

The who, what, when, where, and why of SOLO taxonomy

PAM HOOK WITH JOSIE ROBERTS

In Q&A Pam Hook reflects on what drew her to SOLO taxonomy and why she is so motivated to develop its classroom-based use to enhance student learning. She explains what SOLO is and how it can help students to articulate their learning outcomes, understand the learning process, and set new learning goals over time. I also asked her to highlight some of the pitfalls that teachers may want to avoid, and to point teachers in the direction of free SOLO resources available through her website and social media. As Pam travels the world introducing SOLO to many schools, education agencies, and governments, New Zealand teachers can be proud for leading in this international practitioner-based movement.

How do you describe SOLO taxonomy to teachers, or even their students, who have not come across it before?

SOLO is an acronym that stands for the structure of an observed learning outcome. The word *taxonomy* simply refers to grouping on the basis of similarities. Essentially, SOLO taxonomy is a model that represents the complexity of an observed learning outcome. In categorising learning outcomes SOLO also outlines the learning process.

John Biggs and Kevin Collis, the original developers of SOLO, were trying to figure out why teachers called some student learning outcomes surface and some learning outcomes deep. They wanted to determine the criteria teachers were using when they held an impression that a certain piece of work showed

deeper understanding than another. The model emerged from work exploring the common patterns found in the student work samples and they began to develop a model from there (Biggs and Collis, 1982).

The SOLO taxonomy is made up of five levels of cognitive complexity (see Figure 1 for an example). At the prestructural level the student hasn't really grasped what the task was about. Here they don't know where to start or they more or less just repeat the question. At the unistructural level the outcome is one relevant idea. The multistructural level is where they have many relevant ideas. There is a quantitative difference between the unistructural level and the multistructural level, it's just more of the same kind of thinking. They're both considered to model surface level understanding.

After that there's a qualitative jump in complexity to the relational level. Here you will find the work that teachers recognise as deep learning. It's work where a student connects the loose ideas in some way. They explain, compare, sequence, or analyse the ideas. Looking at pieces of work we notice students using connector words like "because" or "so that" or "the same as". Biggs and Collis then found student work that seemed to go beyond the relational level. It goes by different names, such as transfer or conceptual understanding, but SOLO labels this work as being at the extended abstract level. At this level a student has taken a risk with what they're doing and they've stepped out beyond what is known and have made a generalisation, prediction, or an evaluation. It's the sort of work where a student might say "the author's purpose was...", or, "the effect on me as a reader

was ...", or, "I think in 50 years' time we'll see ...". The student makes a claim and backs it up while zooming out to another level of abstraction.

The power of SOLO is that you can categorise both the learning task and the learning outcome independently. Figure 1 illustrates a multistructural task where the student responses all describe the cat—some at a surface level and some at a deep level. When using SOLO, all students are able to say "I think my learning level for this task is 'X'", explain why and then suggest next steps in learning. Progress in SOLO is not linear—a race to extended abstract finish. Progress is spiral—it is iterative, when a student's response reaches an extended abstract level they simply zoom out and start again. They can say, "I think I need to find out more about ...", say, euthanasia, or feral cats. Likewise, SOLO can be used

