A learning framework for teaching ADHD students

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This presentation will examine a framework for understanding the learning of ADHD students. The model of learning identifies the key learning interactions students need to implement to learn successfully. It is used to describe the key characteristics of ADHD students and show how these can lead to learning disabilities. The model is also used to develop a range of relevant teaching strategies that can be applied systematically across content areas.

Attention deficit is a common behavioural disorder that has significant implications for how individuals learn and how they relate to others. The key symptoms are persistent developmentally inappropriate levels of inattention, hyperactivity, and impulsivity.

Students differ in how they display this deficit. Some are hyperactive while others are underactive. Some have difficulties largely in the attentional domain and some with difficulties with impulsivity. This leads to two types: the predominantly hyperactive-impulsive type (formerly known as attention deficit hyperactivity disorder) and the predominantly inattentive type (formerly known as attention deficit disorder). Some have difficulty in the three areas (attention, hyperactivity, and impulsivity (the 'combined type').

These information processing difficulties lead directly to learning disabilities. All learning situations make particular demands on how students learn. In any learning situation, the likelihood of learning disabilities increases as the mismatch between the demands made by the teaching and the learning characteristics of the student widens. The particular learning characteristics shown by students who have an attention deficit lead to the learning disability.

In this paper I am focusing on the learning characteristics of these students and what these mean for effective teaching. Many people have done this already. They have done this by linking each characteristic separately with a teaching procedure. The teaching procedures are quite separate from what the child needs to learn.

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The approach I will talk about is different. To learn any particular topic a student needs to engage in a range of separate activities. What I will do is to describe each of these activities, look at how students who have attentional disabilities go about using them and the teaching we can use.

To do this, we will focus on the a combined subtype of attention deficit disorder. In this way we can include the ways of learning shown by the inattentive subtype and the hyperactive-impulsive subtype. We will refer to the combined group as ADHD.

A large body of research shows a strong link between attentional processes and academic learning success. ADHD is more than a behavioural disorder; it is linked directly with learning disabilities. The model of learning identifies the key learning interactions students need to use to learn successfully. We will use it to describe the key characteristics of ADHD students and show how these can lead to learning disabilities.

The model is also used to develop a range of relevant teaching strategies that can be applied systematically across content areas.

The present approach examines learning from the perspective of knowledge enhancement (Munro, 2001). It is based on the question : What do individuals need to do to learn ? To answer this, we analysed some of the most popular theories of learning to identify the aspects or components of learning each had validated. We synthesised these into a framework that identified what learners need to do to learn effectively. We call these actions 'learner functions' or learning interactions. They are the actions learners use to transform their existing knowledge at any time.

To illustrate the learning actions I will use a context in which I was recently involved. My task was to teach a year 3 class how fish breathe.

Learning interactions are what learners do to learn. The set of learning interactions are as follows:

1. ***A purpose for learning*** The first interaction relates to learners framing up a purpose or reason for learning a topic. They are 'challenged' to learn, are in a state of 'cognitive conflict' (Lowenstein, 1994).

The fishy activity Look at these two situations.

Here is the Darebin Creek. It has fish swimming around. They are healthy and well. Sometimes people catch some of the fish at take them home for dinner.	Here is the Darebin Creek. It has very few fish. They are sick and dying because they can't breathe. swimming around.

You need to do something to help the fish to become healthy. You need to know how fish breathe so that you can make the creek better for them.

Teaching students who have ADHD This is the point at which we attempt to catalyse the students to want to learn, to attract or capture their attention, to generate interest in them, to galvanise them to want to learn. You might want to use colours to show the differences between the two situations.

2. ***The outcomes of the learning*** The second interaction involves the learner forming an impression of the outcome of the learning, They visualize the desired outcomes of the learning. They form an impression of where they will end up, what they will know, be able to do or what they may believe or feel. They 'see' the goals as personal experiences (Locke & Latham, 1990; Pintrich & Garcia, 1991). This gives them a direction or focus of their learning.

The fishy activity Students imagined the outcomes of studying how fish breathe. They say what they will know having learnt. They can imagine what their finished project will look like. What will they say in it ? What might they know when they have learnt this topic?

