# Teaching Spectrum-Style—Part 3: Learning Through Critical Thinking

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The Spectrum is structured around two clusters of teaching styles, one reflective of a learner's capacity to *reproduce* movements and the other reflective of a learner's capacity to *produce* movements (Mosston and Ashworth 2008). Within the reproduction cluster (styles A–E), a model of a movement is presented to the learners, which they then attempt to replicate during practice. There is a time and place in which to employ these instructional styles, which some refer to as *direct* or *teacher-centered* teaching (Metzler 2017; Rink 2020), in the learning environment. Within the production cluster (styles F–K), a question or problem is presented to the students, which they then attempt to solve. Terms such as *critical thinking, problem solving, inquiry-based learning* and *discovering* are used to describe the type of learner decision making and thinking that takes place in these styles. As with the reproduction teaching styles, there is a time and place to employ these instructional styles, which some refer to as *indirect* or *student-centred teaching* (Metzler 2017; Rink 2020), in the learning environment. Mosston and Ashworth (2008) view the Spectrum as a universal model that is designed to help teachers understand the processes of teaching and learning across a continuum of teaching styles that include teacher-centred (A–E) and student-centred (F–K) approaches.

The first two "Teaching Spectrum-Style" articles published in *Runner* (Byra 2018, 2019) focused on the reproduction cluster of teaching styles, in which learners work from memory, a state of "cognitive consonance" (Mosston and Ashworth 2008). The focus of this third article is on the Spectrum's *production* cluster of teaching styles, styles that require the learners to discover knowledge through inductive and deductive reasoning, inquiry and problem solving, styles that evoke "cognitive dissonance" (Mosston

and Ashworth 2008). Within this cluster of teaching styles, there appear to be two groupings: styles F–H (student-discovery learning) and styles I–K (student-initiated learning). Styles F (guided discovery), G (convergent discovery) and H (divergent discovery) are based upon the premise of learners discovering knowledge. These three styles emphasize students' cognitive development, triggering specific thinking processes like comparing, contrasting, hypothesizing, discovering and creating (Chatoupis 2013; Cleland 1994; McBride 1992). Styles I (learner-designed individual program), J (learner-initiated) and K (self-teaching) also emphasize learners' activation to seek knowledge, but through self-initiated learning. It has been found that styles I–K impact students' perceptions of autonomy more than the act of discovering knowledge (Papaioannou, Theodorakis and Goudas 2011). In the remainder of this article, I will describe styles F–K within the structure of these two subgroupings (F–H and I–K), provide example scenarios for the styles and discuss them in light of Alberta's K–12 physical education learning outcomes (Alberta Learning 2000).

## Styles F, G and H—Learners Discovering Knowledge

The guided discovery (F), convergent discovery (G) and divergent discovery (H) styles revolve around learners discovering knowledge as evoked by a stimulus (a single or series of questions, or a problem) presented by the teacher (Mosston and Ashworth 2008). In style F, the teacher leads students to discover a predetermined response through a series of logically designed questions. In style G, the teacher presents students a single question or problem that leads them to discover the predetermined response (convergent discovery). In style H, the teacher

presents a question or problem that leads the students to discover multiple answers to the presented problem (divergent discovery).

## Style F—Guided Discovery

In style F, students solve a problem through a series of carefully constructed questions designed by the teacher (Mosston and Ashworth 2008). The answer to each posed question within the series cumulatively leads the learner to discovering the "sought-after" response (p 215). Mosston and Ashworth (2008) envisioned style F as the gateway to introducing learners to the process of discovering knowledge. This way of learning and teaching is not the norm in physical education, nor is it in other school subject matter areas. Learning by replicating modelled movements with teacher-presented task feedback, as is the case in styles A and B, represents the norm in physical education (Cothran et al 2005; Cothran, Kulinna and Ward 2000; Syrmpas, Digelidis and Watt 2016; Syrmpas et al 2017). Hence, Mosston and Ashworth (2008) viewed it important to introduce teachers and students to this new paradigm of learning (that is, constructing knowledge, reasoning, inquiring, problem-solving, discovering), refer to it as what you may, through a series of questions that gradually lead the learner to solving the final question.

