Complex Instructional Knowledge Made Accessible for Teacher Candidates through the Alignment of Concepts in Visual Format

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Abstract
Complex concepts that relate to planning lessons, teaching them, and assessing learning may be very difficult for some teacher candidates. Relationships among ideas are difficult to name and identify as new teacher candidates begin learning about teaching. Five visual organizers have been prepared to support teacher preparation program goals in relation to the planning, teaching, and assessment skills of new teachers. These organizers have been used in both consecutive and concurrent teacher education programs. Teacher candidates’ reflections about these visual supports show that they value their ability to facilitate understanding of complex concepts. The purpose of this paper is to present and explain these organizers and how they are used in one teacher preparation program. Research related to their perceived value is mentioned but is peripheral in this theoretical conceptual paper.

Purpose
Teacher candidates in Faculties of Education are taught many complex instructional concepts in a short and intense professional preparation program. It is difficult to relate and synthesize these concepts to support internalization of the professional ideas. By aligning many of these complex concepts into easily accessible graphic format, program instructors can support the teacher candidates’ understanding of ideas and ensure that their developing understanding can continue to grow in professional contexts beyond the preparation course. This paper presents five distinct resources in visual format that have shown promise in producing strong understanding in teacher candidates (Maynes, 2011c).
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Theoretical Framework

Graphic organizers provide visual representations of concepts. They can represent very complex interrelations of ideas. Organizers provide cognitive structures that support learners’ ability to relate ideas and support critical thinking and higher levels of cognition (Johnson, 1990; Mayer, 1989). Holley and Dansereau (1984) explain that concepts may be more easily learned if they are presented in a non-linear fashion, as might be supported by a graphic organizer to depict elements of lesson planning and delivery. The use of graphic organizers to support comprehension has its origins in schema theory (Axelrod, 1973; Darch & Carnine, 1986). Research also shows that the use of graphic organizers increases achievement of learning goals by 27 percent (Marzanno et al., 2001).

Schema theory (Axelrod, 1973) holds that a highly accessible schema, as provided in graphic visuals, is checked for understanding before a less accessible schema (i.e., a lesson planning template) is attempted. The graphic organizers are much more accessible than the linear template. Teacher candidates can retrieve their understanding and the relationships among instructional ideas more readily when they have a complex graphic representation of these ideas. Visual graphics provide access to the thinking embedded in both direct and indirect modes of instruction; they provide schema that allow teacher candidates to conceptualize the other information about their professional roles related to planning and instruction. If the graphics are known to work for this purpose, teacher candidates should develop more confidence in their ability to apply the general visuals (schema) across contexts. Complex schema also reduce memory requirements because teacher candidates are able to interpret separate bits of information about a current lesson in terms of the parameters of the general schema of the organizers, as consistent with schema theory. The credibility of the figures should be enhanced when the teacher candidates are able to apply them to many lesson instances so they can align and generalize the graphic representations. When they understand each new lesson plan and its complex elements by aligning their plan with the graphics, teacher candidates can make connections among the elements of planning, teaching, and assessing learning.

As in the theory of schema use, teacher candidates should see the graphics as readily adaptable if they support their interpretation of the needs for a lesson plan or its delivery. For example, a teacher candidate might decide that the consolidation time for a specific learning expectation needs to be greater than the diagrams indicate visually. These graphics readily allow
for such adaptation to specific cases. A previous study (Maynes & Julien-Schultz, 2012) has shown that teacher candidates identify that some graphics (Figures 1, 2, and 3) support their understanding of several planning, teaching, and assessment concepts.

Schema theory also holds that a common error in recalling an experience is to recall the part that is compatible with the existing schema and to forget or discard the part that does not fit (Axelrod, 1973). By providing teacher candidates with these five graphic organizers in accessible visual format, we theorize that teacher candidates have fewer opportunities to reduce their schema to more simplistic boundaries and must explore the lesson’s complex nature more thoroughly.

Finally, each teacher candidate’s cognitive style may be reflected in the value he or she sees in the graphic organizers. In the course context where these visual organizers are used, verbal support is also provided for learning the same skills. By making use of the graphics to support the verbal instruction, each teacher candidate’s cognitive style is supported (Mayer & Massa, 2003).

