Conceptual Modeling Techniques for Online Curriculum Design

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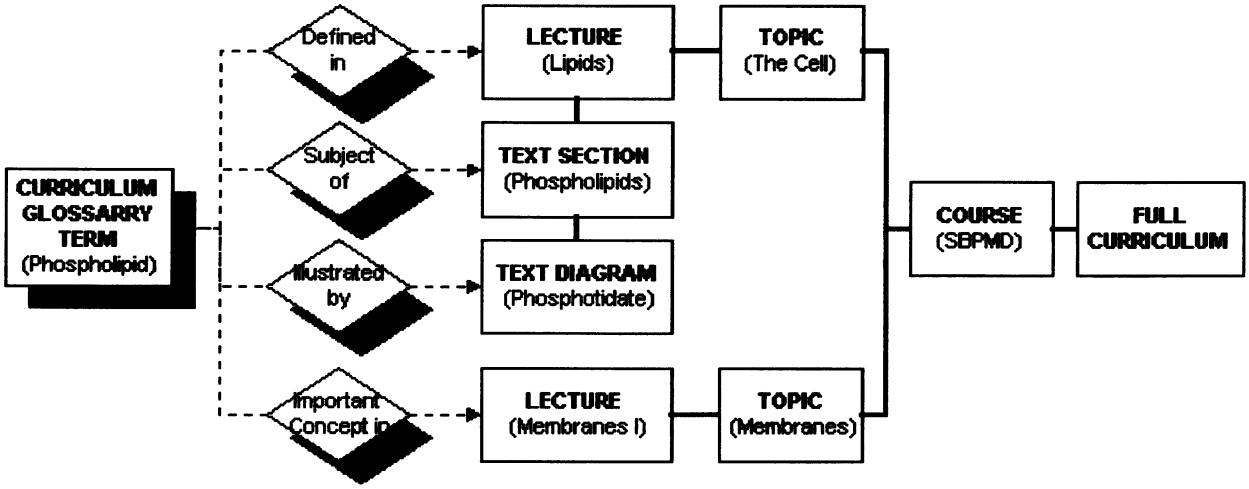
We are using entity-relationship (ER) diagrams to design a semantic network model of our online curriculum. In these diagrams (see sample below), rectangles show curriculum entities - courses, lectures, labs, images, glossary terms. Diamonds show associative relationships between the entities - a glossary term is *defined-in* a lecture and *illustrated-by* an image. Solid lines show aggregation relationships - a text section is *part-of* a lecture which is *part-of* a course.

These relationships form the basis of our database design: each entity becomes a database; the relationships become fields (slots) linking it to other databases. For example, each record in the database of glossary terms includes a slot '*defined-in*' which points to the name of a lecture in the lectures database. Storing the curriculum data in these databases and using the ER conceptual model assists us in two directions: it facilitates external links to other similarly structured resources (the UMLS) and, as I will discuss below, it provides the basis for a rich set of navigation, search, and interface tools for exploring links within the curriculum.

The associative relationships shown below can be used to create navigation paths within the curriculum. For example, the *defined-in* relationship is presented to students as a bi-directional link: one can go from a lecture to a list of all terms defined-in that lecture, or from a glossary definition to the lecture where it occurs. Similarly, search results are presented to the user as a menu of possible relationships to follow: one can go from a search for a term to the lecture it is defined-in, or to another lecture where it is a key concept, or to an image illustrating the term. Presented in this fashion, the search results are a visible representation of the place of the term within the curriculum as a whole: the student can see at a glance the variety of contexts of the term within the course.

The *part-of* relationships (shown by solid lines below) are hierarchical and are based on the structure of each course. In the example, the course is made of topics (e.g. 'The Cell') each of which is made up of labs and lectures, which are themselves made up of text sections, images, and multimedia modules. These relationships are presented to the user as a hierarchical menu: the student selects from a list of lectures, then chooses a list of text sections within the lecture. The *part-of* relationships are also used to present different subsets for browsing and for generating self-assessment quizzes. One can browse the glossary for the whole curriculum, for a single course, or for a single topic within a course. A glossary term quiz can be generated by making random selections in the whole curriculum or by limiting the selection to a given course, topic, or lecture. These selections are based on relationships between three or more entities/databases: glossary term is *defined-in* lecture, lecture is *part-of* topic, topic is *part-of* course; therefore (via inheritance) glossary term is *part of* course.



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