Teaching students who have ADHD This is important for students who have ADHD. Having them imagine and say what they will know or what they will end up helps them see an outcome for their learning. They can see where they will end up. It also helps them direct their learning.

In working with students who have ADHD doing a reading comprehension activity, I have found it useful for them to show me what they will have done when they have finished; they point to the questions they will have answered and where they will have written their answers. In doing maths tasks, I have found it useful for them to point to the tasks they will have done, where they will get down to, what they might have done.

3. ***What learners know about the topic*** Learners make links with and use what they know about the topic. Knowledge change begins with what students know that is relevant. This interaction involves are several aspects.

- One aspect is what they know about the topic. Students can have their knowledge of a topic stored in a number of ways;
  - in abstract, verbal ways
  - in imagery ways as experiences and
  - in action ways.

A plethora of studies have examined the multiple ways in which learners can know a topic (learning styles, for example, Riding & Cheema, 1991; multiple intelligences, for example, Gardner, 1995, 1999; dual coding theory, for example Paivio, 1991).

The fishy activity To stimulate students' existing knowledge about how fish breathe

- What do you do when you breathe ? Imagine you have been shrunk and you are travelling in a bubble of air your friend has breathed in. Where would you go ? What would you see ? Where does it stop ? In small groups students compiled a picture showing where the air goes ?

- In a 'think-pair-share activity, students listed the words they thought of when talking about how they breathe (such as throat, lungs, blood, every part of the body). What actions do you do when you breathe ?

- What happens when you run fast ? They reviewed how their breathing changed when they engaged in exercise. Practise breathing ? Breathe fast/ slowly. They did and described the breathing action.

- Reviewed where the air went : mouth –throat-lungs –blood –all parts of body

- They imagined how their pets breathed and thought about the question : Do all living animals need air to stay alive ?

- How do fish breathe ? Imagine a fish swimming in water ? How does it breathe ? What things might make it hard for you to breathe ?

Teaching students who have ADHD This activity helps the ADHD students to get what they know about the topic ready for learning and in their thinking space, It helps them see that they already know something about the topic. Recalling what they know and holding it in their thinking space helps them use it as a starting point for learning. They are more ready to 'grab' and to understand the teaching information.

- A second aspect relates to what they know about how to learn it, how to think through the topic.

The fishy activity For our fish breathing activity, the students said how they would go about learning a topic, what they would do, and how they would direct and focus their learning activity. If students say what they will do before they do it, they are more likely to do it.

Teaching students who have ADHD When students say what they will do to learn in the next minute or two, they are more likely to do what they say. This is important for students who have ADHD. It focuses their attention on the learning activity. It also allows them to learn, gradually, how to manage and direct their own learning and to plan what they will do, even through small tasks.

In my work with students who have ADHD doing a reading comprehension activity, for example, I have found it useful for them to tell me what they will do as they read the first paragraph; they will read the first sentence and then tell themselves what it says.

Then they will read the second sentence and do the same. The students point to where they will pause (at the end of each paragraph) and say what they will do (make a video in their minds of what they have read).

Obviously students need to learn to say what they will do first of all. Again this needs to be taught gradually, in a systematic and consistent way. They learn to say what they will do and to tell themselves to do this.

Often having students say what they will do for each part of a task helps them break the task into smaller parts.

- A third aspect relates to what they believe about themselves as learners of the ideas, how they value the ideas, whether they believe they can learn the topic successfully (their self-efficacy, for example, Nichols & Utesch, 1998; Pajares, 1996). Learners' self efficacy judgments have an important influence on how they go about learning, the effort they invest in learning and the learning strategies they use. They make these judgments quickly and unconsciously and independently of their actual level of ability.

  It is critical that teachers optimize students' self efficacy judgments before they begin to learn a topic. Teachers can do this by having students identify explicitly what they know about the topic, that what they know is valuable, that they are already 'on the way' and that they know how to learn the topic.

The fishy activity For the fish breathing activity, the group saw that it had a good deal of knowledge about how other animals breathed. They also saw that they knew what to do to learn about fish and breathing.

Teaching students who have ADHD All students, including those who have ADHD, are more likely to continue working on a task if they believe they are more likely to be successful. Reminding them of how they did earlier tasks successfully can help them believe that they could be successful.

