Neuroscience in the classroom seminar – tutor notes (total time 90 mins)

**Pre-Learning**

We recommend that before this session trainees use the 10-15 minute Introduction to the Brain self-study slides. In order to become better critical consumers of neuroscience information, it can be helpful to have some basic knowledge about the brain. Education tutors may not feel confident to provide this so it is also there as a source of expert knowledge to refer back to. This is by no means an exhaustive list of what we know, but nevertheless provides some information that can help to combat some of the more prevalent myths that exist about the brain. It helps to challenge the widely held myths that: a) we only use 10% of our brains and b) some people are creative/right brain learners, and others are analytical/left brain learners by showing how the brain functions as an integrated whole. Alternatively, tutors could incorporate it into a teaching session.

**Materials needed**

* Tutor Slides file – ‘Neuroscience for Critical Consumers,’
* Trainee access to a version of slides:‘Neuroscience for Critical Consumers Trainee version’. (e.g posted on a Virtual Learning Environment.)
* Excel file – ‘Data collection of mock experiment Weisberg\_data’
* Paper copies of a set of stimulus sheets (There are 24 different sheets - to make it work like the original experiment you need to give one of these to each trainee. If you have more than 24 people simply give out as many as you need from a second set of sheets. If you have fewer than 24 people give them out from sheet 1 on as far as you need. )
* Optional – paper copy of grid to collate the data gathered from small groups of trainee. Some tutors have found this helpful to speed up the process of entering data on the Excel file if they had a large group size.

*Note on terminology: We use the term ‘trainees’ here to avoid pupil/student confusion, but very much see ITE as education, not training.*

**Outline**

This seminar broadly comprises of three sections:

**1) The ‘seductive allure of neuroscience explanations’ experiment**

At the start of the session, students will be given the opportunity to experience what it might be like to take part in a psychology experiment. This is a cut- down version of a classic experiment by Deena Weisberg and colleagues in 2008. In this, participants were given descriptions of a number of different psychological phenomena, followed by different types of explanations. These were either ‘good’ explanations, or ‘bad’ (usually a circular redescription of the phenomenon). In addition, these explanations either did or did not contain irrelevant neuroscience – for the explanations that did, the neuroscience content did not add anything to the standalone definition. The key finding from the original study was that people were more likely to rate the ‘bad’ explanation as more satisfying if it contained irrelevant neuroscience. This suggests that we have a blind spot when it comes to neuroscience information, and we might be more likely to believe something if it’s claimed to be ‘brain-based’. Given the prevalence of teaching programs that lack in evidence of actual effectiveness (such as Brain Gym, or concepts such as VAK learning styles), this is likely to be something that trainees will encounter at some point in their careers. As such, equipping them with some basic critical thinking skills may help them to better evaluate such programs in the future.

**2) Critical Analysis of Brain-based claims**

In order to become better critical consumers of neuroscience information, trainees need to know what to look for and to practice being critical of information. In the second part of the seminar, trainees will be presented with five claims they might encounter that seem to be ‘brain-based’. After considering their gut response to these, groups of trainees can be allocated a different claim to explore in great depth. The claims include some neuromyths and some claims for which there is more positive evidence of their educational value. The resource provides the group with a scaffolded approach to examining each claim with key questions and different kinds of evidence to consider. Each of the 5 groups then reports back to the whole group.

The final section of the seminar explains the importance of critical thinking for trainee teachers. It also offers some tips they can use in the future when assessing any claims that they encounter about brain-based learning initiatives. More broadly, the tips that are suggested are useful in taking an evidence-based approach to any sort of information or news that they encounter and also recognising that their values and views on the aims of education must be part of this critical appraisal.

