

Integrating Scaffolds into Goal-based Scenarios: The case of an interactive game on biodiversity for children

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ABSTRACT

In this paper, we describe the design of a goal-based problem solving oriented interactive game on biodiversity. The audience is children ranging from age 6 to 14. We focus in our paper especially on a) the instructional design of the game and b) the support structures. We differentiate between modeling, coaching, scaffolding, and general support structures and focus especially on the design of scaffolds that were integrated in order to provide learners with feedback, guidelines, and help structure.

Keywords

H.5.2 User Interfaces; user-centered design; theory and methods; interaction styles.

INTRODUCTION

In her 2005 paper at IDC 2005, Shalom Fisch identified three key factors for the design of educational games for children, one of which was: “designing feedback and hint structures in ways that support and scaffold children into difficult content.”[4]. The literature on designing scaffolding for secondary and post-secondary students is rich and descriptive, especially when the content area or problems to be solved are complex and ill-structured. The literature is rather sparse, when it comes to young children, and complex domains.

A number of elements have been identified as key components in the design of educational activities, among which is the importance of informative feedback for responses given by the learner. One of the most profound learning steps is taken when a learner modifies his/her previous schemas by incorporating new information to already existing ideas [1]. The feedback and scaffolding components of an activity can offer a fruitful opportunity to engage the learner in this kind of cognitive behavior [8]. Extensive research on the importance of informative feedback has already been conducted and proven more beneficial for learning than simple answers, which provide

basic Knowledge of Response (KOR) [8]. Scaffolds, especially well-designed hard scaffolds (see [2] for distinction between hard- and soft scaffolds) can help learners understand the complexity of ill-structured problems.

CONTEXT OF INTERACTIVE GAME

This project is part of the United Nations Convention on Biodiversity initiative to make the goals and mission of the convention available to multiple audiences. The project team was assigned to design an interactive web site to engage children from the age of 6 to 14 in issues of biodiversity and implement the concept. Instead of breaking down the concepts of biodiversity into smaller pieces and building a sequence from simple to complex, the project team opted to employ a goal-based [6, 11], problem solving oriented [6] approach. This approach is based on the assumption that by presenting complexity and an authentic problem first, the simpler concepts will be acquired (with support) in the process of finding a solution to the more complex problem [11].

Within goal-based scenarios that start with complex and ill-structured problems [7], the design of support structures for students become increasingly important. Since different conceptual difficulties of students are anticipated due to (a) individual differences of students [6] and (b) differences in the task [2], different support structures are available.

SCAFFOLDING

As next step, we would like to better define scaffolding and set it apart from modeling, coaching, and general support structures. Scaffolding is the action of providing the learner with tools and resources that support his/her efforts to achieve the objective [3, 10]. The learner gradually loses his/her dependency on the scaffolding structure and is eventually able to perform the task on his/her own, remaining always within the Zone of Proximal Development (ZPD) which provides a continuous challenge [12]. The ZPD, as introduced by Vygotsky [12] is the difference between what a child can do on her/his own and what the child can do with help.

Modeling demonstrates a correct resolution or correct process towards resolution that is based on the actions and

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considerations of an expert in the field [5]. Coaching consists of learning supports that intervene in the learner's actions at specific critical moments in order to provide direction in the interaction [13].

Brush & Saye (2002) make the distinction between hard and soft scaffolds. Soft scaffolds are the "dynamic, situation-specific aid provided by a teachers or a peer to help with the learning process" [2] and are often tailored responses to individual difficulties of a particular learner. Hard scaffolds are the static supports designed in anticipation of typical obstacles faced by learners. The scaffolds designed in the here-described activity are deliberately independent of each other. Some of them provide tiered support, allowing the learner to continue delving into the support information until he/she has reached the adequate level. However, the different scaffolds are not sequenced and are all available at all times during the activity in order to support as many learning preferences and a variety of individual differences (see [6] for details on different teaching strategies for different individual differences) as well as cognitive and subject-specific knowledge.

DESIGN OF THE INTERACTIVE ACTIVITY

In the following sections, we will describe the interactive game in detail with an emphasis on the staging of the problem/goal space, the support structures, and especially the implementation of scaffolds.