Following is an example scenario of a style F series of questions to guide a group of learners' discovery of a game tactic for net games. After observing multiple students in the Grade 4 class participating in long rallies against their opponents in half-court one-on-one badminton games (students using short-handled racquets, not badminton racquets), the teacher stops a group of six students and gathers them together to ask them a series of questions for the purpose of leading them to discover a primary game tactic used in net games—hitting the implement to open space:

1. What was the goal of the game you were playing? Anticipated student response (ASR): To score against my opponent. Teacher feedback (TFB): Yes.
2. Generally speaking, during these long rallies, where on court is your opponent positioned most of the time? ASR: Close to the net or near the back of the court. TFB: Yes.
3. Why did your opponent remain in one place on court during the rally? ASR: Because that is the place where I was returning the shuttle. TFB: Good response.

4. Where might you try placing the shuttle on your next hit if your opponent remains near the back of the court? ASR: Just over the net. TFB: Nice.
5. Where might you try placing the shuttle on your next hit if your opponent remains near the net? ASR: To the back of the court. TFB: Nice.
6. Why would you place it near the back of the court when your opponent remains near the net most of the time, or just over the net when your opponent remains near the back of the court most of the time? ASR: Because they will have difficulty playing it back to me or they will not be able to play it back to me. TFB: Nice conclusion; now let's try this tactic on court.

Style F episodes are designed to be conducted with individual students or small groups of students. It is not a style to be used with the entire class unless you clearly know that the series of questions will lead all of the learners to the discovery. In other words, one cannot discover the answer to the target question if one already knows the answer. Most style F episodes take little time to deliver—in the example scenario, perhaps a minute or two. Logically, style F seems to work well when introducing students to a new topic. It also is a style that can be implemented in a spontaneous manner, on the go, when the teacher sees that a student or small group of students is having difficulty negotiating the learning task. To be able to do this, however, the teacher needs to be highly knowledgeable in the content (badminton in this example), and knowledgeable and comfortable with the structure of the teaching style. The questioning technique used when teaching within the tactical games approach (Mitchell, Oslin and Griffin 2013) mirrors style F. This questioning technique has been shown to enable students' critical thinking and performance during game play (Butler 1996; Curtner-Smith 1996).

## Style G—Convergent Discovery

In style G, students are presented with a problem to which they discover the one correct answer. I will illustrate this teaching style through a scenario using the same content as presented in the style F example scenario (badminton, with the goal of striking the shuttle to open space—moving your opponent).

> "Come on in, Grade 4s. In the next task, you are going to play a game against an opponent [one-on-one half-court game]. Your goal during this task is to score points against your opponent. Please choose a partner and sit next to her/him.

5-4-3-2-1 … very good! Here are your instructions for the game. Begin with a serve as introduced last class and reviewed during our first task today. If you win the point (the rally), you continue to serve. If you lose the point on your serve, your opponent gets to serve. Do you have any questions about what the goal is of this task? Emily, what is the goal of this task?" "To score points against your opponent." "Very good, Emily! You have three minutes to play your game against your opponent. At the end of three minutes, I will tell you to stop and I will ask you a question about the game you played. You and your opponent will then get together and solve the question. Questions? No? Very good. Now find your space and begin your game. Go."

At the end of three minutes, the students are told to stop and sit down on court next to their opponent.

"Each of you scored multiple points during your game. With your opponent, solve the following question: What did you do to your opponent when you scored a point? Once you think you have solved the problem, put your hand up and I will come over to listen to your answer. Begin!"

The major difference between styles F and G has to do with the way the question or problem is presented to the students. In style F, the teacher guides the learners to solve the problem through a series of sequenced questions. In contrast, in style G the learners are given the problem and then engage in the appropriate cognitive operations to solve the problem (comparing and contrasting, analyzing, synthesizing and so on). They themselves determine what are the smaller questions that lead to answering the problem.

