11.4 Developing and Implementing a Project Plan

***MathLinks 9*, pages 440–443**

Suggested Timing
80–100 minutes

Materials
- computer with Internet access

Blackline Masters
Master 1 Project Rubric
BLM 11–1 Chapter 11 Math Link Introduction
BLM 11–5 Research Project Checklist
BLM 11–7 Section 11.1 Math Link
BLM 11–9 Section 11.2 Math Link
BLM 11–11 Section 11.3 Math Link
BLM 11–12 Research Project Rubric
BLM 11–13 Sample Research Project Rubric

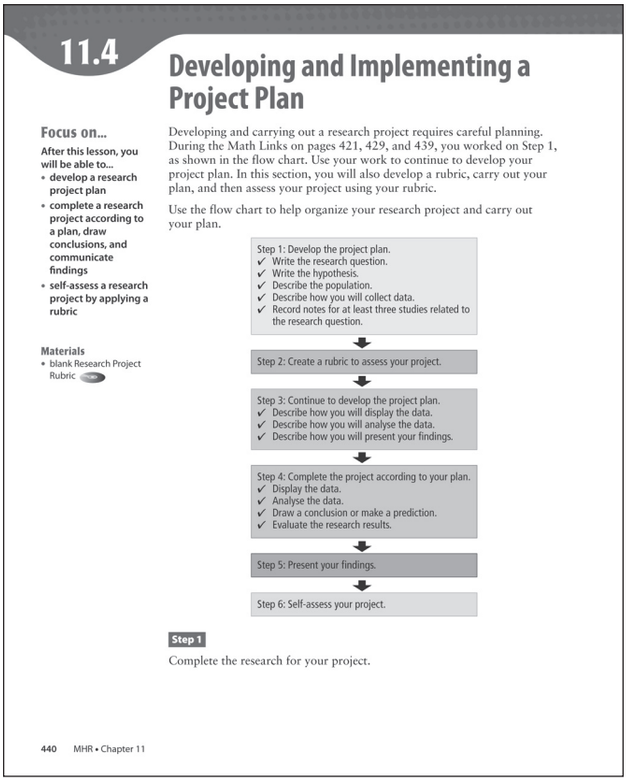
Mathematical Processes
- ☑ Communication (C)
- ☐ Connections (CN)
- ☐ Mental Math and Estimation (ME)
- ☑ Problem Solving (PS)
- ☑ Reasoning (R)
- ☑ Technology (T)
- ☑ Visualization (V)

Specific Outcomes
SP3 Develop and implement a project plan for the collection, display and analysis of data by:
- formulating a question for investigation
- choosing a data collection method that includes social considerations
- selecting a population or a sample
- collecting the data
- displaying the collected data in an appropriate manner
- drawing conclusions to answer the question.

SP4 Demonstrate an understanding of the role of probability in society.

Planning Notes

In this section, students apply the concepts and skills they have learned throughout the chapter to complete their research project. It is essential that students complete the Math Links in sections 11.1, 11.2, and 11.3 in order to meet the requirements for Step 1 as shown on page 440 in the student resource. If students have not completed the Math Links earlier, have them complete Step 1 at this time. In section 11.4, students continue to develop their research plan, develop a rubric, carry out their plan, and then assess their project using the rubric they developed.



11.4

Developing and Implementing a Project Plan

Focus on...

After this lesson, you will be able to...
- develop a research project plan
- complete a research project according to a plan, draw conclusions, and communicate findings
- self-assess a research project by applying a rubric

Materials
- blank Research Project Rubric

Developing and carrying out a research project requires careful planning. During the Math Links on pages 421, 429, and 439, you worked on Step 1, as shown in the flow chart. Use your work to continue to develop your project plan. In this section, you will also develop a rubric, carry out your plan, and then assess your project using your rubric.

Use the flow chart to help organize your research project and carry out your plan.

Step 1: Develop the project plan.
✓ Write the research question.
✓ Write the hypothesis.
✓ Describe the population.
✓ Describe how you will collect data.
✓ Record notes for at least three studies related to the research question.

Step 2: Create a rubric to assess your project.