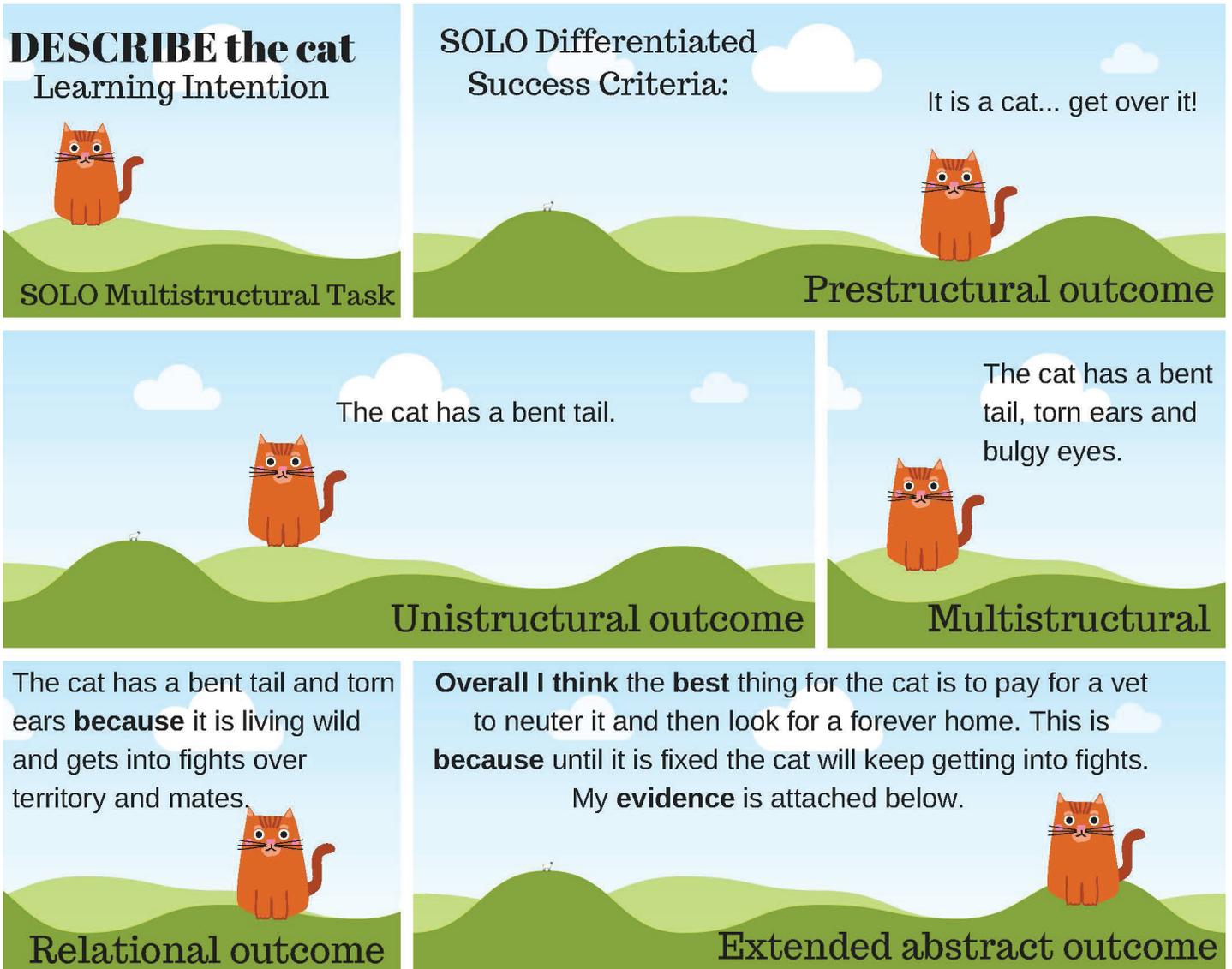


FIGURE 1. A MULTISTRUCTURAL TASK.
Artwork used under license from canva.com.

regardless of age or curriculum level. In this case the same task could be given to vet students at the tertiary level and their description of a cat will become more nuanced at each level of the taxonomy. The quality of the ideas at each level might vary, but not the taxonomy itself.

It's important to understand that SOLO taxonomy isn't just a model of a learning outcome. It is also a way of representing the learning process—how learners move from a stage of “not knowing” to stages of surface, deep, and then conceptual understanding. It models how learners move (with effort and strategies), from a place of knowing nothing to having one idea, to having several ideas, to linking the ideas, and then maybe to extending or transferring those ideas somewhere else. The model says very clearly that you can't privilege deep over surface understanding because you can't get to deep unless you've got the surface understanding. At the same time, SOLO doesn't suggest that learning is a linear process. Instead it represents learning as a spiral of learning that keeps coming around and starting again. And although SOLO is a model of learning at any one moment, it can also be understood as a model of lifelong learning.

What motivated you to develop SOLO for the classroom initially?

I wasn't looking for a model of learning when I first stumbled across SOLO. I was interested in and motivated by student questioning. I fell in love with student questions when I heard John Edwards describe questions as the “things we steal from children” and read about questioning in *Teaching as a Subversive Activity*.

Once you have learned to ask questions—relevant and appropriate and substantial questions—you have learned how to learn and no one can keep you from learning whatever you want or need to know. (Postman and Weingartner, 1969)

I wondered about how we could help students differentiate questions—are some questions really more powerful than others? One of my earliest teaching positions was Head of Department Science in an Auckland alternative school so the belief in student agency and the importance of student questions has been with me for a long time.

