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Pedagogical design considerations in sex education on interactive multimedia using CD-Rom: an example of sexual intercourse

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Human sexuality is a significant issue for educators to understand and teach about, and for young people to learn about. The development of interactive multimedia technologies has added a range of new dimensions associated with designing pedagogies for sex education on Interactive Multimedia (IMM). Here, a module on CD-Rom on Sexuality and Human Relationships designed for student teachers is presented as an example of a resource, and analysed for the pedagogical considerations that accompany it. The paper concludes that the conceptualisation and design of IMM on CD-Rom on sexuality is able to address a range of commonly used pedagogies. The most significant pedagogical renegotiation appears to lie in the transposing of human-to-human interaction, as in discussion, real life scenarios, simulation, role analysis, values and attitude clarification, to human-to-screen interaction. This may be addressed principally by using camera phones where human-to-human interaction occurs visually and in real time, whilst email and discussion groups can cater for delayed, typed text human-to-human interactions. For some learners, using IMM on CD-Rom for sex education may be less effective, but for others it may be ideal as it provides for privacy, solo contemplation, self-dialogue, and negates embarrassment in front of peers or teachers.

Sexual intercourse

Sexual intercourse can be a mystery to many young people and children, and is often perceived by them as an incomprehensible act (Goldman & Goldman, 1982, 1988). Many adults also appear to misunderstand it in light of the wide incidence of rape, sexual abuse, sexually transmitted infections (STIs), unwanted pregnancies, male and female genital mutilation, and female infibulation. In any sexuality and human relationships education course, sexual intercourse is an essential aspect that needs to

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be addressed because of its significant role in human relationships. Frequently parents, as sex educators of their children, are either uninformed (Berger, 1998), or reluctant to discuss sexuality with their children (Blake, 2002). Embarrassment about talking about sexual intercourse may well be a reason to explain such disregard (Goldman & Goldman, 1981a, 1981b, 1982). Blake (2002, p. 5) notes that 'Although parents often want to talk to their children about sex and relationships, they feel ill-equipped to do so, and therefore look to schools to either partially or completely do the job'.

Sexual intercourse is a hidden act, a private activity, intrinsically obscure, a personal experience of heightened intimacy, where, because of the closeness of two bodies, it cannot be physically revealed unless in cross-section diagrams. Further, sexual intercourse probably cannot be addressed effectively unless it is contextualised; within puberty; procreation; pregnancy; contraception; wider human relationships; values, attitudes and emotions; outcomes and consequences of sexual activity; and sexually transmitted infections (STIs) (Goldman, 2000; see Blake, 2002).

A CD-Rom on sexuality education has been designed and developed by two academic staff for university student teachers who are intending to be primary school teachers in Australia. This CD-Rom includes appropriate content, objectives, goals, strategies, resources, concepts and skills relevant for teaching Grades 1–7 (children aged 5 to 12 years) (see Goldman & Krause, 2001, 2003, 2004). The content followed state Department of Education policies and guidelines and is oriented to the human relationships education (HRE) curriculum and, as such, has its delimitations, idiosyncrasies, and historical decalage. The CD-Rom includes ten self-teach modules, and student teachers are required to proceed though these at their own pace, and respond interactively with the program. Module 5, in particular, deals with sexual intercourse and aims to assist student teachers to understand sexual intercourse's prequels and sequels within a broader context of enhanced human relationships. The pedagogies used in this CD-Rom are analysed as examples of a constructivist approach to designing interactive multimedia based on Bloom's critical thinking skills (Bloom in Frangenheim, 1998; Education Queensland, 2001).

Defining Multimedia

There is a burgeoning literature on Interactive Multimedia (IMM), but none has been found on appropriate pedagogies for teaching about sexuality, including sexual intercourse, for student teachers. The confluence of information technology and education has forced educators to review the nature of teaching and learning. So, what is IMM? It may be defined as learner-centred and interactive learning using multimedia. Barker and Tucker (1990, p. 18) see interactive learning as a process rather than a technology, including:

> … the creation of an information-rich learning environment involving interactions between: teachers and learners, print-based materials, and new computer-based media including CD-Rom hypermedia optical discs, satellite, and cable.

Interactivity implies an input/output response relationship between the student and the IMM program (Richardson, 1995). The interactivity can be conducted using either a simple navigational tool, which allows students to move through the stored data, or it may require them to engage in higher-order problem-solving where feedback to the input will indicate the path taken.

At the simplest level, many multimedia educational products are electronic page-turners. Interaction is limited to the ability of the student to 'turn the pages' by scrolling up or down, or clicking a button. However, the essential value of interactive multimedia technologies is that they can be used effectively to empower students to take a more pro-active role in acquiring, analysing and synthesising information. It is the potential of multimedia to foster this higher level of interactivity as an active form of learning that distinguishes it from older technologies such as projectors, radio and television, which are passive forms. The question is then raised as to how viable IMM on CD-Rom is for sex education. This paper addresses this question using an example of teaching about sexual intercourse.

Interactivity and constructivism

The focus on interactivity being of special value in facilitating learning stems from the constructivist view that learners learn best when they are actively constructing their own knowledge based on their own experiences and their own information (Kindsvatter *et al.*, 1992; Biggs, 1999; Rowland, 2000; Torrisi & Davis, 2000; Light & Cox, 2001; Goldman & Torrisi-Steele, 2002). The focus on interactivity to maximise the pedagogical potential of multimedia emerges from the adoption of constructivism as the guiding theoretical basis for the design of many multimedia materials, including the example of sexual intercourse examined later. The constructivist view of teaching and learning is commonly accepted as a framework for developing appropriate teaching and learning strategies for designing multimedia learning environments in ways which will promote the reshaping of teaching practice towards student-centred learning environments (Torrisi & Davis, 2000; Goldman & Torrisi-Steele, 2002).

