

# Using Gagne's model in hematology residency

Muhammad Raihan Sajid, Abdul Ahad Shaikh

Department of Pathology, College of Medicine, Alfaisal University, Riyadh 11533, Kingdom of Saudi Arabia

## ABSTRACT

**Background:** As hematologists teaching in a residency program, we have been constructing lesson plans for residents. In this article, we describe a lesson plan based on Gagne's events of instructions for interpretation of peripheral blood films.

**Context:** Instructional design can be defined as a process through which the character of learning is identified and intended to take place with an approach to the development of teaching and learning methods. Gagne suggested a hierarchy for learning tasks according to the complexity. The main role of the hierarchy is to identify prerequisites that must be completed in order to facilitate learning at each level. The theory emphasizes the point that it is important to teach with a clearly laid plan, to establish course goals early on and design the course with these objectives and outcomes in mind.

**Innovation:** We present here a lesson plan based on Gagne's nine events of instruction in postgraduate haematology residency training program. Each step of Gagne's nine events of instruction is explained stepwise in the teaching of peripheral blood film interpretation sessions.

**Implications:** We have found that Gagne's principles can be used in postgraduate residency and fellowship teaching, and it improves the teaching and learning process by having a structured lesson plan.

**Keywords:** Clinical and procedural skills training, Gagne's events of instruction, haematology, instructional materials/methods, peripheral blood film, postgraduate training

## INTRODUCTION

Interpretation of peripheral blood film plays a central role in the diagnosis of hematological disorders and is an essential skill for all residents in training.<sup>[1]</sup> When teaching haematology residents the interpretation of a peripheral blood film and bone marrow we require an adequate lesson plan. Thus, when designing a lesson plan, it is important to consider objectives and outcomes and the series of events that will occur during the teaching session.<sup>[2]</sup> To teach this essential skill, we present a lesson plan based on Gagne's events of instruction.<sup>[3]</sup>

Gagne proposed nine instructional events and corresponding cognitive processes [Box 1].<sup>[3,4]</sup> Gagne's model of instructional design is concerned with the kind of learning outcomes to be achieved, and the arrangement of specific instructional events that are tailored to achieve the outcomes.<sup>[3]</sup>

## PREREQUISITES

The prerequisites for learning the interpretation of peripheral blood film findings are:

1. Knowledge of normal red cell, white cell, and platelet morphology.
2. Understanding of blood indices (mean corpuscular volume, mean corpuscular haemoglobin, mean corpuscular haemoglobin concentration, and red

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#### Address for correspondence:

Dr. Muhammad Raihan Sajid, Department of Pathology, College of Medicine, Alfaisal University, P.O. Box 50927, Riyadh 11533, Saudi Arabia.  
E-mail: [msajid@alfaisal.edu](mailto:msajid@alfaisal.edu)

### Box 1: Gagne's nine events of instruction

- Gain attention of learners (reception)
- Inform learners of learning objectives (expectancy)
- Stimulate recall of prior learning (retrieval)
- Present the content (stimulus) and break it down into components to avoid information overload (selective perception)
- Provide "learning guidance" (semantic encoding)
- Elicit performance (practice/responding)
- Provide feedback to learners (reinforcement)
- Assess their performance (retrieval of information)
- Enhance knowledge retention and transfer to real-life, authentic work (generalization)

- blood cell [RBC] count) with their normal values.
3. Knowledge of basic terminology to describe various abnormalities in the three cell lines (RBC, white blood cells [WBC] and platelets).
  4. Knowledge of terminology describing increase or decrease in various cells lines, e.g., neutrophilia or neutropenia, eosinophilia, cytopenias, etc.
  5. An understanding of immature cells and other findings in the peripheral film, e.g., blast cells, parasites, plasma cells, etc.

This activity is conducted on a multi-head microscope and number of residents is limited to 8 - 10 in one session. The frequency of these formal teaching sessions is once a week in year 1 and 2. Interpretation of peripheral film is both cognitive (recall and interpretation) and psychomotor skill (identification of cells by microscope).

## ACCORDING TO THE GAGNE'S EVENTS OF INSTRUCTIONS

### Gaining attention

There are many strategies to capture the attention of students like an abrupt stimulus change, such as asking a question, or with a visual or sound stimulus.<sup>[5]</sup> Start by first showing the normal peripheral blood films and then showing peripheral blood films from the previous day's clinic pertaining to patients that the residents had seen. This makes it more interactive and personal since they have already seen the patients, and they are interested to interpret findings and arrive at the possible diagnosis. The resident, who has seen the patient, would present the clinical history and findings, and the residents become more participative as a lively discussion usually ensues.

### Informing the learner of the objectives

At the start of the session, residents are informed of the objectives of the session including interpretation of the findings related to the three cell lines and to arrive at a differential diagnosis or final diagnosis.

