# Stage 2 STEM learning framework

Identify and define phase

Table 1 Prompts and learning tools for identify and define phase

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| What we are looking for | Question prompts to guide learning (Observations) | Possible learning and assessment tools |
| Recognise the role of people in design solutions.  | Who designs things? Why are they designed?Can you explain a design solution in your home or community? Why was it designed? How is it used?How have these jobs changed over time? | [Gallery walks](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/555#.Xt77TF56o-M.link)[Brainstorming](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/542#.XuG1y9K_Pjc.link)[Using keywords](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/565#.XuG1y1Nze-U.link)[STEM journal/design folio](https://docs.google.com/presentation/d/1riWdXBRu5ug9DQ1ib2tBIvDy8jBnSCNsYUvmJPLwtY4/template/preview)[Learning portfolio](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/583#.XuL8o15B_oI.link) |
| Identify main ideas and select and clarify information from a range of sources. | Can you identify …? What evidence can you find …? What are the relationships between … and …?What are the parts of …? How is related to …? Why do you think …? | [Simple graphic organiser](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/599#.Xtmqei5RGpE.link)[Design thinking – design folio](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/619#.Xt7_L7K7Sz8.link)[Learning intentions and success criteria](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/622#.Xt7_L-KcCy4.link) |
| Explore users’ needs and how they think, feel, and behave. | What are users thinking about the problem?How do they feel? How do they show their feelings?Could you make them feel differently? How?What are they already doing? How do you know? | [Plus minus interesting](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/551#.Xtnd8n2lkn8.link)[Hot seat](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/569#.Xtneb2YcUgs.link)[Empathy map](https://education.nsw.gov.au/content/dam/main-education/teaching-and-learning/curriculum/key-learning-areas/stem/media/documents/stem-es1-s1-s2-s3-empathy-map-design-thinking.docx)[Six thinking hats](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/545#.XuG1ZJn0OwU.link) |
| Share and discuss understanding of the terminology within the driving question and contributing questions. | What is the problem I need to solve?What is the driving question asking us to do? What do we know? What do we need to know? How can we find out?Who will be affected? How?What do other people think about this? What other questions do you have?What could we do now?How would you tell others about the driving question? | [Wonder walls](https://www.pinterest.com.au/3hokiesncville/wonder-wall/)[affinity diagram](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/576#.Xtneb15BYog.link)[brainstorming](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/542#.Xtneb0qMVBM.link)[5 Whys strategy](https://simonsinek.com/find-your-why/?ref=mainNav)[Concept mapping](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/577#.Xt77TJTijDY.link) – What if we do nothing?[Rubrics](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/544#.Xt8G0QI4224.link) Allow flexibility in your rubrics to account for multiple learning paths and project variation. |