Biggs (1999, p. 13) states that learning is:

> … a way of interacting with the world. As we learn, our conceptions of phenomena change, and we see the world differently. The acquisition of information in itself does not bring about such a change, but the way we structure that information and think with it does. Thus, education is about conceptual change, not just the acquisition of information.

Designing multimedia interactivities

There are a number of design parameters that need to be considered when constructing multimedia interactivities. First, interaction design should be guided by questions such as those suggested by Fardouly (1999):

- Who are the learners? What do they need or want to learn, in what environments will the learning be applied, and what do they already know?

- What is the teacher trying to achieve with the instruction? Clearly define goals and objectives and relevant content.
- What skills, attitudes and knowledge are you trying to develop?
- How will content be structured?
- What strategies might be used?

As well, there also appear to be broader issues of design necessary to incorporate within a constructivist paradigm. Successful interaction design that engages learners in actively exploring knowledge and experiences is the result of careful analysis of the learner and of the learning outcomes.

Constructivist principles

In constructivism, learning is seen to be affected by the context of the learning, and the beliefs and attitudes of the learner (Prosser & Trigwell, 1999, p. 168) who should be given the opportunity to build on prior knowledge, encouraged to invent their own solutions, and try out ideas and hypotheses. Effective instructional design of multimedia interactivities may be based on eight constructivist principles, according to Savery and Duffy (1996, p. 3), namely:

- Anchor all learning activities to a larger task or problem.
- Support the learner in developing ownership for the overall problem or task.
- Design an authentic task.
- Design the task and learning environment to reflect the complexity of the environment that students should be able to function in at the end of learning.
- Give the learner ownership of the process used to develop a solution.
- Design the learning environment to support and challenge the learner's thinking.
- Encourage testing ideas against alternative views and alternative contexts.
- Provide opportunity for, and support reflection on, both the content learned, and the learning process itself.

In encouraging learners to participate in the interactive experience, interactivities need to be designed to provide experiences that have an appropriate balance between success and difficulty, and between control and discovery (see Seels & Glasgow, 1998; Smith & Ragan, 1999). Success without difficulty does not promote optimal learning, nor does difficulty with little or no success (Csikszentmihalyi, 1990). This seems particularly apt for assessable items in IMM.

Use of interactive multimedia at university

Higher education in many western countries has undergone major changes since the 1990s with increasing student numbers resulting in mass tertiary education, bureaucratic transformations, managerialism, budgetary cuts, and pedagogical shifts including the development of more modular degree structures (Stanley, 1995; Coaldrake & Stedman, 1998; Dearn, 2002; Goldman, 2004). Students no longer

need to remain on campus or attend lectures, and, indeed, many do much of their work on their home computer. The objective in future planning in universities must include analysis of the role of using technology in enhancing teaching and learning (Clarke, 1995; Brady & Kennedy, 2003). Similarly, Dearn (2002, p. 40) advises that:

> Increasingly, the learning resources used in higher education are moving out of the bookshelf and the briefcase and being transformed into digital format where they can be stored, managed, searched, aggregated, transmitted, displayed and printed on a diversity of different platforms using different software applications anywhere in the world.

Not surprisingly, there is a need for enhanced education of teachers in the use, application and pedagogies of computers (Hurst, 1994; Brady & Kennedy, 2003). By including IMM, lecturers are able to incorporate most of the characteristics, domains, and modes mentioned above. The computer can be utilised, then, as a tool, resource, or informational source. Thus, students are not only learning the course content, but are also familiarising themselves with the many and varied uses of the computer and multimedia, and, for many student teachers, this may be reflected in their classroom teaching.

Sexual intercourse education and interactive multimedia

In a search of the literature, apart from web-based sites (see Goldman & Bradley, 2001), none were found on appropriate pedagogies on IMM using CD-Rom for primary school student teachers about sexual intercourse. In light of the speed of current educational technological progress, this may well be at hand.

Method

The next section presents the pedagogical interactivities designed for a CD-Rom for student teachers based on constructivist principles used in teaching about human relationships education. Here, sexual intercourse is contextualised with puberty, having babies (procreation), pleasure, pregnancy, and the menstrual cycle. This approach was chosen because of the linkages with the state Department of Education HRE policies, content and requirements, and this social–biological based model addresses those requirements in this module. However, broader aspects of sexuality concerned with self esteem, communication, relationships and values were addressed in other modules. Other sexualities were included in the prescribed readings, since they were not included in the policy documents. The authors believe that a social–biological model still provides a significant and important knowledge base for primary school students aged from 6 years to 12 years (See Goldman, 2000; Blake, 2002, p. 22), and can readily be contextualised into wider, social, psychological, sexual relationships and personal issues, as indicated above, particularly in upper primary and secondary schools, which in this CD-Rom were addressed in other modules.

Pedagogies used in the CD-Rom

This interactive multimedia CD-Rom has ten sections or modules, each with a varying number of sub-modules. The CD-Rom constitutes a self-teach programme, and is designed to be followed sequentially. The introductory text of each module explains precisely what is required of the student, along with any essential prescribed readings that are necessary before undertaking the modules. Interactivities are distributed throughout the texts; some require 'yes' or 'no' answers, others one or two words, others fully expanded answers. Most of the pedagogies used in the ten modules incorporate Bloom's critical thinking skills (see Bloom in Frangenheim, 1998) such as deciding, judging, prioritising, justifying, concluding, selecting, choosing, comparing, verifying, arguing, and synthesising. These are identified in italics beside the activity.

There are a number of assessable items throughout the activities. The worth of each assessable item is clearly stated for students. On completion of all modules the computer has been programmed to provide the student with a printout of his/her total numerical results.

