ASE 2018

CPAC: making your delivery even better

Accompanying materials

January 2018

Contents

Presentation slides

CPAC – making your delivery even better

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January 2018

The first round of A-level science monitoring visits

- Ran from January 2016 – May 2017.
- Centres allocated by JCQ.
- Visits were awarding body specific for each science.

The scale of the task

- 2,857 visits to 2,651 centres.

- 2,486 first visits passed first time, needing no further action.
- 134 first visits passed first time, but extra evidence was requested in addition by email.
- 233 first visits did not pass first time, but passed on the second monitoring visit after support.
- 4 centres required three monitoring visits, with ongoing support throughout, before passing the visit requirements.

- A very small number of centres needed no visit due to consortium arrangements.

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Pass rate for the endorsement

Joint council for qualifications (JCQ) provisional GCE A-level science endorsement results – June 2017 (all UK candidates).

Cumulative percentages achieved.

Subject	Gender	Number sat	Cumulative Pass
Biology	Male and female	53,946	98.9
Chemistry	Male and female	46,340	99.2
Physics	Male and female	33,065	98.8
All subjects	**Male and female**	**133,351**	**99.0**

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Pass rate by A-level grade

Grade	Not classified %	Pass %	Total entry
A*	0.09	99.91	10,860
A	0.08	99.92	25,724
B	0.18	99.82	27,551
C	0.61	99.39	25,670
D	1.19	98.81	20,446
E	2.72	97.28	10,901
U	8.53	91.47	4,324
Total	**0.91**	**99.09**	**125,476**

gov.uk/government/news/guide-to-as-and-a-level-results-for-england-2017

Awarding organisation vision

- All awarding bodies feel very strongly that the new endorsement of practical work is by far the best way forward. Our collective vision is that, through this approach to practical work assessment, students develop a mastery of 'hands on, minds on' practical skills that prepares them better than ever before for undergraduate science courses, employment or further training.
- The assessment of practical skills through Common Practical Assessment Criteria (CPAC) now gives teachers the freedom to teach practical work in any way they wish as often as they wish, without the constraints of a mark scheme.

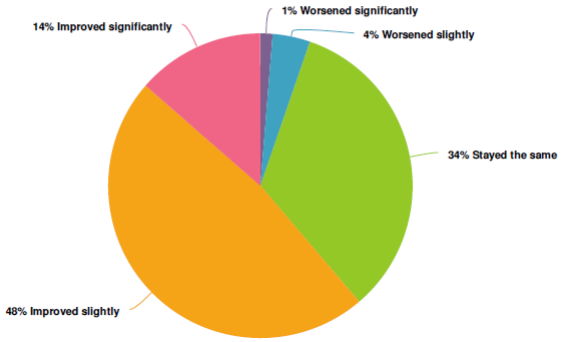
In 2016

Our survey and direct experience was strongly suggesting that:

- direct teaching of practical skills will benefit student learning
- the new practical regime may promote student progression to HE and science careers (more motivated)
- cuts to school college budgets may further impact on the positive student experience (under-resourcing is potentially disadvantaging up to 40% of A-level science students)
- in the short-term, assessing student outcomes in practical-related exam questions and teacher perceptions of student preparation for these, should give an early indication of success
- the lasting impact will not be known for some years.

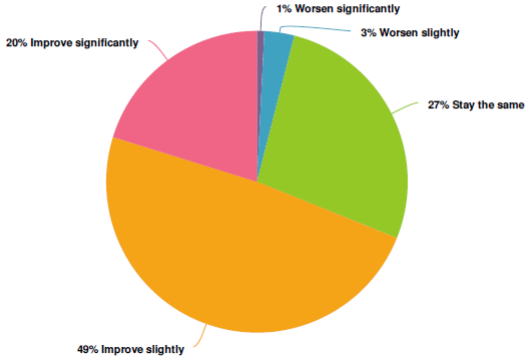
Feedback from 2017 practicals survey

1. Since starting to teach the new specification, has the quality of teaching of practical skills in your school/college:



Feedback from 2017 practicals survey

2. Over the next couple of years, is the quality of teaching of practical skills in your school/college likely to:



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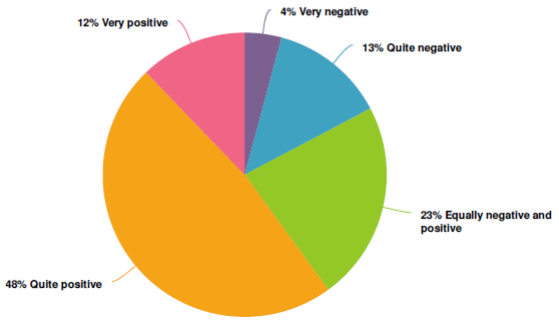
Feedback from 2017 practicals survey

