A WOMAN'S REPRODUCTIVE LIFE CYCLE: A DEVELOPMENTAL JOURNEY

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Abstract

This paper describes the development of a computer-facilitated learning package that integrates the various stages of A Woman's Reproductive Life Cycle integrating reproductive and endocrine physiology. A holistic yet modular approach has been taken with the design of the package and the modules follow the developmental journey of a woman throughout her major reproductive life stages from birth to menopause incorporating puberty, menstrual cycles, contraception and pregnancy. The overall development approaches are described as a part of the package design. Students are presented with a single case study and follow the reproductive and endocrine changes that take place in this woman over time. A core component of the package is a graphical simulation tool, which has been developed to encourage exploration and understanding of the complex mechanisms involved in hormonal regulation of the menstrual cycle.

Keywords

multimedia design and development, educational technology development, reproductive physiology

Background

We are developing a series of computer-facilitated learning modules called *A Woman's Reproductive Life Cycle* that describe and integrate the various stages of a woman's reproductive life cycle. Experience suggested that students typically have difficulties understanding the complex nature of reproduction and endocrinology during various stages of a woman's reproductive life cycle. The menstrual cycle is central to all reproductive aspects of a woman's life and within this cycle the areas of homeostatic hormonal feedback control and regulation are traditionally difficult concepts for the students to fully grasp. A major learning obstacle for the students involves the understanding of the negative and positive feedback regulation of ovarian hormones by the hypothalamus and pituitary gland. To fully understand the menstrual cycle students are required to integrate the hormonal changes with the alterations in the development of the follicle and endometrium throughout the cycle. Another motivating factor in the module development is that an understanding of hormonal feedback regulation is central to students' understanding of many key physiological concepts and systems. Lectures describe the theoretical aspects of menstrual cycle regulation and hormonal feedback but provide little support for students as they attempt to integrate and apply their knowledge. The modules we are developing attempt to address these difficulties by providing a realistic case study that grounds the student in the real-life circumstances of a woman's developmental journey. Thus a primary goal in the development was to provide students with an environment in which they can explore the complexities of the menstrual cycle and integrate their knowledge with other stages of a woman's reproductive life.

Design and Development Approach

The development team adopted Keppell's design and development model for interactive multimedia (Keppell, 1998). This model emphasises a team-based approach and sets out a number of stages including needs assessment, conceptual design, software development, interface design, evaluation and maintenance. In the current project the development team consisted of content experts, project manager, instructional designer, graphic designer, software developer, programmer and an evaluator. A needs assessment established that a two-hour package would be developed containing modules for each life cycle stage. During the initial design phase, the instructional designer and the content experts developed a concept map illustrating the macro-structure of the modules (online). This process was essential in establishing the overall architecture of the package. Through this process the instructional designer became familiar with the content and this knowledge was utilised in subsequent phases of design and development. Concept maps and storyboards were used both as scaffolds for planning the micro-design of each module and as tools for communication between designers, developers, programmers and content experts. Using Kennedy's formative evaluation cycle, which is critical to the design and development approach, the package has undergone iterative expert review of instructional and conceptual design and interface and graphic design (Kennedy, 1999). The first module will undergo useability testing, the results of which will be used to inform the development of subsequent modules.

Design of *A Woman's Reproductive Life Cycle*

One of the primary design approaches adopted by the development team was to construct a series of modules that would follow the developmental journey of a woman throughout her reproductive life stages from birth to menopause. These life-stages (and biological years) are: birth (0 years), puberty (~12 years), menstrual cycle (~14 years), contraception (~14+ years), exercise and menstrual cycle (~14+ years), pregnancy, infertility and menopause (~55 years). Figure 1 presents the home screen and shows each of the eight modules represented schematically as a biological clock. We were able to secure photographs from a woman illustrating her at various ages (from birth to menopause) that represent her major life-stages, reproductive milestones and experiences (Figure 1). The aim of this approach is to create a 'real-life' look and feel for each module so that students come to identify with the woman and feel they 'get to know' her. We are providing students with a realistic and developmental case study that will act as a scaffold for their inquiry into the content. Using this holistic approach, students should come to appreciate and integrate the physiological changes that occur in one individual over her life span. We hope this will lead students to integrate and compare and contrast critical reproductive concepts over the entire life cycle of a woman.

As the menstrual cycle is central to all reproductive aspects of a woman's life, our first step was to develop a graphical simulation of the normal cycle incorporating changes in hormones, feedback regulation and in ovarian follicular and endometrial structure. The simulation dynamically links the endocrine and endometrial profiles with feedback regulation during the menstrual cycle with a graphical representation of follicular development. This simulation will form the corner stone of the package, as students will subsequently be able to compare and contrast the normal menstrual cycle with abnormal situations or to different life stages. The simulation is flexible and will allow students to choose which hormonal profiles, feedback loops, follicular and endometrial structures are displayed. Students will be provided with guided questions and activities which allow them to explore, using the simulation, the normal menstrual cycle.