This courseware was designed by two lecturers as a teaching tool to replace face-to-face lectures and tutorials, as well as for a revising tool. The user interface is designed to allow students the choice of progressing linearly, or browsing at will. The module structure, at the menu level, presents the order in which students might explore modules for maximum understanding. Meta comments such as 'You should have undertaken activity X prior to viewing this module' are provided, where appropriate, throughout the programme in order to guide students. In some instances, where the designers perceived that a development in the flow of thought is required, the navigation 'locks' students into a sequence of activities. Colour is used consistently throughout the program to provide visual clues as to what is expected of student's input. For example, all instructions appear in dense yellow, italic text.

The navigation tools and structure are intentionally kept simple so as to become invisible to the users, and not add unnecessary cognitive load so learners either 'become lost' or struggle to interpret or locate the appropriate control buttons. Further, the menu page makes explicit the overall structure of the multimedia presentation and thus assists students to conceptualise 'where they are' in the program. The toolbox contains a help menu, a glossary and a notepad facility. In the CD-Rom plastic case, a small booklet provides a paper copy of the control button icons and their functions for easy access and clarification for the student. Navigational systems within a computer-assisted program can facilitate a student's learning sequence and reduce the problems of poor learning schema development (Hedberg *et al.*, 1994). The navigational system in this program aimed to do so.

Ten modules

The ten modules in the CD-Rom constitute a human relationships education course for student teachers as preparation for teaching primary school children. In order to provide the context for the reader, the ten are listed here.

Module 1	Introduction, Overview and Contexts
Module 2	Human Relationships Education Curriculum
Module 3	The Human Body's 10 Systems
Module 4	Puberty
Module 5	Having Sex
Module 6	Pregnancy and Birth
Module 7	Contraception
Module 8	Sexually Transmitted Infections and Safe Sex Practices
Module 9	Child Sexual Abuse
Module 10	The Importance of Human Relationships Education for Children.

The average estimated time taken by students to complete the ten modules is equivalent to 42 hours, which is the number of face-to-face hours required during a semester of lecture and tutorial format (14 weeks $\times$ 3 hours = 42 hours). A wide variety of interactivities was used throughout the ten modules. However, because of their large number and relevance to the pedagogies used, not all could be incorporated in every module. Module 5 consists of nine sub-modules, as shown below, with their appropriate Bloom's critical thinking skills identified in brackets. Module 5 follows the module on puberty, precedes the next one on pregnancy and birth, and forms a conceptual link between them.

A screen box is provided for all questions requiring text answers. In instances where students are required to find the information in their readings, diagrams and graphics are presented which require the arrow to be dragged, using the mouse, to indicate the accurate answer. In other activities, students are required to answer appointed questions for assessment. Assessment questions include the interpretation of graphs, answering questions in multiple choice, yes/no, true/false, and short-answer text within the specified boxes.

EXAMPLE: Module 5—Having Sex

5. 1	What has puberty to do with having babies?
5. 2	What does having sex to do with having babies?
5. 3	How are test tube babies made without having sex?
5. 4	What does planning to have a baby mean?
5. 5	What does having sex to make a baby mean?
5. 6	Having sex and getting pregnant.
5. 7	Does a woman have to have had periods to get pregnant?
5. 8	What is a woman's monthly cycle?
5. 9	How does a woman and a man know if the woman is pregnant?
5. 10	Your sex life.

Reading

Prescribed

Clarity Collective (1988) *Taught not caught, self esteem in sex education* (Melbourne, Spiral Educational), Section 4 'Sexual decision making'.

Goldman, J. D. G. (1995) *All of me. Sex education for juniors* (Melbourne, Longman Cheshire).

Recommended

Calderone, M. & Johnson, E. (1990) *The family book about sexuality* (New York, Harper and Rowe).

Carrera, M. (1981) *Sex: the facts, the acts and your feelings* (New York, Lansdowne Press).

In this module some of children's *commonly* asked questions are presented. You are then asked to answer those questions as a teacher would to a Primary School student.

5.1 What has puberty to do with having a baby?

Activity: (*Choosing, selecting, prioritising*) In no more than two paragraphs answer that question.

Compare your answer with the following explanation for Primary School children.

> Puberty is the name for the spurt of changes that occur in your body. The changes start boys' and girls' bodies to grow into adults. As you learnt about earlier, the girl's body develops Ova (which is the plural of Ovum). The boy's body develops Sperm (the plural of Sperm is the same, Sperm). One Ovum and one Sperm are essential to join together to make a baby. That is, a man and a woman cannot have a baby unless they have gone through Puberty, and he produces sperm and she produces an Ovum. A man and a woman can only have a baby if they have had sex together.

Activity: (*Deciding, judging, selecting, choosing*) Type an activity you could use to teach about any aspect of puberty? (Computer requires 10 words to be typed before it proceeds.)

5.2 What does having sex to do with having babies?

Activity: (*Choosing, selecting, prioritising*) In no more than 2 paragraphs answer that question.

Compare your answer with the following explanation for Primary School children.

> In order for an Ovum and Sperm to join to form a baby, a woman and a man agree to have sex. This means that once a woman and a man have agreed to have a baby, considering all the responsibilities, they will need to have sex. Usually both the man and the woman will feel very loving and get very close together. Usually they cuddle and kiss and stroke each other for some time until the woman feels her Vagina is becoming moist, and the man's Penis becomes erect. These activities are called *foreplay*.
>
> Usually the man has to slow his erection down because sometimes it takes a little while for the woman's Vagina to get moist or lubricate. Here the man should be careful to have a slow erection. Then the woman places the man's Penis very gently inside her Vagina, and the man and woman move their bodies to-and-fro. After a few minutes, of moving together, both the man and woman usually each experience a burst of pleasure

called an Orgasm. An Orgasm in a woman is when her sexual organs' muscles contract and she feels pleasure all over her body. An orgasm in a man is when after he has had an erection, he ejaculates, that is, he releases sperm from his penis which is called an ejaculation, and feels pleasure all over his body. Often, the man and the woman have both enjoyed it so much that they want to do it again. After an orgasm both the man and the woman feel warm, comfortable and happy.

