ZUSATZMATERIAL

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(Hrsg.)

Lehrkräftebildung neu gedacht

Ein Praxishandbuch
für die Lehre in den
Naturwissenschaften und
deren Didaktiken

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Wie adaptiert man Unterrichtskonzepte erfolgreich?
Ein Beispiel anhand von Inquiry into Radioactiivy für den Einsatz in Gymnasien.
HULL, Michael M., and JOHNSON, Andy

Supplementary Information on the Vertiefungsseminar

Course Logistics

Pre-service teachers are given the following information during the first lesson of the IiR Vertiefungsseminar in the form of a Powerpoint presentation (example slides taken from summer semester 2020):

Logistics

- Participation (mostly attendance) is worth 1/3 of your grade.
- I can't in good conscience give you permission to miss this class.
    - I respect you as an adult to do what you need to do.
- The only time you will not lose points for not being in class participating is if there is some emergency like the funeral of a family member, or you have a doctor's note to excuse you.
- Announcements will be at the start and/or end of the class
    - Arrive and leave on time
- You will find on Moodle[1] that, after every class where you were fully present, you will get 1 point.
    - It's a small number of points, but each of those points has a large weight in the overall course grade.

Homework

- The second 1/3 of your grade will come from homework.
- The first assignment is currently posted on Moodle.
    - It and HW 2 are BOTH due in two weeks
- If you are not able to access it, send me an e-mail and I will e-mail the homework to you: michael.malvern.hull@univie.ac.at
- Generally, you will do better if you complete the homework soon after class.
    - However, you can have up to Monday night to complete it
- I will grade the homework on Tuesday.
- We will discuss your homework at the start of the subsequent class.
    - If you do not do the homework in time, you will not benefit from that discussion, and there is no reason to do the homework after that discussion
    - Therefore, late = 0 points, unless you have a very good excuse

You will help teach this class

- We will meet here for 90 minutes, Wed 9 – 10:30 every week
- Each week we will look at a different lesson in IiR
- You and your partner will be responsible for one lesson
    - You talking for 50 minutes = 0 points[2]
    - You will modify existing materials to make worksheets and/or powerpoint slides for your „students"
        - You ignoring the existing materials altogether = 0 points
    - You will prepare equipment and ensure that it functions

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[1] We used Moodle as an online learning platform on which pre-service teachers uploaded their homework

[2] The first mock lesson is facilitated by the seminar instructor to demonstrate the inquiry learning style advocated by IiR. Specifically, the "students" work in groups, the "teacher" draws upon their own ideas in the whole class discussion, and the lesson ends by collecting the "big ideas" of the students without telling whether those ideas were correct or not. After the mock lesson, however, the seminar instructor acknowledges that time constraints might make a Gymnasium teacher feel the need to move on to the next Activity at the start of the next class and hence to end the lesson with words of closure about whether those "big ideas" are correct or not. The instructions given to pre-service teachers in preparing for their mock lesson are hence "it is up to you to decide how much of your assigned Activity you will use during the 50 minutes, but you must use at least something from the Activity. It is also up to you how true to the original spirit of inquiry you adhere. However, you are not allowed to just lecture for 50 minutes."

- You will go to a Gymnasium to teach[3]
- This will be the final 1/3 of your grade
    - Facilitation for colleagues, reflection from colleagues, reflections from Gymnasium

Course Calendar

(example taken from summer semester 2019, in which Gymnasium students came to visit us):

07.03.2019	Act 1.0[4] (Seminar Instructor); 11 am -1 pm[5]
14.03.2019	Act 0.1 and 1.1 (Seminar Instructor)[6]
21.03.2019	Act 1.2 (Pre-service teacher (PST) 1 & PST 2 & PST 3)
28.03.2019	Act 1.3 (PST 4 & PST 5 & PST 6)
04.04.2019	Act 1.4 and 1.5 (PST 7 & PST 8 & PST 9)
11.04.2019	Act 1.6 (PST 10 & PST 11)
18.04.2019	NO CLASS
25.04.2019	NO CLASS
02.05.2019	Act 1.7 (PST 12 & PST 13)
09.05.2019	Act 2.0, 2.1, and 2.2 (PST 14 & PST 15 & PST 16)
16.05.2019	Act 2.3 (PST 17 & PST 18 & PST 19)
23.05.2019	Gymnasium visit 1; 11 am -1 pm
30.05.2019	NO CLASS
06.06.2019	Gymnasium visit 2; 11 am -1 pm
13.06.2019	Act 2.4 (PST 20 & PST 21)
20.06.2019	NO CLASS
27.06.2019	Act 4.4 (PST 22 & PST 23)

Course Homework

(example taken from summer semester 2020)