Step 3: Continue to develop the project plan.
✓ Describe how you will display the data.
✓ Describe how you will analyse the data.
✓ Describe how you will present your findings.

Step 4: Complete the project according to your plan.
✓ Display the data.
✓ Analyse the data.
✓ Draw a conclusion or make a prediction.
✓ Evaluate the research results.

Step 5: Present your findings.

Step 6: Self-assess your project.

Step 1
Complete the research for your project.

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Direct students to the flow chart that organizes the research project in steps. Read and discuss the steps.

For Step 1, students need to complete their work for the Math Links in sections 11.1, 11.2, and 11.3.

For Step 2, students develop a rubric using **BLM 11–12 Research Project Rubric** to assess their own work. Review the sample rubric in the student resource on page 441. Explain that the rubric needs to show the criteria for assessing the project and the indicators that show how well the criteria have been met. Explain that the criteria need to reflect the important parts of the project. The sample rubric shows the areas of planning, performing, recording, analysing, and presenting. Explain the four levels of performance. Encourage students to ask questions about what they are to do and clarify any misunderstandings. Tell students that after completing the rubric, they should be able to identify their areas of strength and areas where improvement is needed.

Step 2

Develop a rubric so that you know what is expected. Use the following example and a copy of the blank Research Project Rubric to help develop your own.

- List the criteria in column 1. You may find it useful to order the criteria according to the sequence of the project.
- For each criterion, record an indicator for each of four levels of performance. See how the first row in the example below is completed to give you ideas for your own rubric.
  - Level 1 reflects work that shows little evidence of expected results.
  - Level 2 reflects work that meets the minimum expected standard.
  - Level 3 reflects work that meets the expected standard.
  - Level 4 reflects work that is beyond the expected standard.

Criteria	Level 1	Level 2	Level 3	Level 4
Planning • question and hypothesis • description of population	• not clear and not related • limited or missing	• fairly clear but not related • some description	• mostly clear and related • adequate description	• very clear, concise, and related • detailed description
Performing • research and data collection				
Recording • data display				
Analysing • analysis • conclusion(s)				
Presenting • project plan and evaluation of results				

Step 3

Continue to develop the project plan.

a) Describe how you will organize and display your data. Select only data that help you answer your question.

b) Describe your method for analysing the data from the studies you find. Consider the following ideas.
- Describe any assumptions that were made. Explain the limitations of each assumption.
- Discuss the accuracy of any predictions made about the population.

c) Describe how you will present your findings.

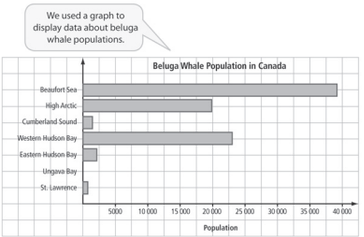
Step 4

Complete the project.

a) Display the data.

b) Analyse the data. Draw a conclusion or a prediction you can make from the data.

c) Evaluate your research results. Consider using the following questions.
- Do the data answer your question or do you need to do further research?
- Do the data support your hypothesis? Explain.
- Are the data biased? Explain.
- What questions could you ask as a result of your research?
- What other sampling methods could have been considered?
- Troubleshoot any problems you may have encountered, such as the following: Did you use too few resources? Was your research question too broad? How well was the data collected? Were there influencing factors on the collection of data?



Distribute **BLM 11–12 Research Project Rubric** and have students work individually, in pairs, or in small groups to develop the rubric. Alternatively, you might use an overhead and a copy of the blank rubric to develop the rubric as a class. You might also consider having students use the **Master 1 Project Rubric**, which is used throughout the student resource, and work individually, in pairs, or in small groups to develop the criteria. If so, provide students with this master, in which the right column is left blank. Again, you might use an overhead of this master and develop the criteria for the research project as a class. If so, use the sample rubric in the student resource as a guide.

For Step 3, students continue to develop their project plan. Ensure that students understand that in addition to the display of data, they need to provide a detailed description and discussion for parts a) and b) on page 442 in the student resource. For part a), encourage students to justify their choices of data.