### Stimulate recall of prior learning

Prior knowledge should be associated with new information and past experiences in order to facilitate learning.<sup>[5]</sup> We ask the residents in turn to explain the findings on the haemogram. Once they interpret the findings, they are asked what they would expect to see in the peripheral film. Once they see the particular finding they can easily relate it to their theoretical knowledge. A simple example is if the blood indices are low the residents would expect to see hypochromic microcytic red cells and by comparing it with the

normal cells or size of a lymphocyte they are able to decipher the findings under the microscope.

### Presenting the stimulus

This is where the actual material is presented to the learner. Content needs to be organized, chunked, and demonstrated.<sup>[5]</sup> The sessions are interactive, and teaching slides are presented in order of increasing difficulty. All the positive and negative findings are discussed in relation to their significance and diagnostic value. A simple example is the identification of normal WBC and then comparing the morphology to abnormal WBC, e.g., blast cells. The residents are asked to point out the differentiating features of normal and abnormal cells on peripheral blood film and bone marrow slides. This keeps the interest of the residents during the sessions.

### Providing learning guidance

This means showing the appropriate actions constitute correct performance. We guide the residents by demonstrating the correct technique of evaluating any peripheral blood film. The sequence repeatedly demonstrated to them presents the demographic data followed by interpretation of the haemogram, looking at the three cell lines and interpreting that data by combining all these to arrive at the correct diagnosis/differential diagnosis. The exercise also ensures that they learn the correct technique and engage in discussion leading to the suggestion of further investigations to confirm the provisional diagnosis. They can then go to their benches and practice the skills acquired during these sessions.

### Eliciting the performance

At this stage the learners need to demonstrate what they have learned. Performance is elicited in two ways. 1) In subsequent sessions, the residents would present a case themselves and demonstrate the findings learned in the previous sessions. 2) Every day the residents see new peripheral films and on a regular basis they would write their findings and the films would be viewed together with a consultant using a multi-head microscope.

### Providing feedback

Feedback enhances learning and corrects mistakes, if any. In our sessions, it is provided in two ways. 1) During the sessions when a resident presents a case, the findings (if incorrect or missed) are demonstrated by senior residents and consultants. 2) , During daily sign-out reporting, the slides are first seen by the resident and then by the consultant with the same resident, therefore, providing instant feedback and learning on their skills and interpretation. The consultant also comments on the technique of the resident and provides constructive criticism on the technique.

### Assessing the performance

The informal feedback and formative assessment are provided in daily sign-out sessions. The end of year examination comprising Objective Structured Practical Examination (OSPE) stations is the summative assessment leading to their promotion to the next level of residency. The OSPE will consist of 15 - 20 stations with peripheral film slides mounted on microscopes and residents are then provided with demographic data and expected to interpret the findings and arrive at the right diagnosis and suggest further investigations.

### Enhancing retention and transfer

Looking at the peripheral films is a daily activity for the residents. This enhances their retention of skills learned during the weekly practical sessions and as they become more experienced they, in turn, become teachers and transfer the skills learned to their junior colleagues.

## DISCUSSION AND CONCLUSION

Instructional design can be defined as a process through which the character of learning is identified which is intended to take place with an approach to the development of teaching and learning methods.<sup>[6]</sup> Gagne identified five major categories of learning: Verbal information, intellectual skills, cognitive strategies, motor skills, and attitudes. Different internal and external conditions are necessary for each type of learning. These conditions of learning are concerned with arranging external events (external to the mind of the student) to support internal processes (events which are internal to the mind of students).<sup>[6]</sup> He suggested a hierarchy for learning tasks according to the complexity of the task.<sup>[7]</sup>

The main role of the hierarchy is to identify prerequisites that must be completed in order to facilitate learning at each level. Prerequisites are identified by doing a task analysis of a learning/training task. The theory emphasizes the point that it is important to establish course goals early on and design the course with these objectives and outcomes in mind rather than teaching without a clearly laid plan.<sup>[8]</sup>

Gagne argues that learning stimuli should be driven by what students will be asked to do with the material.<sup>[9]</sup>

In other words, there must be congruence between the learning material and the assessment of student learning. Gagne's suggestions are in keeping with the notion that students have learned the material if they perform well on an assessment or if students are able to do what the teacher asks of them, they have learned successfully.

As demonstrated in the above example, the residents are exposed to learning a difficult practical skill, i.e. interpretation of peripheral blood film findings, and they are taught in practical microscopy sessions. By exposing the learners to solving real problems, activating their prior knowledge, linking it to clinical case scenarios, demonstrating new knowledge, practicing and applying the skills acquired, facilitates learning and leads to long-term retention.

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