3. So far, what is your view of the process for practical skills assessment in the new specification?



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Positive feedback

When asked “How has the new A-level science practical skills endorsement affected you, your team, or your school the most?” they said:

- “We have been able to buy more resources and the students take practical work more seriously. It’s made our planning for practical work more rigorous.”
- “It has enabled more continuity of teaching, delivering practical work parallel to the teaching of relevant theory. We always had to stop to deliver the ISA.”
- “As a team it increased our workload initially but once we had set up all of our new ways of working it will be an easy system to run.”
- “The competencies also feel like a true reflection of what lab work would be like if students choose to continue the subject at higher education or as a career.”

Challenges highlighted in feedback

- “A lot of time has been spent trying to work out how to ensure all CPACs are covered throughout the practicals.”
- “Although there is now no worry about marks being unfairly gained by other centres, the monitoring of our assessment judgements seems unnecessary, especially when the practical endorsement is not worth any marks”.
- “The new endorsement is too much paperwork and there hasn’t been enough support for teachers.”
- “We have one group of 28 physics students, so we need more than one piece of equipment.”
- “The guidance is far too vague on what should and should not constitute a skills being awarded.”

Feedback summary: what went well

- High success rate of pass first time (approximately 90%).
- Strong teacher survey return rate (Spring 2016) and email correspondence with teachers, reflecting customer satisfaction of our approach.
- Increasing numbers of teachers wanting to take the adviser role, building advocacy.
- Direct evidence of student practical skills improving over time.

Feedback summary: areas to improve

- Engagement with our ‘hard to reach’ schools and colleges.
- Their improved understanding of the requirements and how our resources can be used to best effect as a result.
- SLT awareness of the support that science teachers need regards the delivery of practical work.
- Less schools requiring a second monitoring visit.
- To allow the percentage of students who have not had the greatest of experiences this series to reduce rapidly.

Diamond ranking activity

Task 1

Arrange the 16 cards according to how effective the activity might be to secure a Pass outcome for individual students in the practical endorsement

(10 minutes)

Task 2

Arrange the 16 cards according to 'Must or Should, Could or Won't' (MoSCoW)

(10 minutes)

What strategies will you take forward into your own teaching next series?

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Report on the exam – GCSE practical skills monitoring

Published on e-AQA for teachers to refer to October 2017.

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How did we do?

- Please rate this session on the **Sched Conference app**.
- Using the post-its provided, please write:
  - one thing you enjoyed about our session or will take away for your teaching
  - one thing you feel could be improved.
- Stick these on the feedback poster as you leave.

Get in touch

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Thank you

Executive Summary

GCE practical skills monitoring 2015-17 cycle

Autumn 2017

In order to be awarded a Pass endorsement of GCE practical skills, a student must consistently and routinely meet the criteria in respect of each Common Practical Assessment Criteria (CPAC) by the end of the practical science assessment. A student may demonstrate the competencies in any practical activity undertaken as part of that assessment during the course of study.

Students may undertake practical activities in groups; however, the evidence generated by each student must demonstrate that they **independently** meet the criteria.

We published mandatory Lead teacher training materials in September 2015 and provides a series of resources on our practical webpage to support teachers in their planning, delivery, assessment and tracking of student progress. Our resources have been evaluated and amended to reflect the small changes to the way monitoring will be arranged during the next cycle. We have provided more clarity in areas on which teachers have requested support over the last two years, our own technician advisers now available to directly support teachers and technicians to manage our required practical work delivery.

The four awarding organisations (AOs) have worked together to monitor every school, college and tuition college who submitted A-level entries in Biology, Chemistry or Physics in June 2017. Our cross board messaging was published as a news item on our website on 27 July 2017 and communicated to all examination officers in September 2017. Our monitoring team comprised of a 135-strong team of current or recently retired science teachers, all with experience of delivering the reformed qualifications. Our senior adviser for practical sciences, Catherine Witter, was supported by six team leaders to secure quality in the monitoring outcomes and subsequent feedback to head teachers and principals.