- A fourth aspect relates to students identifying what they don't know about the topic. They identify their unanswered questions about the topic.

The fishy activity For fish breathing, students brain-stormed the topic in small groups and noted some questions they weren't sure of about how fish breathe. What will you do to learn more about how fish breathe ?

Teaching students who have ADHD Having students who have ADHD engage in this type of activity

- indicates to them that we believe that they are able to engage is these higher order thinking activities.

- provides them with an emotional investment or engagement in the learning task
- provides a direction for their learning over the next few minutes. They may be more motivated to pursue the activity if they believe they can move in a direction partly decided by them.

They may recode what they know about the topic to a form that they believe will match the teaching. A learner who believes that the teaching information will largely require the use of imagery may recode an abstract understanding of a topic to a set of images or episodes.

Teaching students who have ADHD By helping the students get their knowledge ready in this systematic way, bit by bit, you have broken what could be a longer task into a sequence of short tasks with an expected outcome for each. With the students ready to learn, they are more likely to engage in the learning. The existing knowledge you have stimulated should help them to get started. With students who have ADHD, you frequently need to review or refresh briefly what you have been working on in this section to help the students to integrate what you have covered here.

4. ***A pathway to the goal*** Learners build or "see" a possible pathway to their goal. This is a critical aspect of successful learning. Students who can see a possible pathway are more likely to maintain engagement and perseverance. While the pathway that learners will follow may change direction during the learning activity, at any time it assists in orienting the learning.

Learners need to have the experience of planning and developing their pathways through a topic. Often they can learn it best by identifying the learning pathway they have followed over the previous few weeks.

More generally, students who see learning a topic as being on a journey through the topic are more able to resist being distracted from the target.

The fishy activity For fish breathing, the students discussed the following questions

- What will you need to do to finish your project ?
- What extra things do you need to learn ? What questions might you need to answer ?

Teaching students who have ADHD Having the students plan their learning pathway is an important activity for students who have ADHD, who often have difficulty organizing tasks and activities into multi-step tasks and seeing pathways to the learning outcomes. They have difficulty sustaining attention in tasks or play activities and following instructions. They frequently fail to finish set schoolwork tasks, not because of oppositional behaviours or failure to understand instructions.

You can have the students

- learn how to plan. Teach to say what they will do first, second, third, initially for comparatively simple tasks.
- talk about what they did to finish short tasks they have completed correctly.
- learn to use planners or time schedules. You can teach them to use task organizers, task schedules and outlines.

5. ***Learn in specific contexts*** Learners learn the new ideas in specific contexts in limited, supported, 'scaffolded' ways by linking what they know into new ideas. They make new links between ideas they already know.

They do this in different ways.

- some make small, sequential links between ideas, while others make larger, wholistic links. This distinction is important when teaching students who have ADHD. It is shown in the following:

Serial - analytic strategies	Synthetic-global strategies
Work on bits of information	Look for overall patterns, scan,
Learn step by step, delay giving answer	Leap in and answer quickly, guess impulsively
Focus on detail and specific facts	Focus on overall idea, miss or ignore detail
Think in one direction provided by teacher	Think by moving in several directions at once
Take things apart, work on the parts	Think in wholes; don't take things apart
Follow other people's directions well	Prefer to direct, manage their own learning flexible in their thinking, unanswered questions.
Prefer less flexible convergent learning	Prefer flexible, open-ended learning contexts
Learn other's explanations, procedures	Prefer to work out own explanations
Analyse, sequence ideas in learnt ways	Arrange, sequence ideas less predictably.
Reflect about an idea often for a long time	More likely to 'guesstimate'

Obviously, students who have ADHD are more likely to use synthetic-global strategies, while most teaching assumes that students are using serial - analytic strategies,

- some may link ideas in time and space in specific contexts; they form images episodes or experiences of new ideas while others link ideas in more verbal, less contextualised ways. They form relationships between ideas in familiar language. Others link them in action sequences.

- think intuitively about the ideas, explore and trial particular components and then use context-evaluative thinking.

- ask questions that bridge from existing to new ideas *How can we get from..to, .. ?* These question sequences allow them to move gradually from what they know.

- recode imagery, action knowledge of new ideas into words.

- practise new ideas.