I bumped into SOLO around 16 years ago. A chance conversation revealed that John Hattie's students were using SOLO instead of Bloom's for designing multiple-choice test questions. I call it my “falling off a donkey on the way to Damascus” moment in teaching and learning. It marked the start of many years exploring and experimenting with the classroom use of SOLO.

Educators in tertiary institutions had been talking about SOLO for many years before this. In tertiary

settings SOLO was used by institutions to look at the learning outcomes of students. Academics used SOLO to grade Masters' theses and to look at the relative effectiveness of different teaching interventions. Hattie and Brown used SOLO as a framework for designing asTTle so that the questions had different levels of cognitive complexity (Hattie and Brown 2004).

I saw the potential to flip this top-down use of SOLO in a classroom-based use of SOLO; where students and their teachers could use the model to monitor their own learning outcomes. Sharing a model of surface and deep learning with primary and secondary students was a practical way to put the learner right at the centre of the learning process.

In the classroom, the SOLO model is practical, and it does something. It helps students to do metacognitive work, to be able to think through “What is the task that I'm doing?”, “How well am I doing?”, and “What should I do next?”. It lets students label the level of their learning outcome at any one moment in time. If you share SOLO with students, it becomes their model of learning. The SOLO levels of bringing in ideas, connecting ideas, and extending becomes a representation of everything that goes on during the school day and helps to make learning more visible and more accessible. To help students, each level is represented by the term, a hand sign, a symbol, and a shape. It's important to remind them that SOLO is simply a model of the cognitive complexity of their particular learning outcome at a particular moment in time. It is not a label for the student themselves. Students and teachers can look at the model and illustrated diagrams to identify where the student's learning outcome sits and figure out how to take their learning further so that it represents deeper learning.

So, overall, my work, a “bottom-up” with the classroom-based use of SOLO, has been a new development of the earlier “top-down” use of SOLO in tertiary settings. John Biggs has been a critical friend and a mentor throughout; he's read my books, watched the videos, critiqued articles, and provided opportunities for me to write and work with others. He finds the classroom-based use of the model very exciting. Indeed, he talks about it as “an extended abstract take” on using SOLO itself, which makes me smile. In addition my work with the classroom-based use of SOLO was endorsed by John Hattie, something that means a lot to me (Hook, 2015).

How does SOLO compare to other models that were already in use, such as Bloom's taxonomy?

You can find a detailed analysis of the differences between Bloom's and SOLO taxonomy in a chapter in Vinther's

book on educational taxonomies (see, Hook 2015). A key difference from my perspective is that when using SOLO the levels of task and outcome can be quite different. This isn't the case with Bloom's, where there is an assumption that task and outcome are at one and the same level. With SOLO you can have a task that could be cognitively complex and yet a student can achieve the task at any level of SOLO. This differentiation of task and outcome is very, very powerful. By using SOLO we introduce challenge for every student regardless of the complexity of the task. There are other issues with Bloom's—like the confused allocation of verbs, low interrater reliability etc.—which add up to make SOLO the more preferred model of learning to share with students.

How can teachers go about designing learning opportunities that are more likely to enable students to stretch into the more complex levels?

With SOLO we can design differentiated learning opportunities which will stretch and challenge every student.

SOLO is a way of looking at a learning outcome and by understanding its structure we also understand how to scaffold a pathway of less complex tasks needed to get there. A teacher would want to understand the big picture of where they want students to go (so have some understanding of the extended abstract or the bigger conceptual ideas). Teachers and students then select learning tasks and strategies to help bring in ideas, connect ideas, and extend. As such, teachers can simply align the different strategies they would ordinarily use within a SOLO planning framework.

Using SOLO doesn't really require us to reject other teaching strategies and approaches used for surface and deep learning. It doesn't mean that prior learning is no longer important or that we no longer need to address the common alternative conceptions or misconceptions that students might hold so that you could confront, somehow accommodate, or replace them. It simply asks that you align these activities with the SOLO framework and make this visible to students. It fits well with ideas of deliberate acts of direct teaching or Hattie's idea of having explicit, proximate, and hierarchical steps in learning.