Did you know that a woman or a man cannot feel whether the Sperm has met an Ovum either during or after they had sex? The sperm will usually last about three days inside the woman's Uterus. The Ovum will usually last about three days in the Fallopian Tube or Uterus.

These activities are called having sex, or sexual intercourse, to make a baby. As well, people have sex to express their love and care for each other, and also for fun. Because having sex is enjoyable, it usually means the couple are prepared to have a responsible and committed relationship with each other.

Answer True or False to the following statements:

Statement	True or False? If False, type why it is false.
1. The only way for humans to have a baby is to make sure that a man's Sperm meets a woman's Ovum inside her Vagina.	
2. If a woman intends to have a baby, she has to have an Ovum released from her Ovary, which is joined by a Sperm that has been ejaculated from a man's Penis into her Vagina.	
3. If a man and a woman want to have a baby they have to have sex.	

Assessable Activity #5a

Activity: (*Judging, determining*) Complete the following cloze activity based on that explanation for children.
Complete the following sentences:

1. In order for an Ovum and Sperm to join, a man and a woman will have _____ (Answer=sex)
2. This means that once a woman and a man have agreed to have a baby considering all the _____ (Answer=responsibilities), they will have sex together.
3. Usually both the man and the woman will feel very _____ (Answer=loving) and get very close together.
4. Usually they cuddle and kiss and stroke each other for some time until the woman feels moist in her _____ (answer=Vagina), and the man's _____ (answer=Penis) becomes erect.

5. Usually the man has to _____ (answer=slow) his Penis down because sometimes it takes a little longer for the woman's Vagina to get _____ (Answer=moist) or lubricate.
6. Here the man should be careful not to let his penis get too stiff too _____ (Answer=quick/ly).
7. Then the woman places the man's Penis very _____ (answer=gently) inside her Vagina, and the man and woman have rhythmic to-and-fro movements of their Abdomen.
8. After a little while of such movements both the man and woman will each experience a burst of pleasure called an _____ (answer=orgasm).
9. An orgasm in a _____ (answer=woman) is when her sexual organs' muscles contract and she feels pleasure all over her body.
10. An orgasm in a man, after he has had an erection, is when he _____ (answer=ejaculates) and feels pleasure all over his body. (Half a mark each)

5.3 How are test tube babies made?

Activity: (*Choosing, prioritising*) In no more than 2 paragraphs answer that question as if from a Primary School student.

Activity: (*Comparing*) Compare your answer with the following:

> A test tube baby is where an Ovum and a Sperm join together in a test tube. A test tube is a narrow glass tube about 20 cm tall. Usually this occurs when a woman and a man decide they are ready to have a baby, but his Sperm will not join her Ovum. Or the man has a low *Sperm Count* with fewer healthy Sperm in his ejaculation. So in the hospital, the doctors and nurses remove an Ovum from the woman, and some Sperm from a man's ejaculation, and both are placed in a test tube so they will join together. If they join together, it is now called a *fertilised* Ovum, and is removed from the test tube then implanted in the woman's Uterus, so the baby grows normally, as you will see later. Here, a couple does not need to have sex to produce a baby.

Activity: (*Arguing, justifying*) Type two reasons why a couple would have a test tube baby. (Computer requires 5 words to be typed before it proceeds.)

5.4 What does planning to have a baby mean?

Activity: (*Selecting, choosing*) In no more than 2 paragraphs answer that question as if from a Primary School student.
Compare your answer with the following:

> Usually if a woman and a man wish to have a baby they both plan to have one in the future. They usually talk over about the enormous responsibility of having a baby, and decide if they are mature enough.

Activity: (*Selecting, choosing*) Type 3 factors a man and a woman should discuss **before** they have a baby.

Activity: (*Comparing*) Compare your answers with the following:

- How much a baby will cost financially.
- How much care and attention a baby requires, even in the middle of the night when its parents are asleep.
- The enormous amount of time and effort it takes to feed, clean, keep healthy, clothe, educate and entertain a new human being.
- Once you have had a baby, it is your responsibility until it is 18 years of age.
- Are we too young to have a baby? Is this the right time for us to have a baby, or should we postpone it?

5.5 Getting Pregnant

When a woman and a man have sex, and the Sperm joins the Ovum, this is called getting pregnant or conception. The word conception originates from the Latin (old Italian) word 'conceptus' meaning conceiving or forming. That is, women conceive or develop a baby. A woman can get pregnant only when she is between about 12 years of age and 50 years of age. That is, from the time of Puberty (age 12) to Change of Life (age of 50) in women called Female Menopause ('Meno' means month). These 38 years are called the childbearing years. During these 38 years a woman produces an Ovum every month. Similarly for a man, he can produce healthy sperm from when he reaches Puberty at about 13 years of age until he has a Change of Life, called Male Menopause, at about 50 years of age.

Assessable Activity #5b

In the following, link the word or phrase to its meaning or meanings. (Use the pencil provided on screen to draw a linking line.)

Word	Meaning
1. When a man and a woman have sex and her Ovum joins his Sperm.	Conception
2. This word originates from the Latin (old Italian) word 'conceptus' meaning 'conceiving or' forming.	The child bearing years
3. A woman can get pregnant during these years.	Getting pregnant
4. The 38 years in a woman's life when she can have a baby.	From about 12 years old to about 50 years old

(Half a mark each)

5.6 Does a woman have to have had Periods to get pregnant? (Periods were explained in an earlier module on the Human Body.)