Using this rationale, we designed five graphic organizers (Figures 1 to 5) to help teacher candidates understand the complexities of lesson planning, teaching, and assessment concepts. The use of these graphic organizers is supported by research into the impact of graphic organizers on the users’ ability to relate and retain knowledge and differentiate among the key concepts (in this case the phases of instruction) and related concepts (in this case, aspects of support and assessment that should be available to learners as they engage each phase of instruction) (Hall et al., 1999).

**Organizer Designs**

The five visual organizers, explained below, use complementary conceptual diagrams that are designed to support teacher candidates’ evolving conceptions of planning, teaching, and assessment. Each provides a different focus on complex ideas related to lesson planning, delivery, and assessment. The organizers were designed to complement each other and share common terminology based in current research literature and government policy.

The first organizer presents a graphic depiction of the phases of instruction. Details of this graphic representation are presented in another paper (Maynes, Julien-Schultz, & Dunn, 2010a) and research related to the application of this model has also been reported in another
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journal article (Maynes, Julien-Schultz, & Dunn, 2010b). The second organizer expands on the teacher’s role throughout the phases of instruction. The third provides a link between lesson planning and lesson delivery, including direction about the various forms and uses of assessment. Additionally, it provides visual support to understand the concepts of the gradual release of responsibility (Fisher & Frey, 2008), differentiated instruction (Tomlinson, 1999), and the different uses of assessment for, as and of learning (Earl, 1995; Earl, 2003). This organizer also uses the teacher’s voice to represent the professional thinking that the teacher would engage in while planning and delivering phases of a lesson. In this organizer the elements of assessment are the focus. The fourth organizer helps teacher candidates understand the differences between types of assessment and uses of assessment, including sample strategies suitable for each use. Finally, the fifth organizer provides a memorable analogy to help teacher candidates understand the differences between criteria for assessment and standards for assessment, and relates these concepts to levels of achievement (reflecting local government policy).

While there is related research being done to examine the value of these resources to support teacher candidates’ understanding of key ideas related to teaching, the research behind each resource is not the focus of this paper. Rather, we seek mainly to explain the resources and disseminate them for broader use. As each resource is explained, we will also provide some background into completed and ongoing related research.

**Objects and Materials**

During the past three years, the authors have worked collaboratively and with the input of several colleagues, to examine ways to support teacher candidates’ understanding of several complex and interrelated concepts. These concepts revolve around key teaching ideas related to planning, delivering lessons, and assessing students’ learning. The resources were developed in the order they are presented here as responses to our own assessment as learning. As we were able to see common misunderstandings or limitations in teacher candidates’ ability to relate ideas, new ways to teach these concepts were designed. Conceptual supports were required that would help teacher candidates shift their thinking from focusing on their teaching, to focusing on their students’ learning (Maynes, 2011c). The proven value of graphic organizers led us to design these resources in visual format. Each resource is accompanied by a brief explanation of its
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meaning, its evolution in the companion set of these five resources, and its use within our teacher preparation program.

The Phases of Instruction in a Direct Instruction Model

When our teacher candidates are introduced to the skill of planning lessons, they are first taught the difference between direct and indirect instruction. Then they are taught to use the graphic organizers to plan their teaching using direct instruction. A solid and effective direct instruction lesson will include several phases that should be predictable in order (Rosenshine, 1997; Collins, Brown, & Holum, 1991). The first graphic organizer was developed to show these phases of a direct instruction lesson in the order that they should be managed by the teacher. This organizer also helps the teacher candidates visualize the concepts embedded in the linear lesson planning template.

When we teach this sequence of phases to our teacher candidates, they are taught using a basketball chest pass example. Through questioning and confirmation of brainstormed ideas, the teacher candidates list all of the steps they would use to teach a good chest pass to a group of children. Their brainstormed list of steps invariably includes:

- Explain to students why a chest pass is a good basketball pass (motivation)
- Show students how to execute a good chest pass (i.e., feet spread, both hands on ball, elbows close to body, lean forward, make eye contact with intended receiver, etc.) (modeling the new learning)
- Have students tell you or show you what you have explained (recapitulation)
- Have students work with a partner to practise the chest pass as shown (consolidation)
- Use the chest pass in a scrimmage or game of basketball (application)
- To end the lesson, have students tell you what they know about executing a successful chest pass (lesson conclusion).

