

# Chapter 10

## Visual Plan Construct Language (VPCL): Visual System and Method for Teaching and Learning Programming and Problem Solving through Knowledge Visualization

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### ABSTRACT

*Teaching and learning programming can be enhanced by the incorporation of visualization. A system and method that the author created, known as Visual Plan Construct Language (VPCL), incorporates programming visualization for teaching, learning programming, and problem solving. VPCL contains a Plan Library that is accessible through the Web. A user can create and establish a working space and environment on the system to examine VPCL plan library and develop one's own plan library. VPCL consists of three phases: Plan Observation, Plan Integration, and Plan Creation. The observation phase rehearses how a program is broken down into smaller components with their integration relationship. The integration phase concentrates on how two plans are related to each other in building a program. The methods of integration are known as appended, interleaved, branched, and embedded. The creation phase concentrates on how a new plan is built using the existing plans from the plan library.*

### INTRODUCTION

Programming is still recognized as a difficult task, and for decades there have been ongoing attempts to improve and enhance learning and teaching of programming. In order to solve instructional and learning programming problems, one should use Visual Plan Construct Language (VPCL). The

main objective of VPCL is to provide a visual plan and a method for teaching and learning programming. A plan is an abstraction that visually provides a solution to a problem or to a sub-problem representing a problem from its macro to its micro level. Any important and meaningful concept that is used to solve a problem is known as a plan. A plan is contingent upon the educator's assessment

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## ***Visual Plan Construct Language (VPCL)***

of the learner's programming and problem solving skills. Besides written explanation, a plan can be visually represented by a dot, a geometric shape or an image (Ebrahimi, 2006).

Other VPCL objectives are to provide programming literacy, making programming easy for everyone; eliminating or reducing programming errors found in syntax and logic; enhancing problem-solving skills by promoting abstraction; and creating a new program by using existing programs (Ebrahimi, 1992).

In order to fulfill VPCL's objectives, visualization has been incorporated in all aspects of programming. Pictures and drawings can help users visualize a plan, rather than memorizing a series of arcane programming language notations. A programmer can concentrate on plans, their relationship, and how they are coded. Therefore visualization can be accomplished through various programming steps such as plan creation, plan composition, language constructs, and program execution. Empirical studies using novice students programmers learning different programming languages has been used to examine the effectiveness of VPCL as an instructional and developmental tool (Ebrahimi, 1989).

Several visual programming studies have been conducted to show how the program works with the data during the execution. (Guo, 2013, Sorva, 2013).

## **BACKGROUND: WHY VPCL**

A problem facing the technological field today is the difficulty of learning programming. Most people are intimidated by the word programming. When it comes to learning, the methods used nowadays may seem too complicated for a beginner. Visual Plan Construct Language has incorporated all aspects of programming and programming languages. Various programming languages can be used to produce the final code in a plan, the execution of plans, and testing of

plans. It is made to help novice programmers learn programming in easy ways. A problem that often arises is that those who know programming do not understand the concepts correctly. VPCL incorporates a visualization plan abstraction; its integration and language constructs into one integrated teaching and learning environment.

The design of both the VPCL system and the method was based on study of novice programming errors with different languages. Visual Plan Construct Language was designed as a solution for a plan composition problem. This chapter describes a system designed by the author that incorporates visualization, plan abstraction and its integration, and language constructs into one teaching and learning environment. VPCL has a library of a common problem set (plan) for novice programmers, which include: statistical problems known as find average, find minimum, a search, and a sorting problem. Additionally, the plan addresses the language constructs of VPCL. VPCL is not language dependent and can be adjusted to any of the current conventional languages. It can be connected to various programming languages to execute various plans; programming languages such as C/C++, Visual Basic, Java, Perl, and PHP can be useful in execution.

Mismanagement of plans has been a major cause of errors by novice programmers, rather than understanding of language constructs such as 'if,' 'while,' 'input/ output,' or other statements. Many programming problems can be identified and corrected at the early stage by training of plan composition than at end by trial and error of coding. (Ebrahimi, 1994). VPCL can be designed and implemented manually (hand drawing, hand writing, cards or blocks, a puzzle, or a game) or can be implemented as a computer software. World Wide Web has given a new dimension to VPCL in regards to its usage and the design principle options. The web programming of VPCL can be done by CGI, ASP, JSP or PHP, under web servers such as Apache, IIS Windows or Tomcat

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