**Before the start of the session**

Before you start the session, you need to make sure that the PowerPoint file (currently ‘WT\_neuroscience\_session\_v3a.ppt’) and the Excel file (‘Weisberg\_data.xlsx’) are saved on to the computer you are using, and are located in the same folder as each other. In order for the student’s data to be accurately displayed in the PowerPoint file, please follow these steps:

1) Navigate to slide 9 in the PowerPoint file (title: “What do your data show?”). 2) Delete the current chart presented in that slide. 3) In the Excel file, click on the tab at the bottom of the screen called ‘Sheet2’. 4) Select the empty chart in Sheet2, and copy this (either right-click and select ‘copy’, or select the chat and press Control+C). 5) Paste this chart back into slide 9 in the PowerPoint file, and click on the clipboard icon that appears in the bottom right corner of the selection. 6) Select ‘Keep Source Formatting’. 7) Move the chart so that it does not overlap with the title. 8) In the Excel file, click on the tab at the bottom of the screen called ‘Sheet1’ to return to original view.

You should now be able to input numbers into Sheet1, which will automatically update the chart on slide 9 in the PowerPoint file.

(And if that all seems too much IT faff, you can keep the Excel file open on a separate tab instead.)

Slide 1 You can customise this to show your name and the date of the session if you wish. Introduce the topic, yourself as presenter and welcome the group.

Timing: <1 minute

Transition statement: Let’s look at what we will be covering today.

**Your notes:**

Slide 2 Talk through the objectives of the session. We will be starting with a cut-down version of a classic experiment in psychology for them to try, and afterwards we will analyse the data they produce. After that, we will look at some of the practical implications of the findings of the study, and what this might mean for their teaching practice. A key point to note here is that this session isn’t intended to provide them with an overview of how to teach neuroscience at primary level; rather, it is more about thinking how they approach the integration of neuroscience research into their teaching methods.

Timing: 1-2 minutes

Transition statement: Let’s take a look at the experiment.

**Your notes:**

Slide 3 Introduce the experiment. By taking part in this task, students will have the opportunity to gain a little bit of insight into how psychological research is conducted, both from the view of a participant and as a researcher. In a typical experiment, we would first gain approval from an internal university ethics board, and the experiment would start by asking participants to provide their informed consent to take part. As this isn’t a ‘true’ experiment, we aren’t going to do this with the students. However, it is important to note that this is a difference between the class task and a real-life experiment. It is also important to tell them that the data we collect during class is only used for demonstration purposes – we won’t be saving it for future use, nor will any of them be identifiable by their responses.

Timing: 3 minutes

Transition statement: Let’s have a look at what we need to do for the experiment.

**Your notes:**

Slide 4 Give the instructions to the students as written on the slide. At the bottom of each explanation, there is a scale ranging from -3 to 3. Their task, for each explanation, is to rate how satisfying they find it on this scale, from very unsatisfying (-3) to very satisfying (3).

Resources: Copies of the experiment stimuli; one set of four sheets per person. Hand these out to students once the instructions have been delivered.

Timing: 2 minutes

Transition statement: If you’re happy with the instructions, you may begin.

**Your notes:**

Slide 5 Allow the students time to read through each of the four sheets and record their answers. They should do this quietly, and not discuss the explanations with other students. Once they have completed all four sheets, ask them to wait until everyone in the class has finished.

Timing: 10 minutes

Transition statement: Before we go through the aim of the experiment, let’s have a look at your data.

**Your notes:**

Slide 6 Once all of the students have completed the task, we will collect their data. Each student will have been given a set of sheets that will have the letters A, B, C and D written at the topic (these will be associated with a number from 1- 4; ignore these). Explain that we are going to look at their data, and then transfer from the presentation slides to the excel spreadsheet that has been provided called ‘Weisberg\_data.xlsx’. For each student, ask them to read out the scores they provided for each of the sheet A through D, and input these into the spreadsheet. If you have a large group, you may find it faster to get one student on each table to gather all of the scores from their group first, and then read out each set of four data points for each participant. (Optional grid for this provided at end of these tutor notes.)

Use a new line for each student (the ‘participant number’ column is purely for visualisation purposes). As the scores are inputted, the graph to the right of the spreadsheet should automatically update with a rolling average.