These six steps of effective direct instruction are depicted in Figure 1.
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Understanding Direct Instruction

Our next step is to add the language of instruction to what they intuitively are able to tell us about direct instruction. To do this we make coloured prints of the diagram shown in Figure 1 on acetate sheets (as used for overhead machines). We cut these up and put them into envelopes. We then ask teacher candidates to consider another learning expectation (e.g., addition) and sort the phases of instruction into the sequence they would use to teach the new learning. Once they have reconstructed the figure as shown in Figure 1, the term *direct instruction* is reviewed and the instructional terminology as presented in Figure 1 is explained.

From this diagram reconstruction, teacher candidates learn that a direct instruction lesson will include the phases: motivation, model new learning, recapitulation (recap), consolidation, application, and lesson conclusion.

![Figure 1: Phases Of Instruction In A Direct Instruction Model](image.png)
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**Understanding Indirect Instruction**

While teacher candidates still have the phases of instruction acetate pieces in front of them, we ask the questions:

- Are there any other ways you could teach something? and
- Suppose that you did not get time to devote to application of the new learning that was modeled during this lesson. What phases of instruction would you use in the following lesson to continue learning related to this expectation?

After discussion, teacher candidates realize that the phases of instruction can be reordered and the modeling piece can be removed if they wanted to teach using indirect instruction. Many examples of indirect instruction are considered (e.g., web quests, field trips, labs, activity centers, project-based learning, cooperative learning, etc.). For each example, teacher candidates re-sort and position the phases of instruction to represent how they will teach the indirect instruction lesson (e.g., motivate, recap, consolidate, apply, lesson conclusion). They recognize that time allocations may vary depending on the expectation being learned. The term *indirect instruction* is used to identify instances of instruction where teacher modeling is not part of the phases of instruction.

**Supporting Students through all Phases of Instruction**

Next, teacher candidates are asked to consider how they will interact with students during each phase of instruction in either direct or indirect instructional methods. Figure 2 is presented and built up using a sequence of PowerPoint slides so that the phases of instruction ring (Figure 1) is presented first. Once this is reviewed and teacher candidates discuss the significance of the dotted lines between each wedge of the diagram (i.e., variations in time needed or variations in the order) the other concentric rings of Figure 2 are added and explained in sequence. First, the three aspects of curriculum that form possibilities for differentiation are introduced (i.e., content, process, products). Then, the various terms that relate to the relationship between teacher and students during the phases of instruction are explained (i.e., *I do, we do, you do*, metacognition). The terms on the outside of Figure 2 are presented, and the significance of the gradually fading arrows is explained in terms of the gradual release of responsibility concept (Fisher & Frey, 2008). Teacher candidates are provided with colour photocopies and electronic versions of this
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diagram to keep in their practice teaching binders for later reference as they plan their first lessons.

**Figure 2: Direct Instruction**

**Understanding Forms and Uses of Assessment**

As teacher candidates become more experienced with lesson planning, the focus of their professional growth turns toward a deeper understanding of assessment. Figure 3 is used to help them envision the sequence of discussions between the teacher and students as the students gradually acquire greater facility with the new learning. Research related to classroom observations of the time teachers spend modeling and their actions following modeling (Maynes, Julien-Schultz, & Dunn, 2010b), is shared and discussed. The connections between this research and teacher candidates’ growing assessment practices are discussed.

Implicit in Figure 3 is an understanding of the differences between the forms of assessment (i.e., diagnostic, formative, summative) and the uses of assessment (i.e., assessment for learning, assessment as learning, and assessment of learning). These differences are discussed and exemplified. The two actions implicit in assessment as learning are discussed (i.e., formative reflective assessment as learning, and formative active assessment as learning). Formative
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Reflective assessment as learning is explained as the students’ ability to understand the criteria and standards for learning expectations and the learning targets. Formative active assessment as learning is explained as the ability of students to understand the criteria and standards for assessment, and to use these to help them improve their own work in relation to the new learning and learning targets.