##  Research and plan phase

Table 2 Prompts and learning tools for research and plan phase

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| What we are looking for | Question prompts to guide learning  | Possible learning tools |
| Review needs or opportunities when designing solutions. | What decisions need to be made? How would you classify...?Can you identify the most important need?What evidence can you find …? What is the relationship …? Can you distinguish between…? | [brainstorming](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/542#.Xtneb0qMVBM.link)[Concept mapping](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/577#.Xt77TJTijDY.link)  |
| Pose questions and link multiple perspectives about the problem. | What other questions do you have?Do we need to find more about…?How do you feel about …? How do others feel about …?How can you compare your ideas with what has already been designed?Has the use of technology changed …? | [peer discussion and conferencing](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/547#.Xt76bqE31fM.link)[student generated lists](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/563#.Xt76rxfLKqk.link)[mini whiteboards](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/575#.Xt77FouPpyw.link) |
| Identify main ideas, select, compare and categorise information from a range of sources. | How would you describe ……...?What are the parts of …? How is it related to …? Why do you think …? What else is different about...?  | [affinity diagram](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/576#.Xtneb15BYog.link)[Frayer diagram](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/553#.Xt8H40ZV3fo.link) |
| Explore factors, including sustainability that impact on design solutions to meet community needs. | What concerns do designers need to think about when developing a design?How can we ensure a design is sustainable?How will your design impact on the environment over time?How will you decide …? | [Gallery walks](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/555#.Xt77TF56o-M.link)[Brainstorming](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/542#.XuG1y9K_Pjc.link)[Using keywords](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/565#.XuG1y1Nze-U.link) |
| Apply knowledge gained from one context to another unrelated context and identify new meaning | What is your opinion of …?How would you prove/disprove ….? How would you assess the value /importance of ….? Would it be better if …?What would you recommend…?What have we learnt about …? How does it compare with...?What examples can you find to support your ideas?What if we …? What other way could you...?What can you say about …?What do we now know? | [Simple graphic organiser](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/599#.Xtmqei5RGpE.link)[Concept mapping](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/577#.Xt7ARiLax2Q.link) |
| Expand on known ideas to create new and imaginative combinations. | What is imagination? What if I you could join two good ideas to make a better one? How could you?Have you thought of as many ‘out of the box’ ideas as you can? What if you tried...?What could be joined to improve, adapt or change …?Can you think of an original way for the …? | [Concept mapping](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/577#.Xt7ARiLax2Q.link)[Hexagonal thinking](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/579#.Xt7DFbxMTSQ.link) |
| Apply creative ideas to propose a range of alternatives about a given situation or task. | Can you tell me the reason …? Can you try a different way…? Can you invent …?How would you add on, to create a different …?What way would you design …? | [Thinking hats](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/545#.Xt77THeAg3I.link) |
| Share, discuss and develop feedback to inform and build ideas. | Why have you accepted this idea?Is it appropriate for your audience?How are you going to apply information provided by your peers?How will you connect or merge your ideas now? | [Thinking hats](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/545#.Xt77THeAg3I.link)[digital-learning-selector](https://app.education.nsw.gov.au/digital-learning-selector/LearningTool/Browser?cache_id=845bd) |
| Experiment with a range of options when seeking solutions and putting ideas into action. | What do you think will happen?What do you mean by...? What could happen when...?What information would you use to support/justify your choice?Who can help you? How? | [Digital-learning-selector](https://app.education.nsw.gov.au/digital-learning-selector/LearningTool/Browser?cache_id=845bd)[Thinking hats](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/545#.Xt77THeAg3I.link) |

****Produce and implement phase

Table 3 Prompts and learning tools for produce and implement phase

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| ****What we are looking for**** | Question prompts to guide learning  | Possible learning tools |
| Generate, develop, and communicate design ideas and decisions using appropriate technical terms and graphical representation techniques. | Can you tell me more about your drawing?Why did you use … to make your model?Explain what is happening …?Could you construct a model that would change …? What information would you use to support the view…?How would you justify …? What do these words mean? Why have you included them? | [Storyboarding](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/559#.Xt7-CNSZlIs.link)[Writing scaffolds](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/625#.Xt8WhxDCBf8.link)[Learning intentions and success criteria](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/622#.Xt7_L-KcCy4.link)[Writing scaffolds](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/625#.Xt8WhxDCBf8.link) |
| Identify and apply appropriate reasoning, prior knowledge and thinking strategies for a design solution. | How could you determine…? What choices helped you decide …? How would you order in importance …? What judgment can you make …? Based on what you know, how would you explain …? | [Peer feedback](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/549#.Xt8IpCfGyq8.link)[Peer discussion and conferencing](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/547#.Xt8IpA9c4E0.link) |
| Select and use materials, tools and equipment to develop solutions for a need or opportunity. | What approach would you use to …?How can you use planning materials for best results?How would you apply what you learned to develop …?What would result if …? Are … the most appropriate tools for you design solution? | [Learning intentions and success criteria](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/622#.Xt7_L-KcCy4.link) |
| Demonstrates the use of planning materials when developing their solution. | What other way would you plan to …?What examples can you find to …? | [Rubrics](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/544#.Xt8G0QI4224.link) |