The learning process at this point draws on and integrates contemporary learning research from a range of sources: the role of imagery in learning, multiple ways of learning (for example, Paivio's Dual Coding theory) , learning through internalised actions or operations, learning through specific episodes (Tulving's work) , the role of short term working memory in learning (Baddeley's work) and the work of information management for learning.

This interaction is frequently overlooked or ignored in conventional teaching. Teaching expect students to learn new ideas in an abstract, decontextualised way initially and then learn to apply it in particular situations later. While this is frequently seen as an efficient way of teaching, it is not as likely to lead to effective learning.

The fishy activity For fish breathing, the students examined specific instances of fish breathing. They

- watched videos of fish swimming. Are the fish coming to the surface to gulp in air ? What do they do as they swim ? What would happen if they tried to breathe through their nose ? Where is the air you will breathe in a minute ? Where is the air that fish breathe? How do they get it out of the water ?

- inspected dead fish; identify the gills and the fins.

- imitated how fish move as they swim.

Students investigated each scenario, and

- heard / read about how fish breathe, situations in which they have been helped to stay alive, visualised and discussed the story, paraphrased the key ideas.
- learnt the key terms relating to how fish breathe
- learnt the actions that fish use to breathe.
- recorded their new knowledge about fish breathing in notes, pictures and showed what they thought.

Teaching students who have ADHD Students who have ADHD are more likely to use synthetic-global strategies, while most teaching assumes that students are using serial - analytic strategies. The teaching to which they are exposed needs to take account of how they prefer to learn so that they can experience success but also needs to help them to learn to use serial - analytic strategies.

In introducing each aspect of new ideas, we need to teach the broad, overall aspect first and then the specific details and teach students to analyse and sequence them. Students may have difficulty beginning a large task that requires them to identify components, such as a research project, conventional science report. They need to practise planning their way through these types of tasks.

To deal with students' difficulty maintaining concentration, completing tasks or duties and the ease with which they can be easily distracted by extraneous stimuli, they can be given feedback for partially completed tasks and can learn work completion routines. Developing new ideas in real life contexts can add student interest and activity to the tasks they are learning. Again working through specific instances allowed the larger tasks to be broken into easily completed segments.

To deal with students' short term memory difficulties and low attention span, we can

- teach rehearsal, imagery, paraphrasing strategies for the ideas being learnt; the students are encouraged to visualise them, talk about them in sentences
- focus on one concept at a time and help students to automatise key aspects of them
- use reading guides and plot summaries when required to learn by reading
- teach note-taking skills to help students keep track of key ideas and the links between them. As well, having students complete teacher-prepared notes ensures that they are learning the necessary language for talking about the ideas at this point.

It is important that the students have the opportunity to review what they have learnt here. It is often useful for students to say, draw or act out what they have learnt in particular instances and to practise these aspects so that they can gradually automatise them. Use this to help them see that they are making progress with their learning, moving along their pathway.

You can also use this to help the students improve their listening comprehension when talking about the topic and their ability to follow relevant instructional sequences. They can be engaged in short tasks in which they ask each other questions about the topic, add to descriptions of the set of ideas, etc.

6. ***Abstract or deepen the new understanding.*** Learners deepen their new understanding. They abstract or "decontextualize" it, and link it more broadly with what they know. They

- link episodic, verbal and action aspects of idea at once ; they say, write, draw, do.
- review, consolidate what they have learnt with what they knew
- decontextualize, summarize, re-organize, re-prioritize, main/subordinate ideas.
- elaborate and extend ideas through questioning.
- teach the conventional ways of communicating new ideas
- identify a range of contexts in which they can use it.

The fishy activity For fish breathing, the students generalised what they had learnt about how individual fish breathe. They

- linked episodic, verbal and action aspects of how fish breathe ; said, wrote, drew, did 'fish breathing.

- examined whether all fish breathe in the same way and how fish that don't have gills breathe, categorised fish on the basis of how they breathe, selected the main ideas.

ways of breathing

lungs (us) gills (fish)

- elaborate and extend their understanding through questioning, for example,
  - "When would it be hard for fish to breathe ?"
  - "Would fish be able to breathe better swimming closer to the bottom of a river or sea, near where the plants grow, or closer to the surface because the air rises ? Would you catch fish better if your line was just below the surface of the water ?