We carried out 1,364 of the 2,758 monitoring visits over a 40 academic week, 200 day timeline. Subject teams that required a second visit (approximately 10% of all monitoring visits nationally), having not met the standard expected initially, were supported directly by our senior team. We carried out 23 monitoring visits for our international customers delivering our reformed A-level sciences. Cases of malpractice was much reduced from our legacy specifications but there are a small number of schools, colleges and tuition centres who failed to offer the required practical work to students, treating practical work and theoretical work as mutually exclusive units. Candidates with entries from those centres received a mandatory non classified summer 2017.

During the monitoring cycle we have gathered a great insight into how teachers are planning for the delivery of a minimum of 12 required practicals and how they are tracking learner progress against the Common Practical Assessment Criteria (CPAC). Common strengths have been shared and incorrect pedagogy, that undermines accurate assessment of CPAC, is highlighted.

Summary of findings

In general the following strategies were found to accelerate the progress that candidates made against the competencies and skills areas over time and are thought by teachers to support the necessary preparation for science based university courses or employment:

- Sharing the pass criteria for each CPAC with candidates prior to their assessment in practical lessons. Many teachers shared the mandatory lead teacher online training videos and clips with their students to exemplify what they needed to do to work at the required standard.
- Making a plan to determine the specific CPAC that will be assessed in each of the required practicals and additional teacher practicals is key to ensuring that candidates can access assessment enough times to deem them to be able to 'consistently and routinely' meet the pass standard. We are committed to opening up practical work, not closing it down, so this is a task individual to centres and their teachers knowing their students.
- If appropriate students should be able to discuss practical work as they carry it out to improve their understanding of the link between practical skill development and associated theory. Examination conditions are not expected.
- Students tracking their own progress against the CPAC and engagement with ATs throughout the duration of the course, to allow them to set targets to improve weaker areas of their practical work.
- Peer assessment was thought to reinforce students understanding of the pass criteria as they used a teacher provided set of pass criteria that reflected the specific practical work being assessed.
- Most effective teacher feedback was non-onerous written feedback, strategically managing to raise awareness of what needed to improve.
- Consistent approaches are being adopted across all three sciences, the CPAC are generic competencies.
- Scheme of learning Year 7-11 strengthening to enable candidates faster access to making progress against the competencies.

1. Follows written procedures

a. Correctly follows written instructions to carry out experimental techniques or procedures.

CPAC 1 was cited by teachers as being one of the more straightforward competencies to assess and many chose to offer this assessment opportunity in a number of their earlier practicals to candidates. High numbers of teachers had provided a written set of instructions, most often the schedule in our Practical Handbook, and generated from that an additional teacher record document, a tick list approach, to capture evidence of pass criteria being met as the students worked. This may have included teachers' bolding out sections of method step text, making it obvious to then observe if a student has indeed carried out that action correctly, in the order written. This was often then strengthened by teachers verbally asking questions to individual students as they carried out their practical work, to ensure they understood the reason for each step. If time was limited, teachers had generated written questions (or used linked legacy specification controlled assessment questions) to test this understanding, which would be offered as a homework task or as part of a test. If appropriate (and manageable) students had been encouraged to plan an experiment or investigation before being assessed against CPAC 1, the parallel assessment of CPAC 1 and CPAC 2 being seen often with Year 13 students.

Teachers have been mindful of maintaining strong quality assurance of assessment judgements and those delivering practical work in colleges with very large cohorts have found this additional teacher record very reassuring despite it not being a requirement. Assessment criteria chosen for observation have been previously discussed in a departmental meeting and all teachers assess all students against the same criteria using the same written method steps. Many teachers with class sizes in excess of 10 candidates have only assessed half the class, or paired up students and assessed one of the pair in any one practical to ensure that assessment is robust, although this may be difficult to develop the required competency for all students if only the 12 minimum required practicals are delivered.

Students made slower progress in CPAC 1when pedagogy was not well developed or when they were not being as closely observed as they worked, with teachers just assuming that they were following instructions correctly based on the accuracy of the data recorded. Although this is a source of evidence for CPAC 1 pass it should not be the only source as interacting with students will support the development of student's use of apparatus and techniques (ATs). Providing written method steps to candidates that are not of level 3 challenge, if offering additional practicals or preferring to use other resources in preference to our Practical Handbook, was also unfortunately evident during monitoring. Some students also told us that they had already carried out a practical before repeating it for assessment purposes. Both should be avoided.

CPAC 1 assessment is undermined if a teacher demonstration is carried out in the same lesson as candidates simply copy the teacher actions rather than engage with the written method steps independently which is expected. Working in large groups, when it was difficult to assess each student's individual contribution to CPAC 1, was also considered unsatisfactory.

