# Stage 3 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 |
| **Examine how people use design thinking.**  | 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 evolved 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 and clarify relevant information and prioritise ideas. | 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) |
| Identify 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 feeling?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 (DOCX 84.3KB)](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 frame supporting questions to support learning. | 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 impacted? How?What do other people think about this? What other questions do you have?What could we do now?How would you explain to 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 |
| **Examine needs, opportunities or modifications when designing solutions.** | What conclusions can you draw? 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)[plus, minus interesting](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/551#.Xtnd8n2lkn8.link) |
| Pose questions to clarify information with the purpose of discovering how ideas are linked. | 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 rapid increase 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) |
| Analyse, prioritise, condense and combine information from multiple sources to identify relevancy. | 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) |
| **Examine differing concerns, including sustainability when designing solutions for future use.** | What considerations 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) |
| Combine ideas in a variety of ways and from a range of sources to create new possibilities. | 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, modify 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)[brainstorming](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/542#.Xtneb0qMVBM.link) |
| Identify situations and challenge existing ideas to generate alternative solutions. | 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) |
| Discuss and critique feedback from others to improve and transform 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) |
| Assess and test options to identify the most effective solution to put 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 processes for audiences 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 …? Why did you choose this language to communicate your design ideas? | [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) |
| Assess whether there is adequate reasoning and evidence to justify a design solution. | How could you determine…? What choices helped you decide …?How would you prioritize …? 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) |
| Plan and use materials, tools and equipment to develop solutions for a need or opportunity. | What approach would you use to …?What are some innovative ways to use planning materials?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) |
| Produce and follow an accurate planning document. | 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 |
| Negotiate criteria for success, based on defined needs, sustainability and aesthetics 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 and justify 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 foresee 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 with known, unknown, local and global audiences within an authentic context for feedback to transform learning. | 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) |
| Justify the reasoning and thinking strategies used to solve more 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) |
| Reflect on assumptions made, consider reasonable criticism and adjust their thinking if necessary. | 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) |
| Scrutinise ideas or concepts, and use evidence when choosing a course of action or drawing a conclusion to share learning. | What changes would you make to solve …? How would you improve …?Can you elaborate on the reasons for …? Can you propose an alternative…? | [Concept mapping](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/577#.Xt77TJTijDY.link) – What if we do nothing? Justification Rhetorical questions[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) |
| Evaluate the effectiveness of ideas, products, performances, methods and courses of action against given criteria. | 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) |
| Combine visual and digital elements for a variety of audiences and purposes to communicate their understandings. | What information would you use to inform people about your design solution?What information was used to make the presentation? Why?Would you use the same presentation techniques 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) |
| Evaluate and justify the effectiveness of 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).