Style G episodes are generally short, but may be conducted with the entire class. This example style G episode could likely be delivered in about two or three minutes (that is, time taken by the students to solve the problem after having completed three minutes of game play). Style G episodes do need to be formally planned in advance as a part of a lesson. As in style F, style G requires the teacher to be highly knowledgeable in the content (badminton in this example) and knowledgeable and comfortable with the structure of the teaching style. Working in pairs, or possibly groups of three, to solve the problem in style G tends to help the students critically think about the solution at a deeper level. Research indicates that neither style F or G is regularly implemented by physical educators in their daily instructional practices (Cothran et al 2005; Cothran, Kulinna and Ward 2000; Syrmpas, Digelidis and Watt 2016; Syrmpas et al 2017).

## Style H—Divergent Discovery

In style H, students are given a problem or question to solve that leads to the discovery of multiple answers. This is significantly different from what is asked of students in styles F and G, which is to discover the single answer to the question (convergent). In style H, students are asked to discover multiple answers to the question (divergent). Asking students to produce movement options is unique to style H, and thus requires the teacher to explicitly set the scene at the beginning of the episode and to verbally support their students' actions while engaged and at the end of the episode (Mosston and Ashworth 2008). Following is an example scenario of a style H episode.

"Children, please sit on your spots with your hands in your lap, legs criss-cross, balloon in front you on the floor, and eyes on me. Excellent, Johnathan! Grade 1s, we have been working on striking with different body parts for the last few classes. In our next task, you are going to discover how to strike the balloon with different amounts of force (strong and light) at different levels (low, middle, high) while using different body parts. I am expecting to see you striking the balloon in many different ways. Grade 1s, please stand. Strike your balloon with strong force. Begin." The learners are given 15 seconds to engage in the task while the teacher circulates and provides individual, specific, neutral feedback (for example, "Yes, Mary—you are using your foot to strike the balloon at a high level; yes, Joseph, you are using your elbow to strike the balloon at a high level). "Stop! Melissa, I like how you are standing still in your self-space with your eyes on me. I saw some of you striking the balloon at a high level (using strong force) with your hands; I saw others using their feet to move the balloon to a high level. Now show me another way of striking the balloon with strong force. Begin. Stop. Next, strike the balloon with light force while you are positioned at a low level. Begin." The learners are given 20 seconds to engage in the task while the teacher circulates and provides specific, neutral feedback (for example, "Yes, Martin—you are using your head to keep the balloon

up while in a kneeling position; Liam, you are striking the balloon with light force with your finger, but what about your body position?" Liam crouches down. "Yes, now you are in a low position"). "Stop! Good work at discovering new ways to strike the balloon with strong and light force! Now, from … Begin." And so on.

This episode would continue in this fashion for perhaps five-plus minutes. At the conclusion of the episode, the teacher would praise the students for the different movement responses produced. In doing so, the teacher is supporting the students' individual discoveries.

In style H, students must produce their movements within the movement parameters that the teacher sets in the problem. If a student is not engaged within these parameters, the teacher must address the issue through corrective feedback, as illustrated in the scenario above with Liam.

In style H, it is very important that the students understand that the movements used in answering the problem are/may be different from one student to the next. They need to know this because more often than not learners are asked to complete a task according to a specific model (demonstration). In this example, the teacher reinforces and encourages learners to produce different ways of striking the balloon within the parameters set by the teacher.

In styles F, G and H, the teacher is asking the students to engage in critical thinking. This takes time, and most physical educators believe they have little of it to begin with (for example, teach students for 25 to 45 minutes, once or twice a week). Teachers who engage their students in these teaching styles are demonstrating that they value students using class time for the process of discovery. They believe that students can improve their performances—motor, cognitive and social/affect—through discovery learning.

Because styles F, G and H are teaching styles that are not a common part of a physical educator's instructional tool box, it is important to realize that successful implementation of these styles is going to take time, require professional support and, perhaps most important, require an open mind (that is, invite opportunity for change). Assuming an open mind, teachers will need time to observe multiple examples of these styles in action, more time to experience the styles while in the role of a learner themselves, and yet more time to implement multiple episodes of each of these styles with their students under the supervision of a knowledgeable and experienced Spectrum teacher. Success is dependent upon the level of professional development offered.