- learn the conventional ways of communicating new ideas. They reviewed the key words such as gills, fins, dissolve, blood.

Teaching students who have ADHD Students who have ADHD often have difficulty integrating the various aspects of the new ideas and learning the conventional ways of writing and / or describing them. They also may have difficulty developing the most effective procedures that match each new set of ideas.

To deal with students' short term memory difficulties and low attention span, we can

- teach summarizing strategies and how to prioritise the ideas
- teach students to generate new episodes for the ideas, imagine them in novel contexts
- identify the key ideas, the main steps in procedures. The students either alone or in small groups can produce summaries, outlines and lists of the main ideas.

Again, it is important that the students have the opportunity to review what they have learnt at the higher level of complexity.

7. ***Invest positive emotion in the new knowledge*** Learners need to invest positive emotion in the new knowledge they have learnt. This increases the likelihood they

- will be self-motivated to think about it and use it on later occasions,
- believe they can learn the ideas successfully and
- that it is OK to take risks.

To make this emotional investment in the knowledge, learners need to see

- the new ideas as interesting, have a value or use,
- that is was their mental activity that learned the ideas and
- that they managed and directed aspects of the learning.

Many classrooms are emotionally sterile. Students are not expected to make an emotional investment in the knowledge they are learning. They don't see this as an expectation and as well they don't learn how to do this. As a consequence, they frequently lack an emotional commitment to or feeling for the ideas they are learning.

The fishy activity For fish breathing, the students commented on the value of what they knew now and discussed how they could use the new ideas. They also decided that it was their knowledge, that they could make work for them. They saw that it was them who did the learning and that the knowledge was in their heads.

Teaching students who have ADHD Students who have ADHD often need to have the opportunity to link strong positive emotions with the ideas they are learning so that when the ideas are next stimulated, the positive emotion will lead to the students being more likely to pursue those ideas rather than competing interests. Many of these students don't get to the point to linking positive emotion with the ideas they learn. This will often need to be done in an explicit, focused way.

8. ***Store what they have learnt in memory*** Learners store what they have learnt in memory and practise remembering it. They say briefly what they have learnt, link it with what they know, build memory "icons" for it and practise recalling it.

Storing what has been learnt in memory and practising to recall it is a critical aspect of knowledge management and enhancement.

The fishy activity In terms of learning about fish breathing, students can learn to

- Say as briefly as you can what they have learnt about how fish breathe
- Describe how it is similar to /different from what you knew about how animals breathe ?
- Picture in your minds a fish breathing
- Imagine yourself remembering the ideas.
- Drawing an icon of the main ideas to remind yourself.

Teaching students who have ADHD The retrieval difficulties ADHD students have in recalling knowledge that has been learned and stored in memory have already been noted. The thinking difficulties associated with ADHD are not to do with intellectual ability more with concentration, memory, and cognitive organization. These difficulties are likely to lead in turn to learning disabilities.

Recall difficulties for these students can be targeted by

- Having students summarize the key information they have learnt and practice sorting the main ideas from the details
- Teaching the students a range of relevant memory strategies such as grouping, chunking and mnemonic devices

- Teaching students to organise and link ideas
- Using recognition tasks followed by retrieval tasks
- giving frequent quizzes that have students practising to recall ideas instead of lengthy tests.

9. ***Identify how they learnt*** Learners identify how they learnt, what they did that helped them to learn. This includes both the learning strategies they used and the metacognitive control they exerted over the learning. They reflect on and review the actions they used to learn.

This allows students to build up, in an explicit way, their knowledge of how they learn and the learning strategies they can use. They can compile a list of 'What I can do to learn'. They also learn the language for talking about what they do when they learn.

The fishy activity For learning how fish breathe, students examine the question What things did you do to help you learn about how fish breathe ?

- Making links between ideas
- Making pictures in my mind
- Thinking of differences between us and fish.

Teaching students who have ADHD We have already noted that a major aspect of the cause of ADHD is a difficulty exerting self control or management over their learning or activity and to direct or guide their learning or thinking : they are less likely to

- think, plan, organize, direct, and monitor their thoughts and activities.
- concentrate longer and to keep track of their thoughts, especially those they need later.
- stay on track, be less distracted by their thoughts and return to work after they've been distracted.
- inhibit, or control their behaviour; they are less likely to delay or pause before acting or doing something. They don't learn to say "not now" or "not a good idea" to an impulse.