Activity: (*Concluding*) In no more than one paragraph answer that question as if from a Primary School student.

Activity: (*Comparing*) Compare your answer to the following.

A woman can become pregnant only after two actions occur:

1. She has started puberty, and her sexual and reproductive organs are developing, and her Ovaries are producing Ova. Periods are a sign that she is starting puberty. Periods are a sign that her Ovaries are producing Ova.
2. She has sex with a man.

5.7 Can a woman get pregnant if her Periods have not begun yet?

Activity: (*Choosing, selecting*) In no more than one paragraph answer that question as if from a Primary School student.

Activity: (*Comparison*) Compare your answer to the following. No.

> A. Activity: (*Synthesising*) There are two actions that have to occur for a woman to become pregnant. Type these two actions.
>
> B. Activity: (*Synthesising*) Circle True or False to this question.
> If a woman's Periods have not begun yet, she cannot get pregnant. True or False. (Answer=true; half a mark)

5.8 What is a woman's cycle?

Activity: (*Choosing*) In no more than one paragraph answer that question as if from a Primary School student.

Activity: (*Choosing*) Compare your answer to the following.

> (A humorous reply is; It is a lady's bicycle!) As you know a woman has a period every month. This regular occurrence is part of a monthly cycle that is repeated every month from about 12 years of age to about 50 years of age. A woman's monthly cycle lasts about 30 days, but her period lasts from 3 to 5 days. It is important for you all to be familiar with the monthly cycle. Let us have a closer look at her cycle.

Graphic here shows the sequences of the female sexual system (from earlier Module 3) with empty labels for students to fill in.

> **Text: The first two weeks of each month**. The first two weeks are the first half of her cycle. During this time, one of her Ova stored in her Ovaries, matures. At the same time, her Ovaries release Hormones called Oestrogens (pronounced ee-stro-gens). This causes the lining of the Uterus to become soft and spongey with tissue and blood lining.

Activity: (*Synthesising*) In this diagram of the female sexual or reproductive system, name these parts.

> **Text: Middle of the month** Usually at the end of the first two weeks the Ovum has matured. It is then released from the Ovary into the Fallopian Tube. This release is called Ovulation. Either Ovary may produce the Ovum. Usually one Ovum is produced

each month. If two Ova are produced, this may result in twins, if both are fertilised by Sperm.

Text: The second two weeks of each month. The Ovum starts its journey along the Fallopian Tube. If the Ovum meets with a Sperm, they join to form a baby and the woman has then become pregnant. If the Ovum does *not* meet with a Sperm then the Ovum and the Uterus wall lining drain out of her body. This process is called a Period or Menstruation. That is why a woman's Period is a sign that she is *not* pregnant. But if her Period does *not* occur, it will usually indicate she is pregnant.

In the next month this process starts all over again. It is called a woman's cycle and continues until she is about 50 years of age. Look at this picture of a calendar. It shows what occurs in a woman's monthly cycle.

Activity: (*Synthesising*) Complete the following, and then answer the questions below.
On this calendar month, shade in the different parts of a woman's monthly cycle to show the *four separate parts* of it.

Diagram: A 30-day calendar month. Students shade in the various parts using toolbox and different shading striations.
(On completion, computer throws up an example beside the student's calendar for comparison.)
Compare your calendar to this one.

Assessable Activity #5d
(Judging, verifying) Would this activity be suitable for Grade 7 boys and girls? (Answer=yes, half a mark)

Assessable Activity #5e
(*Prioritising*) Cut and paste these jumbled actions in the correct order that they occur in a woman's body.
Diagram: Series of actions during a woman's monthly cycle. (Answer=accurate ordering receives one mark)

Assessable Activity #5f
(*Judging, verifying*) Would this activity be suitable for Grade 7 boys and girls? (Answer=yes, half a mark)

5.9 How do a woman and a man know if the woman is pregnant?

Activity: (*Verifying, concluding*) In no more than one paragraph answer that question as if from a Primary School student.
(*Comparing*) Compare your answer to the following:

A woman or a man can never tell **immediately** after they have sex whether the Ovum and Sperm have met. A woman cannot feel them join together in her Uterus. There are only two ways to find out.

Activity: (*Synthesising*) Type those 2 ways.
Compare your answer with the following.

1. The first sign that conception has occurred is when the woman's Periods stop each month. This means she has to wait until the days she **normally expects** to have her Periods, in about one month's time, to see if they come

   - If a woman **has** her next Period, then she is **not** pregnant.
   - If a woman **does not have** her next Period, then she will usually be pregnant.

   Now you can see how useful it is for women to keep a record in their diary of the days each month when they have their Periods.
2. A quicker method is a Pregnancy Test. This is really easy to do. You just go to a Supermarket or Chemist and buy a Pregnancy Test Kit. You take it home and do this simple test. A small amount of the woman's urine is needed. So the woman goes to the toilet and holds a cup under her stream of urine to collect about a teaspoon of urine. Then she places a few drops of that urine into the well in the plastic disc in her Kit. The small window on it will shortly indicate if she is pregnant or not. She should always make sure she reads the Directions on the Kit very well, and does the test carefully, so she gets an accurate result.
3. If a woman is pregnant, the doctor can feel the foetus (pronounced feet-us) (or the young baby) only after about 7 weeks after sex. Before 7 weeks the foetus is too small to feel. It is important for women to find out straight away by using one of the two methods above, especially the Pregnancy Test Kit, which is quick, easy and economical.

Assessable Activity #5g
Can kissing make a woman pregnant? (Answer=No, quarter of a mark).

> She can only get pregnant, if, after she has had sex, her Ovum and a Sperm join together inside her Uterus.

5.9.1 How old has a girl to be to get pregnant?

Activity: (*Choosing, deciding*) In no more than one paragraph answer that question as if from a Primary School student.
(*Comparing*) Compare your answer to the following.