## Styles I, J, and K—Self-Initiated Learning

The learner-designed individual program (I), learner-initiated (J) and self-teaching (K) styles revolve around individualized learning (Mosston and Ashworth 2008). Two of these styles, I and J, may be observed in school physical education classes, most likely at the high school level; the other, style K, takes place outside of the school setting. Style K exists beyond the purview of K–12 physical education.

### Style I—Individual Program

Students in style I seek to "discover a structure that resolves an issue or problem" (Mosston and Ashworth 2008, 274) that is presented by the teacher. The teacher's role in style I involves introducing the subject matter topic to the students through a carefully designed set of questions or criteria. This set of criteria subsequently serves as the guide for the students to design an individualized program of study. Following is a scenario depicting style I.

> "Grade 11s, during the past 15 lessons, you have been introduced to the fitness and exercise centre in our school. You have learned to employ proper technique when lifting free weights and using weight machines, and you have learned how to design resistance exercises using your own body, all for purpose of developing muscular endurance and strength; you have learned to employ the treadmill, stationary bicycle, stair mill, rowing machine and elliptical to develop cardiorespiratory endurance; you have learned a variety of flexibility-based activities and methods of stretching to improve flexibility; and you have been introduced to body composition, specifically to understand what it is and to interpret body composition measures. You have also been introduced to multiple concepts related to health-related fitness like the FITT formula, principles of physical activity (overload, progression and specificity), the stages of lifestyle change, the physical activity pyramid, goal setting and assessing your individual level of health-related fitness. Now you are ready to design

your own personal physical activity program that has as foci cardiorespiratory, muscular endurance and flexibility development. The program you design for yourself will be implemented over the next four weeks during our class (16 lessons). In developing your personalized physical activity program, you must (a) establish your reasons for designing the program, (b) establish short-term goals for the three foci, (c) rate your stage of change, (d) employ the FITT formula when designing and selecting the physical activities to include, (e) maintain a written record of your program and (f) at the end of the four-week program assess the goals that you set for yourself.

"My role during these four weeks will be to observe your progress in designing and implementing your personal physical activity program, and to listen to your questions. I will communicate with you through the questions you ask and the questions I pose to you based on my observations of the development and implementation of your personalized physical activity program."

In style I, the teacher presents the details of problem to be solved. The learners subsequently design an individual program to solve the problem. Compared to Styles F–H, students' level of independence increases significantly. Students who have experience in the content area and experience with the processes related to problem solving (discovering) learned through their involvement with styles F–H, as well as with the student decision making associated with styles A–E, will be able to participate in a productive manner in style I.

## Style J—Learner Initiated

Students in style J design and implement their own learning experience based on movement ideas that they initiate themselves. In style I, the idea of the learning experience is initiated by the teacher through the presentation of a problem; in style J, it is the student who initiates the idea (problem) for a learning experience. Following is a scenario depicting style J.

"Miss Linske, now that we have experienced designing and implementing a personal physical activity program in physical education class, I want to design a more comprehensive physical activity program for myself that I would like to implement next year while in Grade 12. Would I be able to do this next year as a part of Grade 12 physical education class?"

"Madelyn, what a great idea! And yes, you can! I offer a physical education class for Grade 12 in the fall that is scheduled from 12 to 1 pm, Monday through Thursday, that I call "Learner-Initiated Physical Activity Experience." Our facilities here at the high school as well as those available at the community recreation centre can be used during this class. Students who come to me with a written plan for a physical activity learning experience may choose to use this experience to meet the school district's Grade 12 physical education semester-long course requirements. Now, I have a fairly extensive document that outlines in detail what you need to do if you choose to enroll in this special Grade 12 physical education class. I will share it with you."