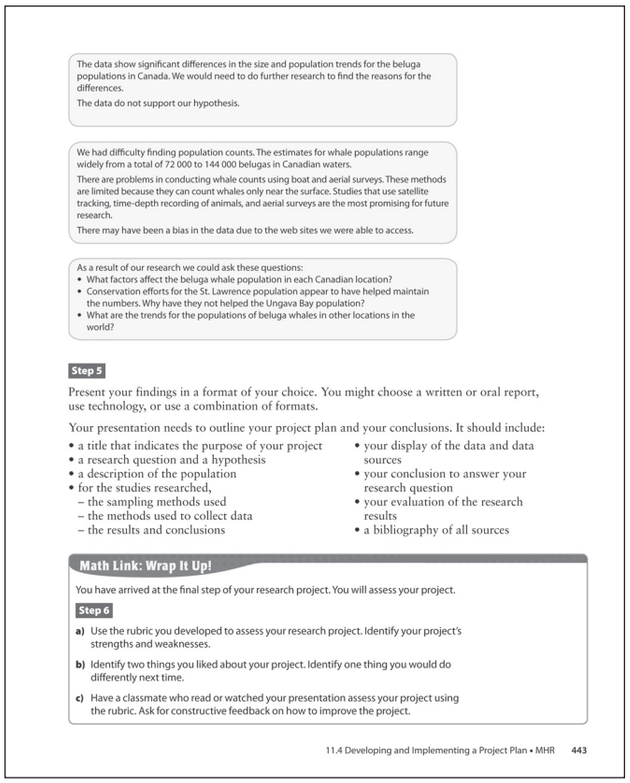
For Step 4, students complete their project according to their plan. Have students draw a conclusion or make a prediction from the data. Remind them to take into consideration whether the samples are representative and to include any assumptions and limitations in their prediction.

Direct students to the example for Step 4 on pages 442 and 443, which shows using a graph to display data about the beluga whale population in Canada, and provides an example evaluation of the research results.

For Step 5 described on page 443, students present their findings in a format of their choice. Encourage them to select a presentation format that allows them to show their work throughout the project and their findings. Review the criteria for the presentation. You will need to allow for additional time for students to present their findings.

Remind students to provide a bibliography of all sources using the format you prefer. You might refer them to the format modelled in the Math Link on page 439 in the student resource for electronic sources. The Web Link on TR page 593 provides a link to information about using MLA style to reference electronic sources.

For an electronic source include:
- Author and/or editor names
- Name of the database, or title of project, book, article
- Any version numbers available
- Date of version or posting
- Publisher
- Date you accessed the material
- Electronic address



The data show significant differences in the size and population trends for the beluga populations in Canada. We would need to do further research to find the reasons for the differences.

The data do not support our hypothesis.

We had difficulty finding population counts. The estimates for whale populations range widely from a total of 72 000 to 144 000 belugas in Canadian waters.

There are problems in conducting whale counts using boat and aerial surveys. These methods are limited because they can count whales only near the surface. Studies that use satellite tracking, time-depth recording of animals, and aerial surveys are the most promising for future research.

There may have been a bias in the data due to the web sites we were able to access.

As a result of our research we could ask these questions:
- What factors affect the beluga whale population in each Canadian location?
- Conservation efforts for the St. Lawrence population appear to have helped maintain the numbers. Why have they not helped the Ungava Bay population?
- What are the trends for the populations of beluga whales in other locations in the world?

Step 5

Present your findings in a format of your choice. You might choose a written or oral report, use technology, or use a combination of formats.

Your presentation needs to outline your project plan and your conclusions. It should include:
- a title that indicates the purpose of your project
- a research question and a hypothesis
- a description of the population
- for the studies researched,
  - the sampling methods used
  - the methods used to collect data
  - the results and conclusions
- your display of the data and data sources
- your conclusion to answer your research question
- your evaluation of the research results
- a bibliography of all sources

Math Link: Wrap It Up!

You have arrived at the final step of your research project. You will assess your project.

Step 6

a) Use the rubric you developed to assess your research project. Identify your project's strengths and weaknesses.

b) Identify two things you liked about your project. Identify one thing you would do differently next time.

c) Have a classmate who read or watched your presentation assess your project using the rubric. Ask for constructive feedback on how to improve the project.