A "resources" catalogue will be available to students at any time throughout the package giving them the option to further explore concepts and issues based on their individual interest and needs. Formative assessment activities and exercises (such as drag and drop activities and prediction tasks) will be included at critical points in the package to allow students to test their knowledge and understanding of the material. Once students have familiarised themselves with basic science concepts associated with the normal menstrual cycle, they will be able to extend and integrate their knowledge to other stages of a woman's reproductive life cycle. This process will also involve

students applying their knowledge of "normal" processes to "abnormal" processes such as lack of menstruation (amenorrhea), athletic menstrual cycle irregularity, infertility and menopause. Using their knowledge students will be asked to make predictions about the basis of endocrinological and physiological changes that are a result of these situations. Throughout, the single case study will be emphasised, showing students that these changes are a normal part of every woman's life.

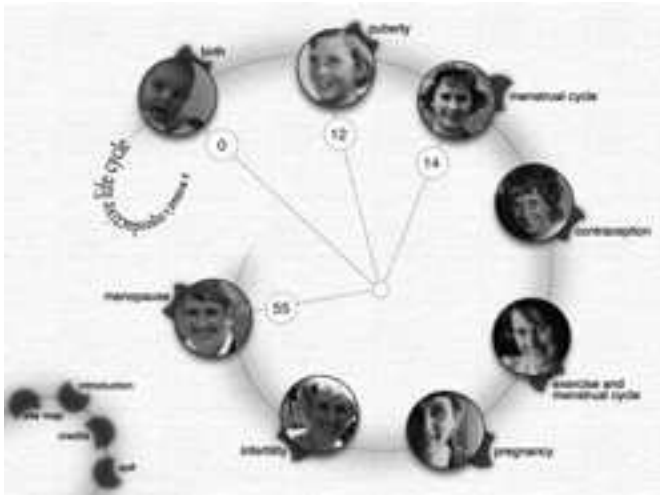

Figure 1: A Woman's Reproductive Life Cycle (online)

Integration of reproductive concepts over the life-span will be further encouraged in the contraception module. Students will be presented with background information on contraceptive techniques, including basic biomedical information, physiological methods of action and effectiveness (i.e. pregnancy rates). Students will be able to investigate the physiological effects of oral contraceptives by manipulating the components of the graphic simulation. By considering case studies at various life stages (i.e. adolescence, multiple partners, secure relationship with one partner, married no children, not intending to have children, birth spacing, family complete, perimenopausal), students will determine the most appropriate form of contraception given the characteristics of the woman at that reproductive life stage. Students will justify their choice based on physiological methods of action using their knowledge of menstrual cycles.

Educational Approaches to Design

One of the educational approaches taken to the design of this package was the use of multiple perspectives. Koschmann, Kelson, Feltovich and Barrows (1996) argue that if students are provided with a singular perspective, they may oversimplify concepts that may ultimately prove misleading. Additionally, researchers such as Ramsden (1992) and Laurillard (1993) have advocated the use of multiple perspectives to support for higher levels of cognition including reflective thinking. The use of multiple perspectives was incorporated into the package in two ways that are linked to the design approaches. First, students were asked to consider biomedical and social aspects of the reproductive cycle by identifying with a woman at different life stages. Students are challenged to consider the similarities and differences in the reproductive cycle of, for example, a menstruating teenager and a menopausal woman. Second, through the use of the graphical simulation students were asked to consider and integrate the menstrual cycle from a variety of biomedical perspectives (endocrinological, physiological and pathophysiological). Only by integrating knowledge, both across the lifespan and across different biomedical perspectives, will students come to fully appreciate the complexity of the female reproductive cycle.

A second educational approach to the design was to ask students to adopt roles when considering various aspects of a woman's reproductive health. Aspects of Joyce and Weil's (1986) role playing approach to learning have been adapted and are a unique feature and strength of this module. Joyce and Weil (1986) suggest that "the essence of role playing is the involvement of participants in a

real problem situation and the desire for resolution and understanding that this involvement engenders" (p. 242). Within the contraception module students will be asked to play a variety of roles and make decisions about the most appropriate form of contraception at the various stages of the woman's reproductive life, firstly from the woman's perspective and then from her partners point of view. By taking this approach we hope that students will "explore their feelings and gain insights into their attitudes, values, and perceptions" (Joyce & Weil, 1986, p. 242).

The modular nature of *A Woman's Reproductive Life Cycle* allows flexibility in design and development as well as teaching and learning. The package is planned for integration in a variety of curricula at different year levels and across a number of disciplines and will compliment current teaching and learning methods. Both biomedical information and the graphical simulation can be used as a lecturing tool; introducing, exemplifying and explaining concepts. The package will also be used as a self-directed learning resource for students studying in the problem-based learning curriculum in the School of Medicine. Finally, specific modules will be used as computer-based tutorials in the Science, Optometry, Dental Science and Biomedical Science courses.

Conclusion

The team-based approach has greatly assisted with progress on the project so far. An emphasis on conceptual design and the macro structure of the package enabled the content experts and the designers to gain a clear understanding of where the project was headed before computer based design began. A prototype of the menstrual cycle module is close to completion (at the time of writing) and Version 1 of the package will be ready for be curriculum integration in 2002.

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Acknowledgments

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