Student independence is more pronounced in styles I and J than in the three discovery styles (F, G and H), because it is the students' responsibility to make all of the design decisions regarding the topic of study and, in style J, to initiate the idea of the learning experience. As indicated earlier, students' perceptions of autonomy have been found to be stronger in styles I and J than the act of discovering knowledge because of the high level of student independence associated with these two styles (Papaioannou, Theodorakis and Goudas 2011). However, success for the students in styles I and J is dependent upon their experiences with mastering the decisions and processes related to styles A–H, because styles I and J require that the students integrate this previously learned knowledge and skills into the design and implementation of their individualized program.

A primary goal of most high school physical education teachers (as well as middle school and elementary physical educators) is to develop a level of knowledge, skill and self-efficacy in their students so that they want to continue to choose to engage in physical activity for a lifetime. Styles I and J will move students a step closer to meeting this overarching goal of physical education.

## Style K—Self-Teaching

In the self-teaching style, the student is responsible for making all of the decisions associated with serving in the role of teacher and learner. In essence, the learner becomes both teacher and student. This style cannot be

found in the school physical education setting. Mosston and Ashworth (2008) conclude with this style because it reflects one teaching oneself. It is the self-contained teaching style that naturally evolves from the 10 other Spectrum teaching styles.

Once we graduate from high school, many individuals become interested in performing a new physical activity or perhaps several new physical activities. I taught myself to windsurf as a young adult (style K). I was able to successfully navigate this new endeavour (that is, teach myself) because of the understanding I had of learner and teacher decision making related to the five reproduction and five production Spectrum styles, the investigation of the new activity through readings and YouTube videos, and the opportunity to observe others doing it.

## Styles F–K and the Alberta Physical Education K–12 Learning Outcomes

Development of the cognitive learning domain is of primary emphasis in styles F–K. Improving motor performance and affect are secondary to the production teaching styles. Time within the instructional process is specifically devoted to student thinking. Students specifically engage in inquiry-based learning, or discovery learning, through the student-centred instructional practices employed by the teacher. In styles F–K, students produce the answers to movement questions or problems through the process of discovery or inquiry.

The aim of K–12 physical education is to "enable individuals to develop the knowledge, skills, and attitudes necessary to lead an active healthy lifestyle" (Alberta Learning 2000, 5). In terms of the outcomes found in Alberta's K–12 physical education program, styles F–K can be used to help students acquire skills through a variety of developmentally appropriate movement activities in typical and alternative learning environments (general outcome A), and to help students foster responsibility to lead an active lifestyle specifically through effort and goal setting/personal challenge (general outcome D).

In addition to the above connections to Alberta's K–12 physical education program, styles F–K are also intimately connected to general outcome C, "students will interact positively with others" (Alberta Learning 2000, 5). Communication, leadership and teamwork can all be developed within the student-centred instructional approach used in styles F–K. In essence, learners are highly engaged in the cognitive and affective educational learning domains

while actively performing physical activity in styles F–K. The learner-designed individual program style (I) and learner-initiated style (J) are especially well connected to effort and personal challenge, two elements of general outcome D.

## Summary

The Spectrum is a framework that unifies, embraces and connects the range of instructional approaches that exist in teaching and learning. The notion that one approach to teaching is better than another is not supported by the Spectrum. Mosston and Ashworth (2008) theorize that different teaching styles are needed to meet the many different student learning styles and the diverse range of learner objectives spanning the psychomotor, cognitive and affective learning domains. I hope that these three articles on the Spectrum provide readers with the knowledge and intrigue needed to integrate one or more of the teaching styles into their daily instructional routine. Let me close with a statement from Mosston and Ashworth (2008) that seems to summarize the essence of teaching from the Spectrum: "Anyone who desires to reach for a non-versus pedagogical approach, rich in alternatives, can benefit from learning the Spectrum from Command to Discovery" (p xxi).

Are you interested in learning more about the Spectrum of Teaching Styles? Go to https://spectrumofteachingstyles.org/ to download a free copy of Mosston and Ashworth's textbook, *Teaching Physical Education* (2008, 6th edition, first online edition).

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