****Test and evaluate phase

Table 4 Prompts and learning tools for test and evaluate phase

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| What we are looking for | Question prompts to guide learning  | Possible learning tools |
| Develop a set of criteria for success with guidance to evaluate the design solution. | How would you organise ….to show …?How would you show your understanding of …?What approach would you use to …?How would you apply what you have learned to develop …? | [Rubrics](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/544#.Xt8G0QI4224.link) |
| Evaluate the positive and negative impact of a design solution within an environment.  | What would happen if ……? How could you determine…? What possible problems can you see if …….? What are the links between …? | [Logic modelling](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/581#.XuG1y3YLUgA.link) |
| Communicate creative ideas and products with known, unknown, local and wider audiences to gather different forms of feedback to inform design choices. | Why have you chosen this idea? What is the purpose of …?What do you mean by...? Tell me more about ……What are some possible consequences...?What have you come to know? What did other people think?How can you apply what you have learned to your design solution? | [Question formulation technique](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/568#.Xt7_L96OQpw.link)[Mystery feedback](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/573#.Xt8Whx36XYY.link)[Video performance](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/578#.Xt8J1_tc0Mc.link) |
| Identify and apply appropriate reasoning and thinking strategies to solve complex problems. | How did you decide to include...? Why?What information would you choose to show ….?How could you determine…? Why did you choose …?How would you prioritise…? | [Digital learning selector](https://app.education.nsw.gov.au/digital-learning-selector/LearningTool/Browser?cache_id=0ebea) |
| Explain and justify ideas and outcomes. | What do you now know and understand?What would have to happen for...?Why have you chosen …?What are you most proud of? Why?What would you change if you did it again? Why did you choose to present your design solution in this way to this audience? | [Learning intentions and success criteria](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/622#.Xt7_L-KcCy4.link) |
| Reflect on, explain and check the processes used to come to conclusions. | What changes would you make to solve …? How would you improve …?Can you elaborate on the reason for …? Can you propose a different …? | [Concept mapping](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/577#.Xt77TJTijDY.link) – What if we do nothing? Justification Rhetorical question[Storyboarding](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/559#.XtmuCyTXLsI.link)[Peer discussion and conferencing](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/547#.Xt8IpA9c4E0.link) |
| Present their findings using a variety of media to communicate their understandings to an audience. | What is meant …? Is there any more to do?What can you say about …?Which is the best idea/design …? Why/ Is there room for improvement? Where? How?What conclusions can you draw? | [student generated lists](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/563#.Xt76rxfLKqk.link)[What did we learn today?](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/558#.Xt8Wh6fZwQo.link)[Rubrics](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/544#.Xt8G0QI4224.link) |
| Identify pertinent information in the design and communicate separate smaller parts or ideas.  | What information would you use to inform people about your design solution?Which pieces of information were used to make the presentation? Why?Would you use the same presentation methods for a different audience? Why/ Why not?Can you propose and alternative …? | [Gallery walks](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/555#.Xt77TF56o-M.link)[Digital learning selector](https://app.education.nsw.gov.au/digital-learning-selector/LearningTool/Browser?cache_id=0ebea)[Storyboarding](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/559#.XtmuCyTXLsI.link) |
| Upon completion of the design process, evaluate and justify the effectiveness of all feedback to inform future learning. | Why is feedback important?How have you used feedback throughout the design thinking process?Where am I going next? (What are the goals?) How am I going? (What progress can be made towards the goal?How will I use what I have learned? (What learning, ways of working will support me best?)Where to next? (What activities need to be undertaken to make better progress?) | [Peer feedback](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/549#.XumUv8-M5vE.link)[What did we learn today](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/558#.XumUv7nO2cM.link)[Parking lot](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/570#.XumUv-qlkcA.link)[KWLH](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/562#.XumUv5C3yHg.link) |

Through STEM project-based learning, students have the opportunity to celebrate their learning through assessment opportunities.

 These could be in the form of:

* STEM journals, learning logs and or digital portfolios
* demonstrations and performance, final product reviews and presentations to multiple audiences
* documentaries, writing pieces, debates and infographics
* showcases, expos and presentations of design solutions to stakeholders (authentic audiences).