These students need to be taught to use self scripts for guiding their thinking and how they direct and use on task attention. They also need to learn to use cognitive monitoring.

Because they use relevant self talk less effectively, they are more likely to have difficulty

- resisting distractions, staying on task and an inconsistency in how they think and learn, working toward long-term goals
- have difficulty managing their emotions in functional ways and show a changeable mood, emotional over-reactivity and a low "boiling point" for frustration
- delaying their need for feedback, gratification
- judging time and timing,

- solving problems.

These students need to learn to reflect on how they went about learning or doing a task in small ways initially, keep a list of what worked for them and return to use these ways of thinking again at a later time.

10. ***Making progress as a learner*** Learners see themselves making progress. They implement their own indicators of learning and use these to map and to monitor their progress.

The fishy activity In relation to fish breathing, the students can examine
- What questions they can answer now that they couldn't answer earlier ?
- What they know / understand that they didn't know /understand earlier ?

Teaching students who have ADHD Students who have ADHD need to see themselves making progress along their academic learning pathway in concrete ways. They need to be able to plot their learning path and tell you about the learning path they are following.

This allows you to provide positive feedback frequently and use it to show that you expect students to complete tasks. Students can say the specific goals they have achieved. Doing daily or weekly progress reports can help these students to be structured in the learning contexts.

11. ***Automatise what they have learnt*** Learners automatise aspects of what they have learnt so it can be used for further learning. They do this by automatizing links between ideas and organizing what they know into larger "chunks".

Teaching students who have ADHD Students who have ADHD often have difficulty automatising what they have learnt. This restricts their ability to hold the key ideas in short term memory and to build new ideas. They need teaching procedures that help them to achieve this. It should be noted that these students frequently resist these automatising activities and so don't develop their knowledge at this level. They need automatising activities that capture and retain their interest.

12. ***Transfer and generalise the knowledge*** They transfer and generalise the new knowledge. They explore and analyse the new understanding from a range of perspectives. They

- explore and analyse the new understanding from a range of perspectives, , for example, use Bloom's levels of questioning, de Bono's Six Thinking Hats, Taylor's Multiple Talents Model
- transfer the ideas (near and far transfer)
- use the knowledge in open-ended creative problem solving.
- create new episodes for the ideas.
- categorise problem solving contexts in terms of whether the ideas are useful

- answer higher-level Bloom-type question sequence
- look at ideas from various angles,
- suggest questions the new ideas answer.

The fishy activity In terms of the fish breathing, the students

- explored and analysed the new understanding from a range of perspectives, for example,
  - Would the gills in all fish have the same shape ?
  - Do bigger fish have more gills ?

- transferred the ideas (near and far transfer). Would a fresh water fish be able to breathe as well if it
  - swam into deeper water ?
  - swam into warmer water ?
  - swam into sea water ?
- What fish might be more likely to survive in 100 years ?

- categorised problem solving contexts in terms of whether the ideas are useful
  - Why is it harder for fish to breathe in muddy water ?
  - How would dangerous chemicals in the water affect how well fish breathe ?

- used the knowledge in open-ended creative problem solving: You are member of committee advising the Darebin Council about what steps to take to stop the fish from dying in the Darebin Creek. What might you recommend ?
  - Pump air into the creek
  - Put air into water under pressure and put it in river
  - Keep water cool; have water coolers
  - Make the creek salt water and put in sea fish
  - Grow plants in the water
  - Breed special fish that need less air to live
  - Give fish places where they can be safe from fishermen
  - Make 'air spaces', 'air bubbles' in the water
  - Put pipes into the water that allow air to get into it
  - Slow release air tablets

- created new episodes for the ideas. In the future the world may need fish to grow faster. Imagine what fish that grew faster would look like.

Teaching students who have ADHD Again, students who have ADHD often don't get to this level of knowledge elaboration. This is unfortunate because these students benefit from the open-ended aspects of these tasks and the freedom to pursue topics from their perspectives. Their problem solving difficulty can to some extent be handled by developing this interaction.