So one approach is for teachers to use the "SOLO plus one" strategy. When you start teaching, your first step should always be to understand the SOLO levels of their prior knowledge and experience. What do they know already? What level of understanding do they already hold? Do their learning outcomes show surface or deep levels of understanding? Once you've found out the SOLO level of their understanding you design (or co-construct) the next

learning task one SOLO level above—"plus one"—thus ensuring the next learning intention holds challenge and is hierarchical, proximate, and explicit (Hattie 2012). It should be a little bit beyond where students already are so that it's interesting (hierarchical), but not so far ahead of where they are that they don't stand a chance at being successful in getting there (proximate). Hattie also uses the word *explicit* to make sure that students are very clear about what they're trying to get to. In other words, set a learning intention or an intended learning outcome. Either co-construct it with the students or ask them to do it, depending on their understanding of SOLO, so that they can say, "The next step is...". Because each task can be designed to be able to be completed at different SOLO levels all students should be able to say what their next learning intention might be. I outline other specific teaching strategies in my books and resources.

Overall, SOLO is a model that says, "Effort and strategy will get me there". It's the strategy bit that is sometimes difficult for teachers to identify. They can often say "you're trying very hard and I see you're stuck", but they also need to be able to say "It's my job as a teacher to find you a better learning strategy. You keep trying and we'll see if this new approach works better for you to bring in ideas or connect ideas or whatever you're trying to do". Hattie and Donoghue (2016) put together a lovely paper on the effect size of different learning strategies at different stages of the learning process, which might also be useful for teachers to look at for designing learning opportunities. It should help teachers when they're asking, "We want students to connect ideas or we want them to compare and contrast, but what are the learning strategies that might help?"

What do you see as the main pitfalls for teachers when they're designing or scaffolding learning tasks using SOLO taxonomy?

I see it as a pitfall to use the SOLO levels to label the student. We can be fooled into making assumptions about a student based on the complexity of their learning outcome. For an identified task—we look at a piece of student work and then tell others we have "an extended abstract student". I'd rather we say, "The outcome for this piece of student work was at this level of SOLO". We can annotate or edit the work to change the level up or down. SOLO is a way of understanding the cognitive complexity of a work sample. To categorise or label students is to miss the opportunity to understand learning as a process of moving from surface to deep levels of cognitive complexity and to instead think of learning in terms of fixed ability or a fixed mindset label.

Another pitfall I notice is when teachers don't support students to invest sufficient time and effort to develop and embed their surface understanding. It can be easy to forget that the SOLO learning model is both iterative and spiral. If you get caught up in thinking of SOLO as a linear rush to the top, it can be appealing to throw up a lot of images about something, introduce a complex idea in quite a trivial and visual way, and then expect students to connect ideas and come up with the big picture.

A final challenge lies in keeping a sense of fun and unpredictability when planning learning activities to support surface and deep learning outcomes. We can be so busy trying to align SOLO levels of cognitive understanding that we forget about the need to create memory and the excitement of learning. In focusing on the #skill of learning we could neglect to include plans for building the #will and #thrill of learning (Hattie and Donoghue 2016).

Could you give an example of how SOLO has been used in the secondary setting?

The easiest way to see what happens at secondary school is to visit one and listen to the student and teacher conversations about learning going on in classrooms. Alternatively, look at the New Zealand Transport Agency (NZTA) website's curriculum portal. There's a whole raft of secondary resources that have been designed using SOLO across every learning area apart from languages. Another place to look is at the exemplars in NCEA Mathematics. NCEA maths Levels 1, 2, and 3 uses SOLO as a discriminator: Achieved is numerical reasoning; Merit is numerical understanding with relational understanding; and Excellence is numerical reasoning with extended abstract understanding.

You seem to travel a lot! Where are schools particularly interested in SOLO and why do you think that is?

SOLO makes surface and deep learning visible. Educators across the world aspire to higher order thinking, critical and creative thinking, and deep learning but up until now I don't think we've had a model that is clear enough for students to use to help them understand what's required to get to this level of deep learning. SOLO is a simple and powerful model that makes surface and deep visible to students and teachers. Over the years, educators outside New Zealand have followed up on my writing, use of social media, and all the free resources I've put on the HookED website and wikis. Many have visited New Zealand to see how schools are using SOLO. Others have worked with enthusiastic SOLO practitioners overseas who have been introduced to SOLO in New Zealand.

Our teachers travel widely. Educators have seen how students talk about their learning when they have a simple model of surface and deep outcomes, they have undertaken their own teacher inquiry into the model and this has sparked invitations for me to work overseas.