2. Applies investigative approaches and methods when using instruments and equipment

a. Correctly uses appropriate instrumentation, apparatus and materials (including ICT) to carry out investigative activities, experimental techniques and procedures with minimal assistance or prompting.
b. Carries out techniques or procedures methodically, in sequence and in combination, identifying practical issues and making adjustments when necessary.
c. Identifies and controls significant quantitative variables where applicable, and plans approaches to take account of variables that cannot readily be controlled.
d. Selects appropriate equipment and measurement strategies in order to ensure suitably accurate results.

Although there is a real emphasis of a holistic judgement of progress against each CPAC, there is a need to ensure that candidates do meet the pass standard in all areas. Many candidates find investigative work difficult initially and teacher's early perception was that the planning for and delivery of CPAC 2 would be challenging. Some teachers left the first assessment of CPAC 2 until the second year of study, something that we would not recommend.

CPAC 2a and 2b involve the manipulation of apparatus and direct observation of students working is required. Many students were demonstrating strong practice when their teachers interacted with them. Although multitasking was required in some of the more involved practical schedules, teachers expected students to work independently which had the desired outcome, eg making adjustments to a method, when a student recognises accuracy can be improved by introducing a further step or using a different piece of apparatus has been evidenced by students writing a note in a different colour against the method when working, which they go on to explain in more detail in their written work at a later date. Some teachers have introduced homework that challenges students to see the practical issues in the method steps written and to rewrite them before carrying them out in the next practical lesson (a strategy often also seen when encouraging students to consider CPAC 3). Some teachers would provide method steps that were 'thin' so that the students had to make choices and therefore adjustments.

There is no requirement for students to design and carry out a full investigation, however the majority of monitoring visit reports detail that the provision has been made towards the end of the course, to stretch students. Earlier on CPAC 2c can be assessed in a number of different ways that require variables to be both identified and controlled. In a number of centres students could be seen making notes in different colours in their lab books, aide memoirs about things they needed to refer to later and very often the different types of variables were reinforced in colour in student work. Questioning students whilst they work to ensure that they can see the relationships between variables and indeed understand the importance of controlling variables was fairly common practice. Often CPAC 2d was assessed by requiring students to choose from a range of apparatus then justify choice of that apparatus with regards to uncertainties, this was seen in written tasks in addition to lesson observations.

Barriers to rapid CPAC 2 progress included a lack of choice of resources and teachers 'stepping in' too soon. Lack of technician support to model practical techniques to students was raised as a concern by teachers. It was also a concern in some centres that the meaning of key glossary terms were not always understood and applied eg precise, accurate.

3. Safely uses a range of practical equipment and materials

a. Identifies hazards and assesses risks associated with these hazards, making safety adjustments as necessary, when carrying out experimental techniques and procedures in the lab or field.
b. Uses appropriate safety equipment and approaches to minimise risks with minimal prompting.

It was pleasing to see that many teachers required students to write a concise risk assessment detailing the main hazards, associated risks and control measures for all practical work taught. Teachers who had a passion for practical work delivery had this as standard pedagogy. Although a written full risk assessment would be exceeding the pass standard for CPAC 3 it does no harm to model the requirements of higher education science courses. Many students could define the terms hazard, risk and control and discuss them during lesson observations. This coupled with teacher observation of the non-negotiable, practical specific safety that teachers would expect to be employed through their own assessment of risk meant that students in many centres were meeting the pass standard early on in the course.

In physics the assessment of CPAC 3 is more challenging due to the theoretical basis of the required practical work however teachers had identified the most appropriate practicals involving the use of lasers, springs and masses and radioactive sources and taken full advantage of those assessment opportunities at various points through the course.

If appropriate teachers had provided a writing frame risk assessment document in the early practicals to scaffold students' access to the pass criteria. Many had adopted a 'tick list' additional teacher record, similar to that mentioned with regards to CPAC 1 above, to quality assure assessment judgements of CPAC 3 across teachers and all students.

In some cases however students questioned had never heard of or engaged with CLEAPSS hazcards. In addition to supporting the development of CPAC 3a this experience would be most valuable when referencing sources (CPAC 5b) and so advisers felt an opportunity was being missed. In the weaker centres teachers told us that the pass standard was being met as 'nothing went wrong or there were no accidents' which is not at all a reflection of the criteria that is being assessed. Open questioning to allow the class to identify major hazards, associated risk and control measures before all students wrote them into their lab record clearly presented a barrier to the assessment of students working independently. In some centres therefore students conveyed little understanding of how to manage a practical incident at the time of monitoring, their lab records limited to basic low level statements including 'tie hair back, bags under stools' and such like.

