Innovation Portal

What to Include in Each Element?

NOTE: For all elements, use standard (APA or MLA) formatting for sources. Anything that is not your original work (ex: images, statistics, expert interviews, data from books or online) should have a source. More information on citations can be found at: <http://owl.english.purdue.edu/owl/>. You can use also use an online citation engine such as <http://www.calvin.edu/library/knightcite/> or easybib.com

Innovation Portal Homepage:

Include:

* A description of your team, picture(s), Title of your project

Element A: Presentation and justification of the problem

5 - The problem is clearly and objectively identified and defined with considerable depth, and it is well elaborated with specific detail; the justification of the problem highlights the concerns of many primary stakeholders and is based on comprehensive, timely, and consistently credible sources; it offers consistently objective detail from which multiple measurable design requirements can be determined.

*Reflective Questions:*

*What exactly is the problem?*

*How do I phrase it as an objective problem statement?*

*What is the background, context or setting of the problem?*

*Who in fact says that this is a problem worth solving and why should anyone believe them?*

Include:

* Problem statement
* Problem background/statistics
* Validation of problem:
	+ Experts who say it’s a problem (what are their credentials?)
	+ Consumers, users – surveys, interviews
	+ Scholarly articles
	+ Brief summary of existing products and patents (more in Element B)

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Element B. Documentation and analysis of prior solution attempts

5 - Documentation of plausible prior attempts to solve the problem and/or related problems is drawn from a wide array of clearly identified and consistently credible sources; the analysis of past and current attempts to solve the problem—including both strengths and shortcomings— is consistently clear, detailed, and supported by relevant data.

*Reflective Questions*

* *What are all of the methods, products, or actions that are being used or have been developed to try and solve this problem and exactly why doesn’t each of them actually solve the problem?*
* *How do I/we prove to others that I/we have done an extensive search for possible current solution attempts?*
* *Who has helped me/us identify and state the shortcomings of the solutions attempts found and why should anyone believe them?*

Include:

* Intro paragraph describing how you found your information and what you learned from prior solutions. Who helped you analyze these solutions (hint: mentor or other expert)
* Patents – images, patent number, date of patent, abstract, pros and cons
* Existing products – images, price, features, pros and cons

Element C. Presentation and justification of solution design requirements

5 - Design requirements are listed and prioritized, and they are consistently clear and detailed; these design requirements presented are consistently objective, measurable, and they would be highly likely to lead to a tangible and viable solution to the problem identified; there is evidence that requirements represent the needs of, and have been validated by, many if not all primary stakeholder groups.

*Reflective Questions:*

* *Now that I know what the problem statement is and why current solutions are not solving the problem well enough, what are the measurable things a new design would have to accomplish (in order of importance) to be seen as a real solution?*
* *How did I/we determine each of these design requirements?*

Include:

* Intro paragraph on how design specifications were determined.
* Indicate who your primary stakeholders are (ex: users, buyers, sellers, manufacturers).
* How you got input from these groups.
* Explicitly state that your list is in ordered by highest priority.
* List design specs.
	+ Must be measureable and clear

Element D: Design concept generation, analysis, and selection

5 - The process for generating and comparing possible design solutions was comprehensive, iterative, and consistently defensible, making a viable and well-justified design highly likely; the design solution ultimately chosen was well-justified and demonstrated attention to all design requirements; the plan of action has considerable merit and would easily support repetition and testing for effectiveness by others.

*Reflective Questions:*

* *What brainstorming or idea generations techniques did I/we use to help define possible solutions and how can we show that I/we kept all of the design requirements in mind throughout the entire process?*
* *What was the best solution to try and why was it the best solution to try?*

Include:

* Intro paragraph – how did you brainstorm possible solutions? (ex: examined existing products’ good and bad features, took into account consumer interviews, researched products from similar applications, SCAMMPER technique, brain mapping, etc.)
* Show/describe 30 original solutions
* Discuss how you narrowed these down
* Show decision matrix, discuss how it was filled out – input from mentor/experts?
* How did you get input on the best 3 from customers?
* What revisions did you make (and why) to determine final design?
* Make sure you refer back to your design specs!

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Element E: Application of STEM principles and practices

5 - The proposed solution is well-substantiated with STEM principles and practices applicable to all or nearly all design requirements and functional claims; there is substantial evidence that the application of those principles and practices by the student or a suitable alternate has been reviewed by two or more experts (qualified consultants and/or project mentors) and that those reviews provide confirmation (verification) or detail necessary to inform a corrective response.

