Pedagogical Background

The well known American psychologist Carl Rogers (1902-1987) introduced first the humanistic person-centered approach in psychotherapy and counseling and further in educational settings. It is based on the hypothesis that students who are given the freedom to explore areas based on their personal interests, and who are accompanied in their striving for solutions by a supportive, understanding facilitator not only achieve higher academic results but also grow with respect to their personal values, such as flexibility and self confidence. This approach builds the pedagogical background for modeling a pattern network for secondary school computer science.

Patterns

In the years 1977 and 1979 the Architect Christopher Alexander published “A Pattern Language: Towns, Buildings, Constructions” and “The Timeless Way of Building” his idea of how patterns can be formulated, described and structured for the field of architecture. This approach was taken for this work to capture successful computer science lesson sequences. In this spirit, a pattern network for computer science lessons at secondary school level was described. The prerequisites for the teacher are necessary to apply the network appropriately.

The computer science pattern network is depicted below:

![Pattern Network Diagram]

Pattern Examples

The two patterns bellow give an example how such a pedagogical computer science pattern looks like in detail. Each pattern has the same structure in order to allow comparability for an easier reuse and implementation in practice.

The problem is stated in bold font face followed by the section about forces where the way to the solution is described in detail.

Another important part of a pattern is the semi-formal description of the pattern itself and possible relations to other patterns. Each pattern is connected to other patterns where some patterns complete other patterns and some patterns get completed. For example is the pattern Teacher Lecture a smaller part of the pattern Add knowledge.

The end of each pattern describes a practical example how the pattern has impact in computer science lessons.

Application in Practice

This lesson plan shows how the patterns can be assigned to the corresponding content of learning HTML and CSS. The table gives a rough overview on six weeks when assuming that the computer science lesson takes place once a week.

The model on the right side demonstrates along the week and content plan as described above, how the patterns could be arranged for these intentions.

As each pattern above is described in an abstract way in order to give the teacher freedom to design lessons on his own style, the following arrangement of patterns for this solution is just one way of arranging them. Another teacher maybe chooses another way to arrange patterns for the same learning objectives. This would be also said as person-centered course scenario if the teacher fulfills the prerequisites.

Further Work

Application and testing in practice

Another concern of this work is to promote the pattern approach for computer science education at secondary school level. As the suggested patterns can and should still be improved, it is important to prototype this approach for other computer science teachers. When more teachers can test and apply this system, it can be refined further from practice experiences.

Integration of Computer Science Content

Basically this suggested pattern system does not include patterns which describe computer science content eplicitly but rather build a pedagogical framework for lessons. As next step it could be considered how content related patterns can be integrated in this network model. A pattern as “Computational Thinking” could describe the relevance for secondary school and is connected with smaller patterns as “Sorting Algorithms” where the explicit implemention for lessons is described.

Further Work

In order to make the patterns reusable, a web application is currently under development. The web application is supposed to assist the teacher in creating a common cartidge file for computer science lessons along with the pattern network. First the teacher selects a topic, then he can modify the suggested course scenario and finally the web application creates an archive file which can be downloaded and imported into a learning platform. This tool could also provide a communication center for sharing and improving insights from practice.

Development of Common Cartidge Webtool

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References


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