4. Makes and records observations

a. Makes accurate observations relevant to the experimental or investigative procedure.
b. Obtains accurate, precise and sufficient data for experimental and investigative procedures and records this methodically using appropriate units and conventions.

CPAC 4 was an early choice for assessment within practical work. Many students could design a basic table, complete with headings and units and record data on collection. They could identify the independent, dependent and control variables. CPAC 4a demanded both qualitative and quantitative data and biology teachers in consideration of that worked hard to up-skill students in their ability to draw a high quality biological drawing whilst introducing them to a range of different specimens. Photographic evidence was used to good effect in some centres eg colour changes in titration experiments or transition metal chemistry. The need for accurate and relevant observations to be recorded was key to meet the pass standard in 4a, many students finding this sub-strand relatively straight forward, taking 'accurate' within the context of the teachers expectation of results given within the limitations of their equipment.

When students understood the errors associated with the use of key apparatus and had had the opportunity to consider uncertainty calculations they became more likely to plan for the collection of sufficient data and recorded that data to the correct precision for the equipment being used with less support. Reference to the expected value from secondary sources, an opportunity to assess CPAC 5, was fairly common. Again the use of glossary terms was a barrier in many cases initially. Copying out data tables neatly is not required and compromises the assessment judgement of CPAC 4 as data should be recorded on collection. If students insisted on doing this they learned to staple the original table into their lab record in addition.

In centres where CPAC 4 was considered weaker students found it difficult to differentiate between decimal places and significant figures when recording data. There were also occasions were teachers had deemed work to be meeting the pass standard when there was a lack of sufficient data and repeats when expected.

5. Researches, references and reports

a. Uses appropriate software and/or tools to process data, carry out research and report findings.
b. Cites sources of information demonstrating that research has taken place, supporting planning and conclusions.

Students could take raw data collected for CPAC 4 and process it through calculation and graph work well. A calculator is a simple tool but in many cases well established links with universities enabled more sophisticated processing. In the strongest centres processing data to formulate a conclusion was standard practice; many centres teaching candidates how to use excel to plot graphs to generate a gradient. It was exciting to see many students using their mobile phone as a tool, to take photographs of a field of view before a biological drawing, as evidence of qualitative change, to allow Rf analysis of a TLC plate or to support research to inform their practical work.

The majority of students were employing research to compare a number of possible methods or techniques eg to produce aspirin. Students could consider factors such as cost, safety implication, yield, accuracy of data but also whether their school or college had the apparatus and if their lesson length was supportive of them choosing one particular method to carry out in the laboratory. Research was also well used to find secondary data to compare with recorded primary data or to help to identify major hazards, associated risks and control measures (CPAC 3) associated with practical work. Much of this was a directed homework activity.

There is no requirement for students to write a full report; however sufficient evidence is required to enable assessment of the CPAC being focussed on, together with detail that may help candidates to answer an examination question related to the required practical. Weaker practice seen was unsupportive of students maintaining a working lab record.

CPAC 5a, Referencing to support planning and process conclusions was weak with some candidates not recognising what was required in a conclusion and evaluation. Progress against CPAC 5 was slowest when teachers had simply set a ‘find a method for’ task.

Diamond rank activity

Activity 1

Develop a strong awareness of how the development of practical skills supports examination performance

Involve students in the tracking of their own progress against the CPAC criteria

Use a tracking document that demonstrates routine and consistent pass being met for students in all areas by end of course

Complete the AQA practical skills lead teacher online training package personally

Plan to assess sub-sections of each CPAC without trying to assess too many in the same lesson

Provide written feedback in student lab records

Talk to other teachers about how they are planning for, assessing and tracking student progress against CPAC

Set aside time to engage fully with the practical work assessment requirements and associated resources

Bookmark the Practicals page of the AQA website – print off key resources

Activity 2

Thoughts about training needs - what courses are on offer? How might you improve capacity subject wide?

