

Exam CS411-January 2021

1. What were the independent and dependent **variables** in your experiment? Could you add a second independent variable? In this case, what interaction effect(s) could you expect? (If you had already two independent variables, describe the interaction effect or the non-effect in simple terms.)
2. In your experiment, did you apply a **between-subjects** or within-subjects design? Why? If you had more time, what would you have preferred to do? Design an experiment to answer your research question using the other design, ie, if you used a between-subjects design imagine an experiment with a within subjects design and vice-versa.
3. Did you integrate any of these **methodological** elements into the design of your experiment: a treatment check, counter-balancing the order or controlling the initial equivalence of participants in the two conditions? If not, which one(s) could be relevant while re-doing this experiment?
4. An experiment has compared the effectiveness of collaborative learning in a face-to-face situation versus in a zoom meeting. It occurs they found no significant effect. The researchers then decided to count the number of interactions in each situation. They compared teams above and below the median in terms of number of interactions and found that those who interacted more had significantly higher learning gains. They concluded that verbal interactions increase learning outcomes. Why is this interpretation **incorrect**?
5. An experiment aims to verify if watching a video generates as much knowledge as reading a book. The researchers select a well-known textbook on crystallography written by the famous professor Schmutz. The book is composed of 5 chapters of about 40 pages. They also ask Schmutz to record 5 videos of 12 minutes, each summarizing a chapter. The design of this experiment suffers from several methodological **weaknesses**, cite two of them.
6. Design an experiment that measures the effects of advance **organizers** on learning negative numbers (integers only), at the end of elementary school. You also want to verify if the effect of advance organizers is higher for weaker or better students. What would be the independent variables, the dependent variable and a potential interaction effect?
7. Design an experiment that measures the effects of **gamification** on learning to add fractions. You also want to verify if the effect of gamification is higher for boys or girls. What would be the independent variables, the dependent variable and a potential interaction effect?
8. Design an experiment that measures the effects of immediate versus delayed **feedback** on learning outcomes. You also want to check if this effect is the same for memorizing German vocabulary as for constructing complex sentences in German. What would be the independent variables, the dependent variable and a potential interaction effect?
9. Design an experiment that checks whether EPFL students acquire better programming skills if they code individually or in **pairs**. You would also like to know what is the role of assistant intervention. What would be the independent variables, the dependent variable and a potential interaction effect?
10. Design an experiment that checks whether EPFL students acquire better coding skills if they code homogenous pairs (same programming level) or **heterogeneous** pairs. You would also like to know whether familiarity, the fact that students know each other very well before the experiment, leads to better coding skills. What would be the independent variables, the dependent variable and a potential interaction effect?
11. Design an experiment that compares the effect of **inductive** versus deductive methods on the level of motivation of students and whether this effect is the same for introductory courses, such as Calculus-101 (Analyse I), or advanced courses, such as "distributed algorithms".
12. Design an experiment that compares the effect of inductive versus deductive methods on the capacity of **transfer**, for kids learning to compute the surface of a square. The experiment should also check if this effect is the same for weaker students or for better students. What would be the independent variables, the dependent variable and a potential interaction effect?
13. You want to measure the effects of immediate versus delayed **feedback** on learning outcomes for the concepts of constructing complex sentences in German. Which tests would you include in your experiment: a pre-test, a post-test, a **delayed post-test** or measure of transfer, and why?
14. In the learning scenario that you developed for the project, could you have integrated one of the following concepts: **metacognition**, **induction** or **socio-cognitive conflict**? Pick the most relevant concept for your scenario (a concept that was not yet part of it) and explain how you could integrate this concept in your scenario.
15. In the learning scenario that you developed for the project, could you have integrated one of the following concepts: **knowledge compilation**, **germane cognitive load** or **mutual regulation**? Pick the most relevant concept for your scenario (a concept that was not yet part of it) and explain how you could integrate this concept in your scenario.
16. In the learning scenario that you developed for your project, did you include a measure of **transfer**? How could you have promoted transfer in your case?

17. In the learning scenario that you developed for the project, could describe which elements of the task given to learners have increased or decreased intrinsic, extrinsic or germane **cognitive load**? Alternatively, describe how you could change the design to increase germane cognitive load.
 18. In the learning scenario that you developed for the project, could describe which elements of the scenario may have increased or decreased intrinsic or extrinsic **motivation**? How could you could modify the design of your orchestration graph to increase intrinsic or extrinsic motivation?
 19. Let us consider four approaches to learning: direct **instruction**, verbal elaboration of knowledge through **social** interaction, incremental **mastery** of procedural skills, **discovery** of concepts or laws. Which approach inspired the most the scenario that you developed for your project? How would you adapt the scenario to use one of the other approaches?
 20. Did the scenario that you developed for the project focus on **declarative** knowledge or procedural knowledge or both? Explain how.
 21. Was the scenario that you developed for the project focused on **induction, deduction or analogy** or a mix of them? Explain. How could you redesign the scenario from one method to another one?
 22. How did the scenario that you developed for the project take into account the **pre-requisites** of the learners? If it did not, could you have done it?
 23. Can the scenario that you developed for the project be described as '**adaptive**'? If it does, explain the adaptation mechanism you used. If it does not, how could it be made adaptive?
 24. Did you find different learning strategies among the participants of your experiment for your course project? Could you have modified the scenario to **adapt** the learning activity to these differences?
 25. Some scenarios focus more on **individual adaptation, others on social interactions**. To which category does the scenario that you developed for the project belong to? Could you redesign the scenario to change this category, i.e., shifting from individual to social or vice-versa?
 26. Knowing the results of the experiment for your class project, how could have improved the quality of your pedagogical scenario? Consider namely the following concepts: **intrinsic/extrinsic motivation, feedback, inverse progressivity**. You may bring other suggestions.
 27. Knowing the results of the experiment for your class project, how could have improved the quality of your pedagogical scenario? Consider namely the following concepts: **gamification, adaptivity, metacognition**. You may bring other suggestions.
 28. Knowing the results of the experiment for your class project, how could have improved the quality of your pedagogical scenario? Consider namely the following concepts: **induction, argumentation, compilation**.
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