

Overview of Checkpoints for Science Research Project

Checkpoint 1 - Selecting a general area of interest Provide evidence that you have:

- Pursued background research on several potential general areas of interest
- Selected one general area of interest
- Used on-line bibliographic searches and electronic communication to locate sources related to your general area of interest
- Used textbooks and general references to become knowledgeable about your general area of interest
- Explained (in writing) why you selected the general area of interest

Checkpoint 2 - Researching and narrowing the topic Provide evidence that you have:

- Pursued in-depth research in the area of interest--including primary, secondary, and tertiary sources in scientific journals
- Communicated with scientists working in this topic area
- Narrowed the topic through in-depth research
- Discussed (in writing) the contributions that specific scientists have made to understanding this topic
- Explained (in writing) your reasons for selecting this topic
- Explained (in writing) how this narrowed topic relates to other science concepts (fits into the big picture)
- Explained (in writing) the relevance/importance/potential applications of this topic

Checkpoint 3 - Understanding the scientific research process Provide evidence that you have:

- Located and studied several primary research papers related to your topic of interest
- Summarized the research plan in these research papers using a design matrix
- Written a 100-word summary of these research papers in layperson's terms.
- Presented oral report on these primary research papers to the class including: purpose of research, rationale for the research, pertinent scientific literature, methodology, results, discussion, and conclusions.
- Understand the key elements of the science research process--review of the literature, statement of purpose or hypothesis, methodology, presentation and analysis of data, conclusions and implications.

Checkpoint 4 - Developing a research question Provide evidence that you have:

- Studied additional background on your topic with a particular emphasis on primary resources
- Identified a professional researcher who will serve as your mentor/supervising scientist
- Arranged for a meeting between your sponsor and your mentor scientist
- Developed a written agreement with your mentor that clearly identifies agreed upon expectations for you and the mentor scientist (including roles, responsibilities, time, and materials)
- Developed a tentative and original research question
- Discussed your research question with your sponsor and mentor scientist
- Used additional resources to develop and refine your question
- Selected a research question that has potential for original research
- Stated your revised research question (in writing)

- Explained (in writing) the relevance/importance of your research question

Checkpoint 5 - Designing a research hypothesis Provide evidence that you have:

- Written a review of the literature for the your research project
- Developed a tentative hypothesis or statement of purpose
- Briefly explained (in writing) the reasoning and research that led to this hypothesis
- Confirmed that your research question and hypothesis are original
- Discussed your research hypothesis with your sponsor and mentor scientist

Checkpoint 6 - Designing a research plan Provide evidence that you have:

- Drafted a tentative research plan to test your hypothesis through experimentation (data collection) and analysis
- Summarized your tentative research plan using a design matrix
- Prepared a list of needed materials and resources
- Determined the feasibility of the research, including time, materials, and cost
- Described (in writing) the proposed method or procedures for your project
- Clearly indicated how you manipulate the independent variable, measure the dependent variable, and control other potential variables
- Determined that you have included sufficient numbers in both control and experimental groups to be statistically valid
- Discussed your research plan with your sponsor and mentor scientist
- Developed a realistic timeline for each component of your research plan
- Developed data tables for recording raw and derived data
- Determined that your research plan meets the safety and ethical guidelines (for appropriate research involving human subjects, non-human vertebrate animals, pathogenic agents, controlled substances, recombinant DNA, and human or non-human animal tissue)
- Prepared a formal research plan (in writing) that describes the question being addressed, the hypothesis/problem/engineering goals, a description in detail of methods and procedures, and a bibliography (follow guidelines provided by your teacher)
- Answered (in writing) the question, "How did you get the idea for your research?"

Checkpoint 7 - Obtaining required approval for the research plan Provide evidence that you have:

- Reviewed the information, rules, regulations and forms available at Science Service for the Intel Talent Search (International Science and Engineering Fair Science Project) at <http://www.sciserv.org/isef>
- Reviewed information, rules, regulations and forms for entry into other science fairs or symposiums recommended by your teacher
- Used ISEF Rules Wizard at <http://www.sciserve/isef/students/wizard/index.asp> to determine what forms and approvals are necessary before implementing your research plan
- Arranged for a meeting between your sponsor and your mentor scientist
- Worked with your sponsor and mentor to complete the following forms: Checklist for Adult Sponsor, Research Plan (1A), Research Plan Attachment, Approval Form (1B), and SRC/IRB approval (if needed)
- Ordered or arranged for needed materials/equipment required for implementing your research plan