Once all of the data have been collected, provide a descriptive overview of the graph. At this stage you do not want to tell them which column refers to which condition, but you can simply point out which descriptions (A-D) they overall found most and least satisfying.

Resources: Excel spreadsheet named ‘Data collection of mock experiment Weisberg\_data.xlsx’

Timing: 15 minutes

Transition statement: Let’s now match up the letters to the experimental conditions, and look at what this study was all about.

**Your notes:**

Slide 7 At this point, we can start revealing what the purpose of the study is. Weisberg and colleagues tested over 150 participants across three different experiments, where they were given 18 different explanations of psychological phenomena like the ones the students just read. There were four different types of explanations – ‘good’ explanations provided additional information that accurately illustrated the reason behind the phenomena. ‘Bad’ explanations, on the other hand, we just circular rediscriptions. Each of the good and bad explanation could either contain some irrelevant neuroscience that added nothing to the explanation, or did not contain this.

The rationale behind the study was that people are inherently fascinated about brains and neuroscience, but the researchers were interested in whether this actually caused a problem when it comes to being objective about neuroscience itself.

Timing: 5 minutes

Transition statement: So, what did Weisberg and colleagues find in their original experiment? Let’s take a look.

**Your notes:**

Slide 8 These are the findings from one of Weisberg’s experiments. On the vertical we have the measure of how satisfactory people found the explanations. A positive score would mean that people were satisfied, whereas a negative score would denote dissatisfaction. Explain the two blue bars first – the researchers found that good explanations are seen as very satisfactory whether or not they’ve got neuroscience in there. Next, look at the left-hand red bar - people can tell when a weak explanation is weak, because they find the bad explanations very unsatisfactory. The interesting (and perhaps problematic) finding is that when you have a bad explanation with neuroscience (the right-hand red bar), you find that people find the explanation much more satisfactory, even though the addition of neuroscience adds absolutely nothing to the explanation.

Timing: 5 minutes

Transition statement: This is what Weisberg and colleagues found in the original experiment. How does this compare to the data we’ve just collected?

(In our pilot study all 12 groups followed the Weisberg pattern…)

**Your notes:**

Slide 9 Providing the excel and powerpoint files have been set up as outlined on page 3, this slide should show the students’ data in the same format as the Weisberg data from slide 9. If this doesn’t happen, revert back to the Weisberg\_data excel file, and select the ‘sheet 2’ tab at the bottom of the spreadsheet. Walk the students through their results – they may or may not resemble the Weisberg data; if they do, then the point to make is that they have similarly expressed more satisfaction at the bad explanation with neuroscience, even though the additional information adds nothing. If they show different results, this is fine; as a class discussion point you can ask why their data might have shown something different. This may be because the data are ‘noisier’ due to fewer participants/stimuli, or it may be due to more initial neuroscience knowledge (especially if there are a lot of psychology students in the class), or it may be that they are already good critical thinkers.

Timing: 5 minutes + discussion if needed

Transition statement: Now that you know what the different conditions relate to, have a look back at the explanations and see if you can find the irrelevant neuroscience.

**Your notes:**

Slide 10 Allow the students time to read back over the explanations, to see if they can spot the differences between the good and bad explanations, and to see if they can spot the irrelevant neuroscience.

Timing: 5 minutes

Transition statement: Let’s think about what the implications are of this study.

**Your notes:**

Slide 11 The reason that this study is relevant to primary teaching practice is precisely because it highlighted the fact that we have a blind spot when it comes to neuroscientific explanations. Because neuroscience is such a complex field, and is still relatively ‘new’ (in that we are still learning lots about the brain), it means that it is very difficult to link basic neuroscientific research to classroom-based initiatives, teachings programs, or student learning outcomes.

Timing: 2 minutes

Transition statement: This therefore has practical implications for your teaching practice.