*Reflective Questions:*

* *How do we show that our design ideas were not just guesses and that my/our ideas and each of the proposed design attributes really is based on sound logic and subject related knowledge?*
* *Why does this proposed solution have merit to try?*

Include:

* Consider design stage, testing stage and data gathering stage
* Explicitly list and describe each concept you used – relate back to design specs where possible
* Describe who helped you validate your STEM work – what are their credentials?
* Show calculations – you can scan in from notebook
* Explain why the calculations were important to the process
* Some engineering principles to include: project management (Gantt chart), documentation (engr. Notebook), stress, strain, material properties
* Describe science concepts you needed to investigate
* Any special computer programs, technology or equipment you used?

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Element F: Consideration of design viability

5 - The proposed design was carefully reviewed based on several relevant extra-functional considerations; a judgment about design viability based on those considerations—the capacity of the proposed solution to address the problem—is clearly realistic and well supported with credible evidence

*Reflective Questions:*

* *How do I/we show evidence that the proposed design has merit beyond the classroom or lab as a real solution?*
* *How can I/we show evidence that the design could realistically get into the hands of the people the design is trying to help in a sustainable way?*
* *What evidence would I/we have to offer to honestly ask a family to invest their life savings in this idea?*
* *(NOTE: Please remember this is not information related to making a profit off of your idea in the stereotypical sense, but rather about if the idea has any chance of succeeding as a real solution. An idea to help very poor areas gain access to clean water is indeed a real problem to solve but not likely one that is about making a financial profit. It should be noted that even the most openly giving and caring of non-profit organizations will not invest their resources in any idea that has no plan for getting the solution working at the source of the problem in a sustainable way.*

Include:

* Market analysis – who are your competitors? How much do current solutions cost? How much will consumers pay? How does your product fit in?
* How will your product be manufactured and distributed? Is this reasonable?

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Element G: Construction of a testable prototype

5 - The final prototype iteration is clearly and fully explained and is constructed with enough detail to assure that objective data on all or nearly all design requirements could be determined; all attributes (sub-systems) of the unique solution that can be tested or modeled mathematically are addressed and a well-supported justification is provided for those that cannot be tested or modeled mathematically and thus require expert review.

*Reflective Questions*

* *How can I/we explain to others that if tested, the final prototype design or collection of individual segments representative of the complete solution idea will be able to yield real evidence of how well the idea meets each of the design requirements?*

Include:

* Intro paragraph: What part of your design did you focus on to build? Why was that chosen? (refer back to design specs)
* How was prototype constructed?
* What refinements/changes were made as the prototype was constructed?
* Are the materials the same as you designed? If not, how are they representative of the final product?
* Pictures!!

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Element H: Prototype testing and data collection plan

5 - The testing plan addresses all or nearly all of the high priority design requirements by effectively describing the conduct (through physical and/or mathematical modeling) of those tests that are feasible based on the instructional context and providing for others a logical and well-developed explanation confirmed by one or more field experts of how testing would yield objective data regarding the effectiveness of the design

*Reflective Questions*

* *What is the plan to test the prototype design and how can I show others that the testing plan for each design requirement is a well thought our test and would yield believable data?*

Include:

* This is where you describe how your test planning (not data or analysis yet)
* Go back to design specs, starting with the most important – what is your plan to test for that spec? (It could be more than one test). Describe how you will test. If you can’t test it, why?
* Go through the other specs and describe how you plan to test those or why you can’t
* Put entire test procedure here
* Who says your tests are valid? How did you decide on pass/fail criteria?
* Computer modeling (like Finite Element Analysis on Inventor) is a test – describe how you will use it to simulate actual conditions if you use FEA

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***Element I: Testing, data collection and analysis***

5 - Through the conduct of several tests for high priority requirements that are reasonable based on instructional contexts, or through physical or mathematical modeling, the student demonstrates considerable understanding of testing procedure, including the gathering and analysis of resultant data; the analysis of the effectiveness with which the design met stated goals includes a consistently detailed explanation [and summary] of the data from each portion of the testing procedure and from expert reviews, generously supported by pictures, graphs, charts and other visuals; the analysis includes an overall summary of the implications of all data for proceeding with the design and solving the problem.