13 ***Organise what they have learnt for assessment*** They organise what they have learnt for assessment purposes. They reflect on the context in which they need to display and apply the knowledge, how they can align the knowledge with various assessment context.

This interaction is the 'flip –side' of assessment. Rather than focusing on procedures for what students know, it examines how students can learn how to show best what they know. It encourages students to reflect on how they will show what they know and how they can 'read' assessment situations'.

More generally it focuses on how students can learn how they can use their knowledge.

Teachers can implement a range of activities for students to learn this interaction, for example

- Having learnt a topic and needing to show what they know, students can practise identifying what they think they need to do to convince their teacher that they have learnt it, allowing students alternative ways to do this

- Having students in small groups make up 'mock tests' for a topic. Each group of students reviews the content and invents easy and difficult questions for another group.

- Having students attempt to link questions with a topic on which they will be tested. When they are working through the test situation, they can see how much easier it is to link questions in their mind with questions on the test paper**.**

The fishy activity For fish breathing, the students showed their understanding by

- Working in small groups to design and write a poster that showed what they judged to be important to say about how fish breathe
- Talking individually to the class about one aspect of their group poster; each student selected one aspect and made a class presentation for about 1 minute
- Working in small groups to make up a quiz of 5 questions for another group, who assembled and wrote their answers to the test
- Working individually to select what they judged to be 10 important questions about how fish breathe. Each student wrote a list of the questions and their answer to each.

Teaching students who have ADHD Students who have ADHD often have difficulty showing what they know in assessment situations for several reasons: they may have difficulty (1) understanding the assessment tasks, (2) linking them with what they know (3) retrieving the relevant knowledge and (4) putting their understanding into words. They need to learn how to 'play the assessment ' or knowledge display game. The teaching activities here are intended to teach them to do this. By using a series of

assessment tasks, we are providing these students with several options for showing what they know and for receiving positive feedback for what they know.

ADHD students have difficulty managing their learning activity. It has frequently been noted that ADHD students have difficulty managing their learning activity. From the perspective of learning disabilities, they present as 'passive' or 'non-strategic' learners; they are less likely to direct or guide their learning or thinking, to

- think, plan, organize, direct, and monitor their thinking and learning activity.
- concentrate longer and to keep track of their thinking.
- stay on track, be less distracted from the task at hand or return to work after we've been distracted.
- inhibit, or control their behaviour; to delay or pause before acting or doing something. They are less likely to say to themselves "not now" or "not a good idea".

The set of learning interactions is can be used to develop a set of matching 'self instructional' strategies that ADHD students can learn to use gradually to guide their way through any learning task. These become self scripts that students with ADHD use to direct their attention selectively and to sequence their learning activities. The interactions actually tell the students what they tell themselves to do when they are using on task attention strategies. Below is a possible set of self scripts these students could learn to use to direct their attention.

- What question do I need to answer here ?
- What will I end up with ? How will I know when I have finished ? What will I have ?
- What do I know about this topic ? What pictures come to my mind ? What words do I think of ?
- How will I say what I have learnt ? What did I do to learn other things like this ?
- What do I know now that I didn't know earlier ?
- Whose brain did the learning for this ?
- What things helped me to learn ?
- What things helped me learn this ?
- What progress have I made ?
- How are new ideas like what I already knew ? How are they different ?
- Where else could I use these ideas ?

A long term aim of the teaching can be that students learn to use the sequence spontaneously and selectively as part of their self talk whenever they need to work through a learning task. Teachers can remind them to talk about what they do when they use each strategy, to evaluate their usefulness and decide when to use them. Students can write the strategies on small cards and use these to self cue. The practice students gain in using the self scripts can be broadened to improve self-control more generally.

Diagnosing learning problems for ADHD students. You can use the set of interactions to diagnose learning problems for individual students or small groups. By interpreting the problems learners show in terms of learner interactions you can see what teaching procedures might be most helpful. You can examine how well the student seems to use each of the interactions in the following table and note your observations and comments.