Setting the problem/goal stage: Background Story

Before beginning the actual activity - creating a suitable home for the endangered Loggerhead turtle - the learners are presented with a short animated narrative about the reasons that led to the Loggerheads' need for a new home (setting the problem space and goals [1, 7, 11]). This provides, indirectly, information about dangers to the Loggerhead species, in a linear narrative manner, making the consequences easy to remember amidst large amounts of information. The story contains all elements of the complexity without the necessary details that will follow or as Plowman et al. argue: "[The] [n]arrative can be seen as a macro-structure which creates global coherence, contributes to local coherence and aids recall through its networks of causal links and signposting... It has both cognitive and affective impact, performing an essential organizing function for the learner by shaping the creation of meaning from texts of all kind" [9]. The story is constantly accessible throughout the activity as a support tool, recounting the hardships and threats to the Loggerhead turtle as the learner is engaged in choosing appropriate living conditions for it.

Checklist

The checklist provides reflection about the problem, and guidance towards identifying the key elements that are to be considered if a successful solution is to be found. In itself, the idea of the checklist is a way to help learners focus their cognitive efforts in the right direction without giving away the answer. It provides four points for

consideration, relating to the four categories of variables the learners have to choose from. The first tier of support provided is the focusing of learners on the categories of variables that are presented and a hint, in the form of a question, as to what is the vital component to look for. For example, one of the items on the checklist is: "Nesting area - Think about: What kind of nest do [Loggerhead sea turtles] make?", prompting learners to consider the type of nesting conditions required before selecting a nesting area. The learner may, if he/she so chooses, delve deeper into this particular hint. Upon request, he/she is presented with a paragraph about Loggerhead nesting behaviors. Among other information, the fact that Loggerheads nest on warm sandy beaches is inserted in the paragraph.

Index Cards

As the website objectives are to familiarize learners about biological diversity, it includes a database of species index cards which provide a first-hand account of the species life cycle, threats and related information. These index cards are also available during the activity, often offering additional information that is not available otherwise. Some of this information is directly relevant to the task at hand, and some is background information that broadens the learner's understanding about the species, and the mutual dependency and interaction between the species and its ecosystem.

Information Bites

Another form of support that is offered to, but not forced on, the learners, is a feature dispensing information bites. These are short bursts of information about the topic, like small hints, which do not contain the answer to the particular choice in question, but provide reflective questions and information. This enables learners to extrapolate from, or build on, the information bites they are given in order to create the answer they need.

Glossary

In addition to sound, graphics, and narrative cues to support the construction of meaning, the language level of all the texts on this website were rated on the Flesch-Kincaide grade-level scale (included in word). Despite aiming for text levels that match mid-audience levels, we provide glossary support for difficult or topic-specific vocabulary. This was meant so we maintain the ZPD (see [12]) and still allow weaker readers to enjoy the activity. Glossary support is available from every screen on the website.

THE UNDERLYING CONCEPT

Though in many cases scaffolding is seen as a support system that begins with the most support and gradually fades away, we structured the scaffolding to provide more support as the learner explores the features of the scenario deeper. This way, more exploration means more support. However, in order to maintain focus in light of such a choice, the support structures are easy to be turned off.

FEEDBACK

"Feedback should not be designed to simply reveal the right answer after children's first wrong guess, since that

would prevent them from continuing to try to figure out the right answer” [4]. As illustrated in Figure 1, the feedback was given in the form that the choices the children did before had consequences (as demonstrated by like/dislike statements of the turtles and the consequences were illustrated (through different color codes and reflective texts accompanying the different choices. Inherent in these consequences were hints and questions that lead the user back into the activities. The concern, once the feedback was given, was how to design the next step to allow the learner to continue learning without discouragement and without given the right answer.



Figure1 : Embedded feedback (in different colors and text)

FORM OF THE INTERACTIVE SCENARIO

The interactive scenario is internet-based, developed in Flash and HTML, including audio and text-based information. It can be found at <http://kids.biodiv.org>.

CONCLUSION

This paper addressed the question of how research and theory informs the design of different support structures and how different support structures (modeling, scaffolding, coaching) can be implemented within an interactive game designed for a young audience. The next step for our work is to research how children reacted and learned with the different forms of support.

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