I will agree that the first half of this year has been a little excessive in terms of air miles travelled. I have worked in Denmark, Australia, and Hong Kong as well as across many New Zealand primary and secondary schools. In Denmark the kommune of schools are training their own SOLO trainers. There the interest is in deep learning. Danish teachers want their students to think more critically and creatively about the world. The top level of SOLO allows that to be visible and thus accessible. I'm also working with the Department of Education in Victoria, Australia, with one of their school clusters where the focus is on new pedagogies for deep learning in particular leveraging digital technologies. In Hong Kong there is interest in how SOLO learning strategies can support deeper outcomes and metacognition in the IB PYP outcomes.

Many countries want to create young people who can think deeply (critically and creatively) about their world—they know these young people are the promise-filled citizens in our future.

Where could teachers who might be interested look next? What tools or resources might you recommend?

I write practical books about the classroom-based use of SOLO with Essential Resources. A large number of schools use these books to support implementation of the model across a school. I try to write three books a year and collaborate with teachers who use SOLO to create powerful learning outcomes with their students in different parts of the world. I co-author the texts and have over 20 books written with global SOLO practitioners. Teachers are encouraged by these practical descriptions of what others are doing with SOLO in their classrooms. Some books have been written in Danish and I have also written chapters on the classroom-based use of SOLO in books edited by Rowan and Bigum (Hook 2012) and more recently with Tay (Hook, 2018).

Educators who are just beginning to explore SOLO can go to my HookED website—pamhook.com The website and wikis host free resources, posters, instructional videos, SOLO rubrics, curriculum writing etc. HookED SOLO apps help teachers and students plan and build SOLO rubrics. Social media makes it easier for teachers to access other teachers' work. I have built a large Twitter following and a big social media presence on Pinterest stuffed with student #SOLOtaxonomy

examples so that teachers can be easily supported by talking to someone else who is working on a similar task. The teachers I work with are generous in sharing their student outcomes with others. This has enabled SOLO to become a practitioner-based pedagogy in classrooms across the globe.

If I had to sum up the classroom-based use of SOLO in one sentence, then I'd say: sharing SOLO with students clarifies surface and deep thinking and gives students freedom and control over their learning.

References

- Biggs, J. (2013). *Changing universities: A memoir about academe in different places and times*. Ballan, VIC: Strictly Literary.
- Biggs, J.B., & Collis, K.F. (1982). *Evaluating the quality of learning: The SOLO taxonomy*. New York, NY: Academic Press.
- Hattie, J.A.C. (2012). *Visible learning for teachers: Maximising impact on learning*. London, UK: Routledge. <https://doi.org/10.4324/9780203181522>
- Hattie, J.A.C., & Brown, G.T.L. (2004). *Cognitive processes in asTTle: The SOLO taxonomy*. asTTle Technical Report 43. Auckland: University of Auckland/Ministry of Education.
- Hattie, J. A. C. and Donoghue, G. M. (2016). Learning strategies: A synthesis and conceptual model. Review Article Number 16013. npj Nature Partner Journals Science of Learning.
- Hook, P. (2012). Teaching and Learning: Tales from the ampersand. In L. Rowan and C. Bigum (Eds), *Transformative approaches to new technologies and student diversity in futures oriented classrooms: Future proofing education* (pp. 115–137). Dordrecht: Springer. https://doi.org/10.1007/978-94-007-2642-0_8
- Hook, P. (2015). *First steps with SOLO Taxonomy: Applying the model in your classroom*. Invercargill: Essential Resources.
- Hook, P. (2015). SOLO taksonomien. In Vinther, A. M. (Ed.), *Læringsmål og taksonomiske redskaber* (English: Goal-oriented Teaching and Taxonomies). Dafolo Forlag. Contact the author for an English-language version.
- Hook, P. J. (2018). How do you design quality rubrics to accompany the AA. In H.Y. Tay (Ed.), *Designing quality authentic assessments* (pp. 52–90). Abingdon, Oxon: Routledge.
- Postman, N., & Weingartner, C. (1969). *Teaching as a subversive activity*. New York, NY: Delacorte Press.
- Vinther, A. M. (Ed). (2015). *Læringsmål og taksonomiske redskaber* (English: Goal-oriented Teaching and Taxonomies). Dafolo Forlag.

Pam Hook is an experienced consultant in learning and teaching. She uses an innovative classroom-based approach to SOLO taxonomy to help schools in New Zealand, Australia, Tonga, Denmark, Hong Kong, and the United Kingdom introduce a common language of learning, and design thinking curricula, to help students learn to learn.

Email: pam.hook@gmail.com