> As soon as a girl starts getting Periods she is physically able to get pregnant. This is usually at about 12 years old. Some girls start earlier at age 9 or 10, and some start later up to age 15. Her periods indicate that her body is preparing the Uterus lining for a joined Ovum and Sperm, that is a tiny baby, to attach itself to.

5.9.2 If I get pregnant what can I do? The next diagram shows you the choices you have about having sex, and what to do if you get pregnant. Read from the top down.

Complete the following Choices diagram. (This shows the choices e.g. abortion, have the baby, keep it, put it up for adoption, next time use contraception.)

5.9.3 What does a man do if he makes a woman pregnant?

Activity: (*Choosing, deciding, justifying*). In no more than one paragraph answer this question as if from a Primary School student.

(*Comparison*) Compare your answer to the following.

> Because it takes both a man and a woman to make a baby, then both of them are responsible for any baby they make. Just because the woman carries the baby in her Uterus for 9 months does not mean the father of that baby has no part to play. If a man makes a woman pregnant accidentally, he should discuss with her what they want to do. Look at the Choices diagram. Together, the man and the woman need to decide what choices to take. No matter what choice is made, the man should always support the woman.

5.10 Your sex life

Finally, read this paragraph, then write your reflections about all that you have learnt in this module.

In your future life, you will have a number of different parts to it, for example, your school life, your home life, your personal life, your sex life, and your sporting life. Try to have the best quality life that you can, including your sex life. Many young people ask how old they should be when they first have sex. The answer is when they are knowledgeable and mature enough to make responsible decisions to ensure no one gets hurt with a sexually transmitted infection (STI), or has an unwanted pregnancy. For good advice on any sexual matters go to your doctor or to a Family Planning Clinic. If a person is unsure about themselves or their feelings for their boyfriend or girlfriend, then they should postpone having sex. Quality sex between mature, knowledgeable and responsible people helps them achieve a higher quality life, because enjoying sex is a normal and natural characteristic of being human.

Congratulations you have now completed Module 5. Shut the computer down, and go and have a break, and think about how you as a Primary school teacher can further assist young people to understand sexual intercourse and sexuality better.

Constructivist principles

The design of each of these interactivities were based on two theoretical principles; higher level critical thinking skills (Bloom in Frangenheim, 1998), including evaluation and synthesis where students are encouraged to undertake deep learning (See Biggs, 1999; Goldman, 2004), and constructivist theory where the learner is provided with a variety of learning aimed at engendering a greater understanding based on students' prior knowledge. Table 1 shows the application of constructivist principles to this sexuality sub-module.

Table 1. Application of the eight constructivist principles to interactivities on sexual intercourse on CD-Rom

Constructivist principles and their applications
1. Anchor all learning activities to a larger task or problem
• Anchored in the problem of sexuality generally, puberty, periods, sexual intercourse, and getting pregnant.
• Purpose clear to learner by being anchored in research findings on the poor knowledge that young people have about having sex, its prequel and sequel.
• Anchored to metacognitive understanding.
• Relevant to the larger task of learning about human relationships education and its application.
• Anchored in the concept of teachers as professionals, and helping to address sexuality for young people.
• Anchored in values, particularly respect and empathy for sexual partners. Having sex should be consensual with parity of power in the relationship.
• Anchored in scientifically proven, replicable research.
• Anchored in understanding concepts and their importance in identifying and addressing sexual intercourse; viz socially negotiated knowledge.
• Relevant to informing understanding of students' metacognitive processes.
• Learner to make conceptual links.
• Learner to experience making knowledge links.
• Learner progresses easier if s/he is fully committed to the task.
• Gain appropriate understandings that everyone grows through puberty.
2. Support the learner in developing ownership for the overall problem or task
• Active participative skills to encourage ownership of learning.
• Learner develops enhanced professional understandings.
• Learner gains marks for enhanced participation.
• Interact with new knowledge for student teachers to understand and teach.
• Instructional goals relate to knowledge of puberty and sexuality as essential for student teachers to understand.
• Learner progresses easier if s/he is fully committed to the task.
• Developing ownership of multimedia learning.
• Develop professionally through the opportunity to encourage individual multimedia learning.
• Experiencing an awareness of goals of respect and empathy for the needs of pre-pubertal and pubertal children.
• Learner to make conceptual links between societal problems and those evident in the classroom.
• Learner as an active participant in addressing social problems.
3. Design an authentic task
• Conceptually addressed in 'bite-sized pieces'.
• Relevant to student teachers' future experiences in primary schools.
• Professionally relevant for users.
• Understanding puberty, periods, and having sex will enhance better quality of life for many primary school children.
• Teachers becoming more professionally aware and active in enhancing young people's understanding of sexuality.
• A meaningful problem for pre-pubertal and pubertal children is addressed.
• Tasks relevant to conceptual understanding and development.
• Tasks relevant for student teachers' portfolio of teaching strategies.
• Tasks relevant to human relationships education curriculum.

Table 1. Continued.