Summer 2020, Homework #1

- Get internet access and familiarize yourself with the Moodle site. In particular, find the section labeled "IiR Materials", which should have four .zip files within it. You will be using these files constantly throughout the course.
-Get familiar with the files within those compressed folders. First, find a way to unzip these files. In particular, open Cycle 1. In the case of a Windows OS, open" Rad 1 Intro Complete", then "Act 1.0 Initial Ideas". This contains the IiR concept evaluation (similar to what you completed in class today) in addition to a teacher's guide for the evaluation, beginning with the letter "TG". Generally, these TG files will also be relevant for the homework assignments accompanying each Activity. I ask you to only open these TG files AFTER you submit the homework, unless otherwise specified. Doing so helps us better identify potential issues for when this curriculum is used with Austrian Gymnasium students. Now open the folder "HW1.0 Nuclear power" and then the file "HW1.0 Nuclear power".
Choose TWO of the 6 questions and, for each question, a) rewrite the question, if you think appropriate and useful to do so, specific to Austria. Then b) answer that modified question, including a relevant quotation from a source that you found and a URL to that source.

Summer 2020, Homework #2

1a) Open "HW 1.1 where is rad.docx" (a Word file) and answer question 4, at the bottom of the page, *from the perspective of a student in the 4th Class*.
1b) Now, do a bit of research online, and answer the question "will a Geiger counter held close to a cell phone measure a higher level of radiation than if the phone is not there?" Cite at least one credible source for where you are getting your answer.
1c) The correct answer to question #1b is "it is indeed possible to get statistically significant higher readings when held close to the cell phone". If this is not the answer you found, then do a bit more research to find out why this happens. Bearing this in

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[3] Unfortunately, as a result of Corona, pre-service teachers did not have the opportunity to work with Gymnasium students

[4] IiR is divided into 4 "Cycles", with each Cycle consisting of a number of "Activities (Acts)". In Act 1.0 (the first Activity in Cycle 1), students complete a conceptual survey. Logistics were explained to pre-service teachers during the first part of this class period, and discussion of the conceptual survey occupied the second half.

[5] Generally, each class lasts a total of 90 minutes. However, this Vorbesprechung and the visits of the Gymnasium students required an extra 30 minutes.

[6] This was the first mock lesson, in which the seminar instructor takes parts of Act 0.1 and Act 1.1 to make a 50-minute lesson appropriate for Gymnasium students.

mind, some teachers will tell their students NOT to measure their phones with the Geiger counter, and will tell them why. Do you think this is a good approach? Explain why or why not.
2) In class today, many of you (roleplaying as students in the 4th Class), answered Q 1.5 with something like *"Since the GM counter recorded a different measure from one minute to the next, it must either be that there is imprecision with the device or the radiation changed. For example, maybe a gust of wind came in the second minute that increased the reading because it had some radioactive stuff in it."* Imagine that you are teaching this lesson to students in the 4th Class and this is what a group has just concluded.
Open and read the file TG 1.1 Monitor.docx. Do you think Prof. Johnson would say anything to this group, or would he just let the group keep going through the worksheet? Include a quote from the teacher's guide to justify your answer.
3) One of you wrote today *"It feels somehow weird that students are guessing for the whole lesson about those questions in the worksheet without getting the 'right' answers in the end. But probably this is exactly what this 'inquiry'-style of teaching is supposed to do, and maybe this kind of lesson promotes the creativity of students."*
a) Respond to this statement. Do you think that this style promotes student creativity? Do you think there are different benefits? (Bear in mind, as I mentioned in the introduction to the seminar lesson, that your students will also almost CERTAINLY find this style of learning weird the first time they experience it, so you will probably need to tell them directly to expect something different than what they are used to)
b) Suppose that you and your partner end up teaching this lesson at Gymnasium this semester (8 of you will be doing so, in fact). Will you give students "right" answers at the end of the lesson? Which answers?
4) Did you individually, or in your Group, have any problems with Skype today? If so, do a little bit of research online to see how you might improve that problem for next week. For example, maybe you should find a computer instead of a phone? Or maybe your group should do voice chat and not video chat? Or maybe you should download any videos in advance of the class instead of streaming them through Skype?
5) Read the teacher's guides for Act 1.1 and Act 1.3. If you have any questions about something unclear, choose the one that matters most to you and write it here. We will discuss some of these at the start of the next class. If everything is totally clear to you, then leave this question blank.