**Figure 3: Understanding Growing Success In The Lesson Planning Sequence**

Understanding Strategies Suitable for the Various Forms and Uses of Assessment

Once teacher candidates understand the sequencing, forms, and uses of assessment as they relate to each phase of direct and indirect instruction, they are ready to delve further into strategies for each form of assessment. Figure 4 is provided as a support to help teacher
candidates understand the various relationships that they learned through Figures 1 through 3 and relate those to strategies. Figure 4 summarizes the details that define the terms in the previous figures and relate principles (i.e., under the column *Uses of Each Form of Assessment*) that should guide assessment for various purposes. The graphic organizer helps teacher candidates see the alignment of various phases of instruction with forms, uses, and strategies for assessment suitable for each phase. Once teacher candidates are familiar with Figure 4, examples of various strategies of assessment, tools for assessment, and recording devices are examined and the benefits and challenges of each are considered.
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<table>
<thead>
<tr>
<th>Phases of Instruction</th>
<th>Gradual Release of Responsibility</th>
<th>Forms of Assessment</th>
<th>Holes of Each Form of Assessment</th>
<th>Uses of Each Form of Assessment</th>
<th>Strategies for Assessment</th>
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</thead>
<tbody>
<tr>
<td>Motivation</td>
<td>I do</td>
<td>Diagnostic</td>
<td>Assessment before learning</td>
<td>Not graded</td>
<td>Concept maps</td>
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<td>Should be done so as not to diminish students in the eyes of their peers</td>
<td>KWRL or KWML charts</td>
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<td>Drawings</td>
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<td>Surveys</td>
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<td>Brain drains (e.g., four corners, scribble writing, flip cards, sticky notes, etc.)</td>
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<td>New Learning</td>
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<td>Assessment for learning</td>
<td>Ongoing and continuous</td>
<td>Eye contact</td>
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<td>Provides information about learning progress</td>
<td>Awareness of the body language of the learner</td>
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<td>Provides information to guide scaffolding</td>
<td>Q &amp; A to determine individual understanding</td>
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<td>Provides information to determine accommodations or modifications that may be needed</td>
<td>Practice embedded in modeling</td>
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<td>Will often be ungraded</td>
<td>Rubrics used as growth schemes (i.e., to show the required criteria and standards)</td>
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<td>Helps students see their progress and focus on improvements</td>
<td>Quizzes</td>
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<td>Includes teaching self and peer assessment techniques in age-appropriate ways</td>
<td>Skills checklists</td>
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<td>Individual response</td>
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<td>techniques (e.g., slides, clickers, etc.)</td>
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<td>Personal communication</td>
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<td>Observation</td>
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<td>Exit card questions</td>
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<td>Graphic organizers</td>
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<td>Rubrics</td>
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<td>Consolidation</td>
<td>We do</td>
<td>Formative</td>
<td>Assessment as learning</td>
<td>Focus on metacognitive awareness</td>
<td>Quizzes</td>
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<td>Self and peer assessment</td>
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<td>Use of self-assessment prompts</td>
<td>Individual response</td>
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<td>Examples:</td>
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<td>- What part of your work was most effective?</td>
<td>Personal communication</td>
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<td>- What is this evidence?</td>
<td>(e.g., learning log, conference, hand signals, etc.)</td>
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<td>- What part of your work is least effective? Why?</td>
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<td>- What actions will improve the process you used?</td>
<td>Observation</td>
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<td>- What actions will improve the products you produced?</td>
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<td>- What actions will strengthen your knowledge of this topic?</td>
<td>Graphic organizers</td>
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<td>- What will you do differently next time?</td>
<td>Rubrics</td>
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<td>Application</td>
<td>You do</td>
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<td>Assessment of learning</td>
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<td>Evidence of increasing independence with learning</td>
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<td>Lesson Conclusion</td>
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<td>Feedback informs the next round of new learning</td>
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**Figure 4:** Graphic Organizer
Helping Students Understand Criteria and Standards for Assessment

