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The use of graphic rules in grade one to help identify children at risk of handwriting difficulties

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ABSTRACT

Previous researches on elementary grade handwriting revealed that pupils employ certain strategy when writing or drawing. The relationship between this strategy and the use of graphic rules has been documented but very little research has been devoted to the connection between the use of graphic rules and handwriting proficiency. Thus, this study was conducted to investigate the relative contribution of the use of graphic rules to the writing ability. A sample of 105 first graders who were average printers and 65 first graders who might experience handwriting difficulty, as judged by their teachers, of a normal primary school were individually tested on their use of graphic rules. It has been found that pupils who are below average printers use more non-analytic strategy than average printers to reproduce the figures. The results also reveal that below average printers do not acquire the graphic principles that foster an analytic approach to production skills. Although the findings are not sufficient to allow definitive conclusions about handwriting ability, it can be considered as one of the screening measures in identifying pupils who are at risk of handwriting difficulties.

1. Introduction

Drawing a pattern appears simple but the sequence of movement to produce the pattern varies. Also, there is more than one way to perform a drawing task. For example, when copying geometrical patterns consisting of several segments, one can usually select many possible combinations of start positions, stroke directions, and stroke orders. These behavioural options allow the copying task to be performed.

Researchers who are focusing on the aspect of graphic behaviour have used the term "grammar of action" to describe developmental rule based on copying behaviour that reflects the organization and planning of start positions and sequence of strokes (Goodnow & Levine, 1973). These graphic rules actually reflect the tendencies of pupils to use analytic strategies when copying geometrical patterns.

1.1. Graphic rules

When children copy geometric figures, they seem to follow a set of rules about where to begin drawing (starting rule) and in which direction to proceed (progression rule) (Meulenbroek, Thomassen, Schillings, & Rosenbaum, 1996). According to

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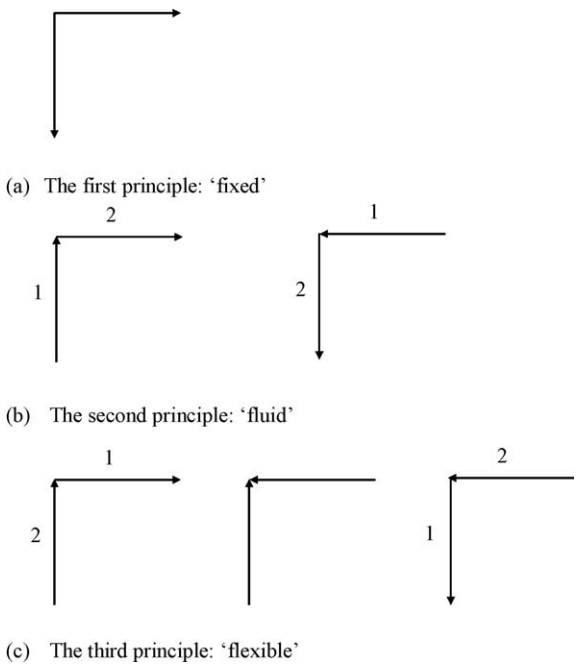

Fig. 1. The three principles of the printing production activity. (a) The first principle: 'fixed'. (b) The second principle: 'fluid'. (c) The third principle: 'flexible'.

Simner (1981), starting rule reflects pupils' preferences to initiate his or her drawing by selecting a certain location point. For example, right-handed children prefer to start at the top rather than at the bottom of the figure, or at the left rather than at the right. Progression rule on the other hand reflects pupils' preferences to segments' directions such as downward rather than upward. Horizontal rule reflects the children's tendency to draw horizontal line after the vertical or oblique line and then proceed rightward.

In addition to the above mentioned rules, Gillespie (2003) discussed graphic production rule for drawing two line segments. Generally, the principles of the production activity for lines copying can be divided into three. These principles are illustrated in Fig. 1. In the first principle, the second stroke is drawn from a starting point of the first line. This principle is called 'fixed'. The second principle is called 'fluid' in which the second stroke is drawn from the end point of the first line. 'Flexible' is the third principle (the second stroke starts at a point in space and is drawn to the first line). According to Ninio and Lieblich (1976), these alternatives differ in respect of their degree of difficulty and complexity, which is best defined in terms of the amount of cognitive load involved in choosing the starting point for the second-drawn line. Cognitive load is actually a term that refers to the load on working memory during production activity and working memory tasks include the active monitoring or manipulation of information or behaviours.

When children learn to draw, the graphic rules appear to build up gradually and finally to become represented in the cognitive system as procedural knowledge. By acquiring this knowledge, the actual sequencing strategy that pupils will choose for a particular task is assumed to be set in advance of the execution of his or her copying movements. However, it is realized that the number of sequencing strategies that pupils can select when they are asked to copy a geometrical pattern increases dramatically with the number of segments of the copying pattern. In this case, Simner (1981) had listed four sequences of events that take place before the children begin to copy the geometric figure. First they will evaluate the visual form as a singular entity composed of subunits. Next, they will select sequences of strokes that require less effort and save labour. Then, they will take into consideration the need to execute a correct reproduction. Lastly, the strokes are selected on the basis of their likelihood of producing the least amount of error.

When discussing about effort and labour, it cannot be denied that many joints in the arm must be controlled precisely in tasks such as drawing and writing. As mentioned by Meulenbroek et al. (1996), these joints or the muscles that control them are grouped into separate clusters or synergies. Even though it is not clear how synergies are formed, synergies may play a role in controlling muscles and limbs during movement production and reduce the number of decisions that the writers need to make. In most cases, when pupils are asked to copy a geometrical pattern, they will organize their movement sequences such that they could employ the strokes that demand the fewest total movements and thus require less effort. Apparently their aim is to minimize the complexity of the copying task which may correspond to their joint-coordination demands.

1.2. Handwriting difficulties

Children who are at risk of handwriting difficulties may display varied graphomotor performance. Khalid, Yunus, and Adnan (2010) had reported the feasibility of using drawing behaviour in identifying children who are at risk of handwriting difficulties.