**Your notes:**

Slide 11 Given this blind spot that we have about neuroscience, if that is coupled with a limited knowledge about the workings of the brain, then the end result could be potentially costly. It could mean that ‘brain-based’ initiatives are implemented uncritically in the classroom, at great cost, when in fact there is no evidence that they actually have any effect.

This isn’t just a hypothetical question – it currently happens a lot in schools across the country. Two examples here are ‘brain breaks’ and a previous example is Brain Gym. (Trainees may remember their own experiences as pupils of being asked to touch their nose with one hand, ear with the other and cross over…And they may feel quite angry to find this was not well-founded.)

Brain breaks – some have claimed that in order to facilitate learning, it can be useful for children to take a break by doing another activity. In one example, a teacher would get children to sit on the floor and say a word relating to something they had been learning earlier – for example Egypt. The teacher would then slowly go through the alphabet, and when the letter E was reached, the children had to jump up. The teacher would then start at A again, and children would have to jump when they reached G, and so on. This isn’t actually a break from anything – in fact it is a very cognitively demanding task. Therefore, while it may nevertheless help in giving the children a break from learning in a more traditional sense, it is not in any way based on neuroscientific research.

Along similar lines, Brain Gym is a system that is (still!) sold to schools that claims to improve academic performance through a series of exercises, but to date there is no convincing evidence that it actually works. An example is the claim that there are ‘brain buttons’ – places on the neck and torso that, if pressed, stimulate blood flow to the brain. This is nonsense.

So the problems with these sorts of initiatives is that they encourage a belief in incorrect science or pseudoscience, can prove to be very costly, and can potentially override other, more effective forms of learning.

Trainees may want to share experiences at this point. They may also want you to give them a definitive answer on whether other brain-based initiative they have encountered is right. And you may not know. Be honest! It is really important that we model calmly recognising the limits of our own knowledge. Explain that the rest of the session is about how we can start to evaluate such claims.

Timing: 3 minutes

Transition statement: But we are interested in the brain, and so are parents… so as professionals we need to be prepared.

**Your notes:**

Slide 12 This slide shows the results of a survey conducted by the Wellcome Trust (2013) that indicates the high level of interest in the brain among the teachers and among the parents surveyed.

You may want to supplement this with your own recent example of the prevalence of brain-based interest.

Timing : 1min

Transition statement: So what kinds of ideas might you encounter from parents, and from colleagues in school?

**Your notes:**

Slide 13 How would you respond?

Here 5 claims are presented as if they are spoken by parents or an education colleague or consultant. Invite the trainees to discuss each claim in pairs. (Don’t tell the trainees yet, but some of these are based on neuromyths and some better grounded in recent research.)

Timing: 4 minutes

Transition statement: How can we decide whether these claims are true and how we should respond to them?

**Your notes:**

Slide 15: Consider one of these claims in more depth

 Organise the trainees into 5 groups and allocate each of the groups one idea to explore. Alternatively trainees could choose a claim to explore. Clicking on the link will take them to a scaffolded exploration of their claim, which is reproduced on the first slide for them. Each claim needs a slightly different kind of exploration so the scaffolded explorations are varied in format but all have some key features: critical questions, sources, questions about implications for practice.

There are also links to further sources so this activity can be made into a longer session, and different working speeds are accommodated. (If used on a undergraduate teaching programme there may even be time for the whole group to look at all the claims over a series of sessions.)

[Retrieval Practice](https://docs.google.com/presentation/d/1oQp-yu5Jq0hgn20A06YsFKom2g7a2rxhb7RAT_Zqz9I/edit?usp=sharing)

[VAK/Learning styles](https://docs.google.com/presentation/d/19KUBSivm9LNlEpXETa2IY6bHOpJE5cWRep_R8Y-afwo/edit?usp=sharing)

[Left brain/right brain](https://docs.google.com/presentation/d/1BIbOM8p2Gqcey9UseHyO8DSwLQsfxIU-Tm8VKC1ekm4/edit?usp=sharing)

[Mindset](https://docs.google.com/presentation/d/1xhDpWzmk9HRtPUIffUx2Nhz0hmpNmlpRBXbbAHvTngA/edit?usp=sharing)

[Brain Training](https://docs.google.com/presentation/d/1p-nBocgnuzXhW723IekekWflQSp5IAHsUD-UUI_WmxA/edit?usp=sharing)

Timing: 20 minutes

Transition statement: You will be asked to feedback a summary of 3 points. (Show slide 15 while they are working.)