• Tasks relevant to children's lives, thus influencing their ability to learn, and teachers' achievements in teaching them. • Tasks relevant to today and tomorrow's authentic social problems. • Learner uses higher order thinking skills.
4. Design the task and learning environment to reflect the complexity of the environment that students should be able to function in at the end of learning • Attempting to understand and address the complexity of human interactions. • Support the learner (student teacher) working in the complex environment of the modern primary school. • Importance of context and complexity of the role of the school teachers and curriculum design. • Complexity of classroom structures and processes for schools. • Complexity of curriculum pedagogical tasks for school teachers. • Relevant to the day-to-day lives of the learners. • Inter-relationship of all educational environments on the globe. • Simplifies the complexity of sexual intercourse into manageable cognitive 'portions', so learner moves from the simple to the complex.
5. Give the learner ownership of the process used to develop a solution • Student teacher progresses at his/her own rate. • Student teacher uses own bookmarks according to their own 'stop–start' learning pattern. • Student teacher suggests solutions to problems. • Student teacher tries examples, and tests own understanding prior to doing assessable questions. • Student teacher makes judgements about the problem-solving process.
6. Design the learning environment to support and challenge the learner's thinking • Problem-based learning. • Zone of proximal development. Students write their answer even if unsure of answer. • Support the learner in becoming an effective thinker using higher order thinking skills, e.g. synthesising, justifying, verifying, arguing. • Learner undertakes task, then compares it with the answer provided. • Learner is immersed in thinking about concepts, conceptualisations, and knowledge of human sexuality and sexual intercourse.
7. Encourage testing ideas against alternative views and alternative contexts • Ideas are discussed and understandings enhanced. • Student compares own responses to the suggested answer.
8. Provide opportunity for and support reflection on both the content learned and the learning process itself • In a later sub-module, students were asked to reflect on their learning progress. • Students discover the advantages and disadvantages of this pedagogy, for themselves as learners and for their future students.

Source: Savery and Duffy, 1996, p. 3.

In Table 1, each of the eight constructivist principles applicable to each of the sub-modules is addressed. For example, to fulfil the first principle—to anchor all learning activities to a larger task or problem—all sub-modules are anchored in the broader issue of human sexuality. In applying constructivist principles of facilitating links to

prior knowledge, interactions were structured to encourage students to examine preconceptions about sexual intercourse. Feedback containing further information about sexual intercourse was provided as students completed interactions. This feedback was framed in such a way as to encourage students to compare their preconceptions with the appropriate information provided. Students were thus encouraged to test their ideas against other views. This further exemplifies constructivist notions of interaction design.

Of the eight constructivist principles, the one that was not specifically addressed here in Module 5 was 'Provide opportunity for, and support reflection on, both the content earned and the learning process itself'. These ten sub-modules were embedded within the broader ten modules, and in the design the authors included reflection at varying appropriate stages within the modules, frequently following the completion of a coherent conceptualisation, pedagogical task or problem-solving activity. In each of the examples above, this constructivist principle may not appear evident; however, it was present later in the modules where students were asked to write their reflections on their learning process and their learning progress. Because of the difficulty in computer-marked assessment for social science subjects such as this, reflections were included to assist learners' micro-, macro- and meta-cognitive processes, rather than as essay-type response assessment.

Bloom's critical thinking skills

The inclusion of Bloom's critical thinking skills here is predominantly in his upper three levels of analysis, evaluation and creating. Most incidences, however, are in evaluation level, and include, in order from the most-used to the least-used, choosing, selecting, prioritising and judging (in equal incidence), verifying, justifying, concluding, arguing and determining. The second highest incidence occurred at the analysis level with comparing, followed by the creating level where synthesising was used. This emphasis on the upper three levels accords with the results found in another study of student teachers' thinking about child sexual abuse (Goldman, 2005) which found that student teachers frequently do not reach these upper levels of thinking, and that further practice there would enhance their deeper thinking abilities.

Discussion

All planning and designing for teaching and learning is problematical, and sex education is no exception. The choice and usage of pedagogies in a CD-Rom on sex education is also problematical, and there are a number of pedagogical renegotiations for the learner and associated learning dimensions that the educational designer should consider. Some of the most significant ones will now be addressed.

Privacy, no embarrassment, and being non-judgemental

In using a CD-Rom, where the individual learner interacts with the computer, that is, human-to-computer, he/she is able to learn about sexuality privately and

intimately. This allows for solo contemplation, self-dialogue, and negates embarrassment because there is no 'other' to be embarrassed in front of, including peers and teachers, nor have one's self-confidence compromised as can occur in face-to-face classroom encounters. For some learners, such positive characteristics may well be of paramount importance in sex education.

Practical dimensions

Other advantages of a CD-Rom include the practical dimensions of allowing students to do it in their own time, in their own home, with no need for travel which takes time and money.

Psychological readiness

A CD-Rom can be used when the student is psychologically ready. This is important for students who are sexually ignorant or less emotionally mature. So, the capacity for individualised personal learning addresses private problems and sexual ignorance, and, as Light and Cox (2001, p. 156) note, 'Some people find it easier to 'open up' and 'speak' with the use of technology'.

Positive and negative effects

The effects of new technology on learning have been analysed by Light and Cox (2001, p. 164) who identify positive and negative effects of four learning dimensions, namely intellectual, practical, personal and social (see Table 2).

Most of these positive effects across the four dimensions are relevant to sex education on CD-Rom, for example 'opportunity for reflection/revision before contributing', 'removal of time and space constraints on learning', and 'increased participation by minority groups'. However, many of the negative effects are minimal in a CD-Rom, for example, 'reduced feedback', 'contextual deprivation', and 'need for a skilled moderator', because each of them can be addressed in the CD-Rom through detailed text, graphics or other forms of information.

Experiential

In Table 2, in practical dimensions, for example, 'opportunities for learning by doing' may be limited, such as in negotiating contraception use with a partner, unless it is by role play or uses camera phones.

