x car payment + Year 3 total |
| 5 | 12 months x car payment + Year 4 total |

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| ***Year*** | ***Accumulated Total Cost Over Time*** *(sample answer based on example provided in traditional workbook problem)* |
| *0* | **$3750** |
| *1* | $197 x 12 = $2364 + $3750 = **$6114** |
| *2* | $197 x 12 = $2364 + $6114 = **$8478** |
| *3* | $197 x 12 = $2364 + $8478 = **$10,842** |
| *4* | $197 x 12 = $2364 + $10,842 = **$13,206** |
| *5* | $197 x 12 = $2364 + $13,206 = **$15,570** |

Notice and Wonder

Another way to open-up traditional problems is to **remove the question completely** (and the answer key!) and simply ask, “What do you notice?” and “What do you wonder?” (Watch this short video to learn how this works: [Ever Wonder What They’d Notice?: Annie Fetter](https://www.youtube.com/watch?v=a-Fth6sOaRA). More detailed information can be found at <https://www.nctm.org/Classroom-Resources/Problems-of-the-Week/I-Notice-I-Wonder/>).

**Traditional workbook problem with the question removed:**

*John is interested in buying a used car for $15,000. He puts down 25% with the rest to be paid over a 5-year period.*

Display the traditional workbook problem (with the question removed) and ask students to spend a few minutes jotting down the things they notice and wonder and then share these observations with a partner or the whole class. This generates critical thinking and reasoning about what information is needed before attempting to plugging into a formula or calculating numbers that may not be relevant. It’s quite common for students to come up with the actual question themselves but in their own words, which helps to make sense of the problem. It also gives them practice developing test-like questions themselves based on their own understanding of the problem and the choices they make.

From those noticings and wonderings, teachers can then move right into the steps to open-up word problems shown at the start of this handout.