**Your notes:**

Slide 15 Feedback

Interact during their feedback if needed to elicit the following points for each claim:

**Retrieval Practice** - Not just lab tested. Here psychology lab findings have been trailed with classes of children.

- What is being tested? The kind of knowledge being tested in the example is recall of vocabulary. This is quite a limited kind of learning. What kinds of knowledge and learning do the trainees value?

**VAK/Learning styles**

* Clarify that there is evidence that labelling children a V, A or K learners and teaching them accordingly does not lead to better outcomes. Use a mixture of approaches for all children according to what is being learned and what an individual needs.
* This myth is persistent! Why do we want to group and label children?

**Left brain/right brain**

* If you google it, you will find it! Try typing in ‘critique of’ to get some opposing views.
* Refer to the ‘pre-learning’ slides: there is some localisation of brain function to each hemisphere, but the brain acts as an integrated whole. A bit of scientific evidence was taken and misused to support the ‘common sense’ idea of ‘folk theory’ that there are different sorts of people; creative and logical.

**Mindset**

* Studies need to be replicated. Look out for when one author seems to dominate - why aren't other people finding the same thing?
* When something fits in with our values be extra cautious and beware over interpreting. Dweck is saying that with a growth mindset and hence effort and appropriate support everyone can get better at something. This fits with our neuroscience views of the brain as ‘plastic’. But she is not saying that everyone can do anything if they only believe in themselves.

**Brain Training**

* Context matters. In general, you get better at the specific thing you practice doing and it may not be transferable.
* Who are the participants? We can't assume that young children will respond in the same way as 60 year olds.
* Does the person/body making the claim stand to gain financially?

Timing: 20 minutes

Transition statement: Let’s summarise the different ways in which you took a critical look at the claims.

Slide 16 Points to consider when faced with neuroscience claims

Go through the slide to reiterate and develop points that were made in group feedback.

Learning about how to be critical about neuroscience doesn’t end with this session - this will be a career-long exercise. That’s a tough thing to ask of anyone, let alone busy teachers, but nevertheless it’s important. At some point in your career, you will be faced with a claim that some sort of neuroscience-based method or programme will revolutionise the way you teach, or the way your students will learn. When that happens, here are some points to think about. These are things that you can use beyond neuroscience though, especially whenever you see any science reported in the news. Walk the students through this list, and place a particular emphasis on the last point. Very often, when we are presented with a claim that fits in with our own existing set of beliefs or knowledge base, we are less likely to be critical of the claim. In a sense, things that we are quick to believe are the most important things to assess the evidence for.

 Timing: 2 minutes

Transition statement:Slide 17 Implications for Primary teaching.

Here want to have a message that supports a critical, but not dismissive, view of the contribution that neuroscience might make to education.

It is important to iterate here that not all science is bad; it may very well be the case that with future advances in neuroscience, a robust science-based learning initiative may well be developed. The important thing is to always try and assess the evidence.

Timing: 1 minutes

**Your notes:**

Slide 18

Thank the group for their participation. If they wish to read further, the books mentioned in this slide are a very accessible place to start.

Timing: 1 minute

**Your notes:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | A | B | C | D |
| Person 1 |  |  |  |  |
| Person 2 |  |  |  |  |
| Person 3 |  |  |  |  |
| Person 4 |  |  |  |  |
| Person 5 |  |  |  |  |
| Person 6 |  |  |  |  |

Optional: Grid for collating data

Please populate the table with the score (-3 to 3) the members of your group ascribed to each example.