Checkpoint 8 - Conducting the research investigation Provide evidence that you have:

- Maintained a Laboratory Project Data Book that includes detailed notes of each and every experiment, measurement and observation (follow the guidelines provided by your teacher)
- Had your sponsor, mentor, or a designated adult sign each of the dated entries in your project data book to provide evidence of your work
- Implemented a preliminary trial of the methods
- Revised or refined the methods based on the preliminary trial
- Discussed with your mentor or sponsor potential techniques for statistically analyzing the data you plan to collect (if appropriate)
- Submitted any revisions of original research plan for sponsor and mentor approval
- Conducted your research following your proposed timeline
- Periodically sought review of your research progress from your sponsor and mentor
- Prepared photographs to illustrate key methods, equipment, or results
- Continued to do research to increase your understanding of other scientists' work related to your research project

Checkpoint 9 - Data analysis Provide evidence that you have:

- Use computer spreadsheet software to enter your raw data into a spreadsheet
- Selected and used appropriate statistical analysis techniques/software to analyze your data
- Used appropriate computer software to create data tables/charts to summarize/analyze your data
- Used computer software to create appropriate graphs and figures
- Prepared a written draft of the discussion/analysis of the data (including patterns, relationships, support/lack of support for hypothesis, and sources of error)
- Obtained feedback this data discussion/analysis from your sponsor and mentor

Checkpoint 10 - Writing a research paper Provide evidence that you have:

- Reviewed the guidelines for writing a research paper provided by the Intel Talent Search at www.sciserv.org or by your teacher
- Written a 250-word abstract that includes the purpose of the experiment, procedures used, data, conclusions, and possible research applications
- Written a rough draft for each section of the research paper including title page and table of contents, introduction, materials and methods, discussion, conclusion, acknowledgements, references and bibliography. (follow the guidelines provided by your teacher)
- Evaluated your research paper and project using the "Criteria for Evaluation of Projects" from the Siemens Westinghouse Competition at <http://www.collegeboard.com/article/0.3868.6-30-0-23645.00.html>
- Sought feedback on each section of your rough draft from your peers, sponsor, and mentor
- Used feedback and self-evaluation to make revisions to each section of the research paper
- Prepared a final draft of your research paper
- Prepared a 100-word easily understandable summary of your project in layperson's terms that includes background, procedures, conclusions, and relevance.

Checkpoint 11 - Completing the applications Provide evidence that you have:

- Draft and revise answers to Essay Questions 1 - 6 for the Intel Science Talent Search

- Completed the Intel Science Talent Search Application process (including appropriate forms from your sponsor and mentor)
- Submitted your application to your sponsor and mentor for review
- Refined your project as required for inclusion in other science research competitions

Checkpoint 12 - Preparing a poster presentation/visual display Provide evidence that you have:

- Reviewed the information of visual displays and the "Display and Safety Rules" available on the Science Service website at www.sciserve.org
- Reviewed guidelines for creating an effective poster presentation (provided by your teacher)
- Prepared a display that is organized, clear, concise, correctly presented, well-constructed, and eye-catching.
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- Practiced speaking freely and confidently about your display to demonstrate that you have a good grasp of your project
- Presented your display to classmates and engaged in discussion and answering questions related to your work

Checkpoint 13 - Preparing an Oral Presentation Provide evidence that you have:

- Prepared a written script for a 12 minute oral, public presentation about your research following the guidelines provided at the Siemens Westinghouse Competition website at <http://www.colegeboard.com/article/0.3838.6-30-0-25653.00.html>
- Prepared appropriate visuals for use in your presentation
- Reviewed the guidelines for oral presentations (provided by your teacher)
- Practiced using the script/visuals
- Used peer review to revise the script/visuals and improve your presentation skills
- Prepared a CD-ROM and overhead transparencies of your final visuals
- Practiced for a "Question & Answer" session in which judges will ask questions about your research project

Checkpoint 14 - Reflections--Past and Future

- What have you learned about scientific research from your participation in this course?
- How has participation in this course enabled you to demonstrate your scientific attitude, curiosity, inventiveness, initiative, and work habits?
- How has your participation in this course influenced your future career plans?
- What suggestions do you have for sponsors or mentors for how they could better guide future students in understanding and implementing independent scientific research?