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An example using MLA style is provided here.

Electronic Source
Complete publication information may not be available for a web site.
Author. "Title of Web Page." Title of the Site. Editor. Date and/or Version Number. Name of Sponsoring Institution. Date of Access <URL>.

Smith, T. G. "COSEWIC Assessment and Update Status Report on the Beluga Whale *Delphinapterus leucas* in Canada." 2004. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 20 Oct 2008 <http://dsp-psd.pwgsc.gc.ca/Collection/CW69-14-170-2004E.pdf>.

Book
Author. *Title of Book*. Publisher, Date.

Cunningham, Mary K., Al Merritt, and Laura Tremblay. *Beluga Whales in Canada*. Toronto: Thomson Nelson, 2007.

Newspaper Article
Author. "Title of Article." Name of Newspaper Date, edition: Page(s).

Daran, Neil. "Beluga Whales Debated." Nunavut Star-Bulletin 8 Apr. 2004, final ed.: A3.

Magazine Article
Author. "Title of Article." Title of Magazine Date: Page(s).

Farley, Chris, and James Will. "Beluga Whales Are Endangered." Macleans 19 Jan. 2008: 50+.

Personal Interview
Till, Adam. Personal interview. 20 Oct 2008.

Remind students to do the following for their bibliographic sources:
- List all references in alphabetical order. If there is no author, use the first word of the title. Ignore *A*, *An*, *The*.
- List the day before the month.
- Use the three-letter abbreviation for each month except for May and July, which are spelled out.
- Single space each reference.
- Indent five spaces for the second and subsequent lines.
- Double space between entries.

An example is provided.
Cunningham, Mary K., Al Merritt, and Laura Tremblay. *Beluga Whales in Canada*. Toronto: Thomson Nelson, 2007.

Daran, Neil. "Beluga Whales Debated." Nunavut Star-Bulletin 8 Apr. 2004, final ed.: A3.

Till, Adam. Personal interview. 20 Oct 2008.

For Step 6 described on page 443 in the student resource, which is the Wrap It Up! for this chapter, students use the rubric from Step 2 and assess their own work.

Encourage students to use the flow chart on the back of their Foldable to continue tracking their progress on the research project. Alternatively, and if you have not done so earlier, you might provide **BLM 11–5 Research Project Checklist** and have students check off each step as it is completed.

Meeting Student Needs

- Encourage students who would benefit from an organizational tool to help plan their work to use the flow chart. Have them use the steps to help direct their progress.
- For Step 1, if students have not completed the Math Links earlier, you may wish to provide them with **BLM 11–1 Chapter 11 Math Link Introduction**, **BLM 11–7 Section 11.1 Math Link**, **BLM 11–9 Section 11.2 Math Link**, and **BLM 11–11 Section 11.3 Math Link**, which provide scaffolding.
- For Step 2, consider allowing students to use the rubric provided on **BLM 11–13 Sample Research Project Rubric** to assess their project.
- For Step 3, encourage students to refer to the notes in their Foldable to review terms including assumptions, limitations, and predictions.

ELL

- Clarify the meaning of *rubric*, *troubleshoot*, and *broad*.
- Consider reducing some of the expectations for the research project. For instance, you might coach students to identify what data to display. Or, you might provide some or all of the related research or have students select research that is written at an appropriate reading level. Pre-teach the vocabulary for research that students provide.

Common Errors

- Some students may present findings with no analysis.

R_x Reinforce the requirements for the project. If necessary, coach students to follow the criteria in Steps 3 and 4, which scaffold the requirements for describing, analysing, and evaluating the project.

Web Link

For information about how to reference electronic sources using MLA style, go to www.mathlinks9.ca and follow the links.

Assessment	Supporting Learning
Assessment *as* Learning	
Math Learning Log Have students complete the following statements: What I liked best about this section is ... What I liked best about this chapter is ...	• Encourage students to refer to the notes in their Foldable. Encourage them to comment on what they learned in this chapter that they can carry over into other courses. • Depending on students' learning styles, have them provide oral or written answers. • Encourage students to use the What I Need to Work On section of their Foldable to note what they continue to have difficulties with.