*Reflective Questions*

* *What did I/we learn from testing about how well this design met the stated design requirements?*
* *Why should others believe my/our analysis of the data?*

Include:

* Intro paragraph – How you collected data, reference design specs and test procedures from Element I
* For each test, put data tables, pictures, video, etc. showing data
* Analyze data – what did it tell you? What changes did you make in your prototype or design before you retested? What conclusions did you draw from the data?
* Remember – even if your prototype didn’t “pass” a test, the test is still valuable – what did you learn from it?

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***Element J: Documentation of external evaluation***

5 - Documentation of project evaluation by multiple, demonstrably qualified stakeholders and field experts is presented and is synthesized in a consistently specific, detailed, and thorough way; documentation is sufficient in two or more categories to yield meaningful analysis of that evaluation data; the synthesis of evaluations consistently addresses evaluators’ specific questions, concerns, and opinions related to design requirements

*Reflective Questions*

* *What do end-users and experts directly related to this project and problem statement think of the testing results and my/our conclusions about the effectiveness of this idea?*

Include:

* Intro paragraph – how did you get feedback?
* Comments from engineers/experts at final presentation – who are they? What are their credentials?
* Put pictures of your final presentation day and posterboard/triboard display
* Upload powerpoint
* What did consumers/users/buyers say about your product? Who did you get feedback from?
* Show data and analysis of data (ex: survey numbers)
* Relate comments, questions, etc. back to design specifications

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***Element K: Reflection on the design project***

5 - The project designer provides a consistently clear, insightful, and comprehensive reflection on, and value judgment of, each major step in the project; the reflection includes a substantive summary of lessons learned that would be clearly useful to others attempting the same or similar project.

*Reflective Questions*

* *If I/we were going to do this project over, what should be done differently during the design process to improve the project and how would those recommendations make the project better overall?*

Include:

* Intro paragraph – looking back on process you followed
* Address each step (element) – what worked well? What would you change? What lessons did you learn?
* Any overall lessons learned? (ex: time management)
* What advice would you give to someone else going through a design process or addressing a similar problem?

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***Element L: Presentation of designer’s recommendations***

5 - The project designer includes consistently detailed and salient recommendations regarding the conduct of the same or similar project in the future; recommendations include caveats as warranted and specific ways the project could be improved with consistently detailed plans for the implementation of those improvements

*Reflective Questions*

Include:

* Intro paragraph – this is a look ahead…If we had more time we would…
* What improvements you would make to materials, size, shape, features, etc.
* What would your “dream design” look like? Include a detailed sketch or Inventor models
* Refer back to Element J – recommendations from consumers and experts to justify the changes and refinements you would make.

***Element M: Presentation of the project portfolio***

5 - The portfolio provides consistently clear, detailed, and extensive documentation of the design process and project that would with certainty facilitate subsequent replication and refinement by the designer(s) and/or others; attention to audience and purpose was abundantly evident in the choice of mode(s) of presentation, professionalism of style and tone, and the variety, quality, and suitability of supporting materials.

*Reflective Questions*

* *Did I/we document each step of the design process in this portfolio well enough that anyone else interested in the problem could pick up this work and both replicate what I/we have done as well as continue working from where I/we ended up?*
* *Is your work documented in the portfolio easy to follow? Do you have introductory and conclusion paragraphs to describe your data, pictures, information? Have you used photos, videos, captions, titles well to enhance the understanding of your design process?*

*Element N: Writing like an Engineer*

5 - Abundant evidence of the ability to write consistently clear and well organized texts that are developed to the fullest degree suitable for the audience and purposes intended (to explain, question, persuade, etc.); texts consistently demonstrate the ability to adjust language, style and tone to address the needs and interests of a variety of audiences (e.g., expert, informed, general/lay audience) and to use a wide variety of forms which are commonplace among STEM disciplines (e.g., notes, descriptive/narrative accounts, research reports); where required by convention, appropriate documentation in standardized form (e.g., APA) is consistently evident.

*Reflective Questions*

* *Throughout the entire portfolio, were the explanations, descriptions and information in each section developed and presented with a wide variety of readers in mind?*
* *Is my/our portfolio more of a scrapbook of disjointed or entries or is it a well written and documented account of my/our work throughout the design process?*
* *Is the writing style folksy and informal or is it technical?*
* *Are accurate, descriptive words used, or are they “squishy”? – Ex: Words like “many”, “good”, “inexpensive”, “easy” require more clarification*
* *Make sure all data and images (that are not your own photos or sketches) have a source. Use consistent citations (ex: APA or MLA)*