Summer 2020, Homework #3

On Moodle, next to where you found this pdf, you will find the Excel file "Background.xlsx". This is the same file that you worked with in class today.
1) Based upon this data, describe a method that you think Gymnasium students might propose by which one can tell whether two locations, sources, etc. are different or not in terms of their radioactivity levels. Have the method be specific to 10-min long averages (because 100 minutes is a long time to measure, and 1 minute samples have such a huge range!)
2) Then use that rule to answer the following questions, modified from the homework of Act 1.2. ***Note that for these questions, I am grading for how well you use the rule you wrote in #1, not how well you can role-play as students in the 4th class! I will be sure to specify when you should pretend to be students!***
a) Suppose someone were to measure radiation in a nearby parking lot. What is the likely range of possible 10-minute averages they should probably get? Explain your thinking.
b) A physics nerd brought a Geiger counter to Stephansplatz and got a ten minute average of 18 CPM. Is the radiation in Stephansplatz different from in our classroom? Explain how you decide.
c) An organization called "Safecast" has many people carrying geiger counters around Japan. Their data are available on a map at http://safecast.org/tilemap/ Please look at this map and think about what it means. The color code on the map is not in CPM, but in radiation dose units of "microSievert per hour". However, the darkest blue color is the same as readings we would get in our classroom - about 0.05 μSv/h. Doubling the CPM would double the dose rate in μSv/h. ***Roughly how many clicks per minute would you expect in the red areas, according to the data you saw in class this week?***
3a) Now that you have seen Act 1.2, which will serve as the second out of three lessons in the Gymnasium, I return to the question from last week's homework. What, if any, "correct answers" should we tell students at the end of Lesson 1 (which you saw last week)?
3b) In your homework last week, one of you wrote that one thing that would be good to tell your students in Gymnasium is the difference between radioactivity and radiation. Respond to this idea. Should we explain this distinction to Gymnasium students at the start of Lesson 1? At the end of Lesson 1? Neither? Why do you think so?
4) Read the teacher's guide for Act 1.2. If you have any questions, choose the one that matters most to you and write it here. We will discuss some of these at the start of the next class. If everything is totally clear to you, then leave this question blank.

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(Additional homework assignments are available upon request)

Summer 2020, Homework #10

Since last week's homework did not ask you if / how YOU would use Acts 3.0 and 3.1 in your own Gymnasium class, this week's homework will focus on how you would use IiR.
1) Imagine that you are now a Gymnasium teacher.
A) According to the Lehrplan, is it necessary for you to teach radioactivity? At what age (ages, actually) will your students learn about radioactivity from you?
B) Based on what is written in the Lehrplan, what topics regarding radioactivity will you teach? You can just paste topics specific to radioactivity from the Lehrplan here.
C) For each of those topics that you will teach, is there an IiR Act **that you have seen so far** that you would use? If so, which Act would you use? If you would not use any Act **that you have seen so far** to teach that topic, you can just write "none". There are a lot of topics on the Lehrplan, so only explain your selections if you feel inclined to do so.
2) Answer the following questions modified from 3.2-3 Followup Questions.doc. Note that many of the answers are in the Act 3.2 Teacher's Guide.
A) Can an alpha or a beta ionize more than one atom? About how many? **(Use the simulator)**
B) What are the red and blue dots in the Cell view? Where did they come from?
C) Are alphas weak? If not, why don't they penetrate very far?
D) Related to Q2.C, betas penetrate farther than alphas. Would you say then that betas are stronger than alphas?
E) Why don't betas interact as often as alphas?
F) Does a gamma lose any energy while it is traveling through an object? Why or why not?
G) At the end of class, we noted that the purple gamma seems to change direction as it turns into a blue beta after an "Interaction". Do gammas turn into betas? What is actually happening?

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Summer 2020, Homework #14 (last)

1) At the beginning of this semester, you completed a survey asking about your views towards the teaching profession. I told you that I assess the effects of the classes that I teach, and this survey is one way that I do that. Now, I will ask you to answer the survey again, so that I can see what, if anything, has changed since when you completed the survey at the beginning of the semester. There are no correct answers to these questions, so the responses you choose of course have no effect on your grade. You can find the survey itself as a pdf next to this homework assignment: Umfrage Deutsch v9.pdf. However, I would like to request, if possible, that you type your answers into the Excel sheet Umfrage Deutsch v9.xls and upload that file into Moodle, together with a pdf for the remaining two questions below. If it is not possible to upload TWO files onto Moodle, then please e-mail the Excel sheet to me. If it is not possible to use Excel, then please type your answers into the pdf that you upload.
2) (Optional) Any suggestions you have to improve the IiR materials would be greatly appreciated. Be specific (specify the Act, for example). I will copy and paste your response to this question to Prof. Johnson for his consideration.
3) (Optional) What questions do you have about radioactivity, IiR, inquiry, etc. that have not yet been answered? I promise to reply at least briefly to what you write here, so be sure to check the feedback I leave.