Consideration of the capacity for the teaching of the use of apparatus and techniques as required in the specification

Consider the technician support at your school or college, with regards to both skills and subject specialism

Meet with your technician to discuss the changes to the assessment of A-level practical work

Direct your technician to the website to allow them to access the practical resources

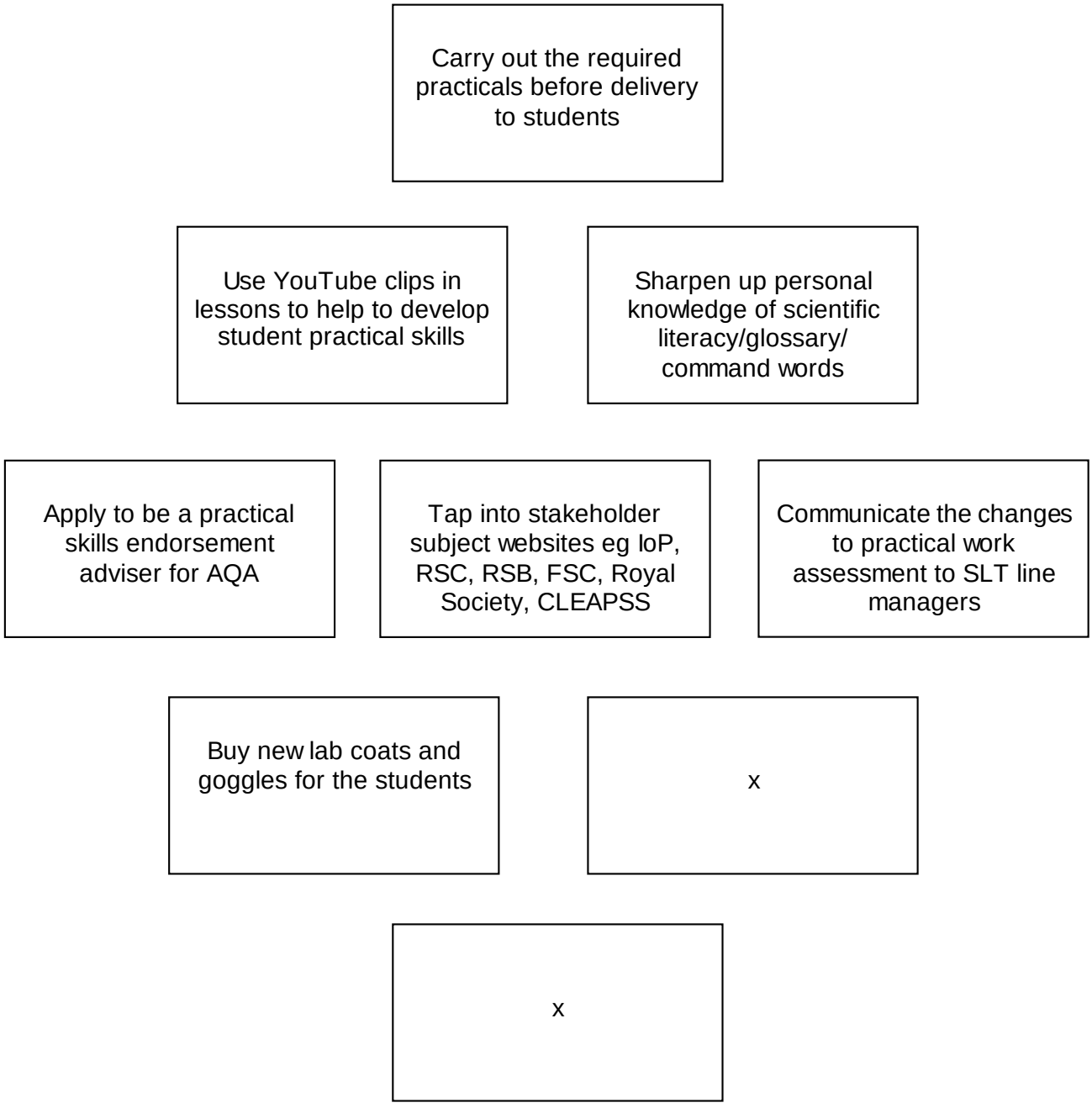
Access the AQA practical handbook and plan dates to deliver the 12 required practicals

Download the specification and teach the content

Produce an inventory of all the practical equipment in school or college to support the delivery of your subject

Match CLEAPSS student hazcards to each of the 12 required practicals - links to CPAC 3 and 5

Activity 3


Carry out the required practicals before delivery to students
Use YouTube clips in lessons to help to develop student practical skills
Sharpen up personal knowledge of scientific literacy/glossary/ command words
Apply to be a practical skills endorsement adviser for AQA
Tap into stakeholder subject websites eg IoP, RSC, RSB, FSC, Royal Society, CLEAPSS
Communicate the changes to practical work assessment to SLT line managers
Buy new lab coats and goggles for the students
x
x

Notes

Notes

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