As teacher candidates become familiar with criteria and standards of assessment we focus on ways that they can help their students visualize and understand the levels of achievement. The concept of criteria for assessment is reviewed. Teacher candidates are introduced to the goal of leading the co-construction of criteria for assessment. They are given opportunities to examine several learning expectations from local guidelines, to consider the criteria for achieving the expectation (assessment as learning) that may be implicit in the expectation or evident in exemplars that are provided to accompany guidelines. Standards for achieving the sample expectations are developed, and teacher candidates are taught to relate criteria and standards to form a suitable rubric or other assessment device to assess a major learning expectation (assessment of learning). The difference between rubrics (i.e., to measure learning) and growth schemes (i.e., to guide next steps in learning) are examined and discussed.

Figure 5 is provided as an example of how to help students understand the differences in levels of their possible performance. The analogy to an ice cream sundae (or various salad components for the more calorie and health conscious) works nicely with students to help them understand variants in work, related to the same learning expectation. Teachers would build on this analogy to help their students understand the learning targets and the related assessment criteria and standards.
Research into the use of graphic organizers for information transfer and retrieval is well established in the literature (McKeachie, 1988; Rabonowitz, 1988). Research into the value seen by recipients of the graphic organizers presented in this paper is underway. Initial research (Maynes & Julien-Schultz, 2012) shows that many themes emerge from teacher candidates’ reflections about the value of these organizers in their understanding of key planning, delivery, and assessment knowledge in their professional roles.

When asked to reflect on the value of these graphic organizers for their understanding of key concepts (Creswell, 2002; Strauss & Corbin, 1990) related to teaching, teacher candidates identify 14 themes that they suggest these organizers help them understand (Maynes & Julien-Schultz, 2012). These themes include: understanding planning conceptions, understanding
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instructional conceptions, time management, support for professional reflection, understanding the gradual release of responsibility, understanding variations of practice for consolidation and application, understanding relationships between successful practice and successful modeling before practice, understanding transitions within phases, using a framework to support continuous professional growth, knowing when to use various forms of assessment, using the figures to help teachers see opportunities for differentiation, developing students’ metacognitive awareness, celebrating evidence of learning and readiness to apply, and understanding that students’ success within any phase of instruction influences potential for success in the next phase.

As pressure to achieve strong indications of student success builds in many jurisdictions internationally, we are witnessing increased debate about the best ways to teach. Direct instruction, or lecture style teaching (which are not synonymous, but are often presented as though they are) is being juxtaposed against various forms of indirect instruction (Peterson, 2011; Schwerdt & Wupperman, 2011). One value of the graphic organizer resources that are being presented here is that they demonstrate the place of both approaches to teaching and situate each approach within the phases of instruction. These resources also help teacher candidates to relate the instructional efforts and the assessment efforts in use, form, and strategy.

Scholarly Significance of the Work

Lesson planning, delivery, and assessment are major skills for teacher candidates to learn. In Faculties of Education, teacher candidates often learn these skills by completing a template that is essentially linear. Such templates embed many instructional conceptions that need to be learned by teacher candidates. However, because of the linear nature of templates, they may not allow teacher candidates to consider the intricacies and recursive nature of the decisions they need to make as they plan and deliver lessons (Schmoker, 2011). Also, such templates may not allow teacher candidates to make connections among the elements of lesson planning and delivery that are known to influence learning (Cochran-Smith, Gleeson, & Mitchell, 2010; Noell & Burns, 2009).

Conceptual diagrams are not constrained by linear representations. The use of such diagrams to support learning is consistent with prior research about strategy training (Garner, 1990; McKeachie, 1988; Rabonowitz, 1988). When learners had an effective strategy such as the
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use of visual frameworks for learning, the learning was improved. Through the use of dynamic visual models for the processes, teacher candidates can learn to be better aligned and research-connected in the way they manage planning, instruction, and assessment (Maynes, 2012). They can see the complex elements of their professional planning, teaching, and assessment roles in a connected and recursive way.

References


Maynes, N., & Julien-Schultz, L. (2011). Reflection with impact?: Do visual frameworks for professional reflection on planning and lesson delivery support teacher candidates’ range
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