Student's name _____ Grade _____ Date _____

Learning interactions : To what extent does the student	Observations and comments
Say her/his purpose or reason for learning a topic ?	
Describe her/his impression of the outcome of the learning ?	
• recall relevant knowledge easily ? • believe she /he can learn ideas successfully? • say how her/he will learn the topic ? • recode what she /he knows to match the teaching ?	
learn new ideas in specific contexts, learn each component of the new ideas separately ?	
learn the new ideas in a more abstract and integrated way ?	
respond positively emotionally to learning the ideas ?	
Identify the strategies used to learn ?	
see her /him self making learning progress ?	
encode efficiently the new idea in long term memory ?	
transfer and apply ideas in a range of situations ?	
automatise them ?	
practise organising the knowledge for assessment ?	

You can see which key learning interactions are not developed for any student with ADHD, how they can be developed and if they are not, the problems that might ensue. Some of these are shown in the following table.

Recommended teaching procedures for areas of learning difficulty Recommended teaching procedures for some of the most frequently occurring area of learning difficulty associated with ADHD are shown in the following table.

Area of learning difficulty	Recommended teaching procedures
Difficulty directing attention to where it is needed at the moment, difficulty starting tasks	• Present idea to be learnt as brief challenge • Cue students to visualise outcome of a learning task • Stimulate what the students already know • Cue students to invest positive emotion in what they have learnt • Have students say, repeat instructions • Increase task structure, highlight or colour code directions and other important parts, use visual cues such as colour, arrows to focus attention • Teach students keyword underlining skills
Difficulty sustaining attention in many situations, lower persistence on tasks not having immediate consequences, may daydream, avoids or is reluctant to engage in tasks that require sustained mental effort	• Cue students to visualise outcome of a learning task • During learning, break task into several short tasks, each with an immediate outcome • Develop each aspect idea separately and then integrate • Avoid repetitive tasks • Help students see themselves making progress in concrete ways, plot their path, have them tell you how they will learn, the learning path they will follow. • Provide positive feedback frequently, use it to show that you expect students to complete tasks. • Have them say the specific goals they will achieve before they begin. • Provide input in small manageable chunks • Provide clear, comprehensible models of the desired outcomes of learning • Help them learn to concentrate for longer periods of time and focus on what interests them • Schedule difficult subjects at the student's most productive time. • When independent learning is set, monitor students' intermediate learning outcomes.
difficulty focusing on something that removes our attention from where	• Stimulate what students already know. • Cue students to visualise outcome of a learning task. • Have students say, repeat instructions.

it needs to be), not paying sufficient attention, especially to details and organization.	• Describe the path to task completion. • Describe the learning activities the student will take. • Provide input in small manageable chunks.
Difficulty completing tasks or duties, easily distracted by extraneous stimuli	• Create work completion routines • Provide opportunities for self-correction • Give partial credit for partially completed tasks • Add interest and activity to tasks • Break larger tasks into easily completed segments • Allow the student choice in tasks
Learn in global wholistic ways, less likely to attend to details	Teach self scripts for noting detail and for sequencing information
difficulty organizing tasks and activities, organizing multi-step tasks.	• Teach students how to plan, to say what they will do first, second, third, initially for comparatively simple tasks • Have students talk about what they did to finish short tasks they have completed correctly • Say aloud the types of organisation involved in particular tasks or information sources • Teach the student to use planners or time schedules, task organizers and outlines • Teach study skills and practice them frequently and in all subjects • Allow time during school day for locker and backpack organization • Allow time for student to organize materials and assignments
Short term memory difficulties, low attention span	• Help students learn to concentrate for longer periods on tasks that interest them. • Teach rehearsal, imagery, paraphrasing strategies • Cue students to automatise key aspects of ideas • Focus on one concept at a time • Write down key ideas, list main steps in procedures • Use reading guides and plot summaries • Teach note-taking skills-let the student use a study buddy or teacher-prepared notes to fill in gaps • Provide summaries, study guides, outlines, and lists
Difficulty recalling knowledge that has been learned and stored in memory.	• Teach the student memory strategies (grouping, chunking, mnemonic devices) • Cue students to practice sorting main ideas and details • Teach information and organization skills • Use recognition tasks followed by retrieval tasks

	• give frequent quizzes instead of lengthy tests) • Summarize key information

Summary

The aim of this paper has been to examine the learning disabilities frequently displayed by students with ADHD. The use of a learning framework was used to provide a learning – teaching integration to the analysis.