The social dimensions can be addressed in CD-Rom; for example the two positive effects, namely 'opportunity for dialogue with wider groups', and 'increased collaboration between teachers and learners and between learners'. In all of these, dialogue can occur. However, on CD-Rom, which consists of human-to-computer interaction, real-time discussion between learners can certainly occur between students using camera phones or in delayed-time using email. Further, solo discussion can take place using Bloom's arguing/justifying as in 'Type two reasons why a couple

Table 2. Some positive and negative effects of new technology on four learning dimensions in teaching sexuality education

Dimensions	Positive effects	Negative effects
Intellectual	• Promotion of interactive learning • Increased typed output • Access to a wider range of material • Opportunity for reflection/revision before contributing • Access to multiple framework/discourse/ perspectives	• Slowness in decision-making • Less reading • Reduced feedback • Loss of impetus to reply
Practical	• Acquisition of computer skills • Opportunities for learning by doing • Management of multiple perspectives • Language skills enhanced through activity in the new technical and disciplinary 'literacies' • Study at home, less costly	• Overfocus on computer and keyboard skills at the expense of others
Personal	• Removal of time and space constraints to learning • Opportunity to take control of one's learning • Empowerment of learner • Opportunity to develop self-skills: self-discipline, self-motivation, self-confidence • Privacy, no embarrassment • Self-disclosure	• Contextual deprivation • Information overload • Techno-stress
Social	• Opportunity for dialogue with wider groups • Increased collaboration between teachers and learners and between learners • Increased participation by minority groups • Opportunity to develop multiple voices within rapidly changing discourses	• Need for a skilled moderator to facilitate (control?) dialogue • Flaming • Lack of accountability • Reinforcement of existing inequalities

Source: adapted from Light and Cox, 2001, p. 164.

would have a test-tube baby'. That is, the learner has to rehearse solo dialogue of argument and justification prior to and during his/her typing of it, which, as a personal reflection, is a form of discussion when no other human discussants are present, just as exam papers have, for decades, frequently asked students to 'Discuss X'.

Real life scenarios, simulation, role analysis

These pedagogies have been an important part of modern sex education. Blake (2002, p. 21) says that biology and technical aspects fail to explore 'real life dilemmas' and develop skills such as 'being yourself in a relationship'. However, simulation on CD-Rom can do just that. For example, consider the question used in

this CD-Rom 'Does a woman have to have had periods to get pregnant?'. This is a real-life problem which helps students develop analysing, forecasting and planning skills. A further example of role analysis included here is 'What does having sex to do with having babies?'. Once again, this question aims to help students develop analysis, decision-making and extrapolation, all of which are in Bloom's highest critical thinking levels.

Knowledge base

According to Blake (2002, p. 22), lesson planning in sex education 'must help pupils to … gain information about sex, sexuality, sexual health and relationships including information about contraception, sexually transmitted infections and HIV'. Such knowledge base can be covered well on CD-Rom as evidenced above, for example in the cloze activity on sexual intercourse and its sequels. Blake (2002, p. 23) also notes that technology can be used for information, knowledge and data access. (Interestingly, this appears to be the only reference to ICT in this useful book.) By including knowledge with an emphasis on factual information, improving students' understandings and interactions, short assessable answers can then be provided, as in this CD-Rom.

Measurability

Measurability is one characteristic mentioned by Blake (2002, p. 12) as an appropriate target for use in schools, and thus is appropriate for student teachers to be familiar with. Blake (2002, p. 12) recommends target setting should include a SMART approach, namely Specific, Measurable, Realistic and Time-related. Sex education on CD-Rom is able to include these, and students can monitor their progress during their learning, then at the conclusion print out their results.

Autonomous, independent learning styles

Asynchronous learning, according to Light and Cox (2001, p. 163):

> … provides students with flexibility as to when they access course materials. It allows them opportunities for going back over and working material both at their own pace and at their own convenience. It also provides time for reflection on the material and for integrating it within their working and/or home environment.

This CD-Rom on sex education accommodates these autonomous, independent, self-paced learning styles, thus enhancing students' responsibility as self-directed learners.

Human/social dimension

The human/social dimension is raised by Light and Cox (2001, p. 161) as an issue in IMM. Maximising this dimension on CD-Rom is probably best achieved by, for

example, incorporating video clips of the teacher addressing students' learning. In this CD-Rom this was included at the very beginning, as an introduction for students to meet the lecturer, but no two-way interaction was possible. In fact, this can now be addressed by having camera phones, emails, SMS (short message service) and chat rooms discussions with other learners and the lecturer. However, Light and Cox (2001, p. 156) note that 'There is no intrinsic reason why the lack of physical presence should be dehumanising'. It may appear anomalous to teach human relationships with only one human undertaking the learning in a human-to-computer learning situation, but with the advent of camera phones and other technologies, social interaction can occur, whether instant or delayed.

Group work

Blake (2002, p. 9) recommends human participatory methods as part of an effective sex and relations education program. This includes group work where learners work together to have 'The experience of listening to others' views and beliefs, practising skills, observing others and developing relationships …' (Blake, 2002, p. 31.). This can now be addressed on CD-Rom by having such activities in tandem with camera phones, telephone video, or computer video. These are increasingly becoming cheaper and more available for all students, but were not available with this CD-Rom.

Discussion in sex education

Discussion is frequently used as an important pedagogy in sex education, for example, to brainstorm a whole range of sex and relationships issues. The importance of discussion is highlighted by Cox and Light (2001, p. 21) when referring to Bruner (1966) who notes that '… meaning is not so much private and exchanged as publicly constructed within exchange'. This is now possible on CD-Rom, in real-time using a camera phone or computer video, or in delayed-time on internet chat room or email.

Values clarification

Values clarification and attitude clarification can still occur using CD-Rom. For example, in the question 'What does a man do if he makes a woman pregnant?', the learner uses Bloom's choosing, deciding and justifying to clarify his/her values and attitudes to make a choice, decide on a plan of action, then justify his/her position.

Negotiation skills

Negotiation skills are an important part of sex education, especially where sexual intercourse is concerned. A CD-Rom has a capacity to develop these skills, through simulation or face-to-face. For example, learners were asked 'Type three factors a man and a woman should discuss before they have a baby'. This includes negotiation

skills, emotional and social skills, and financial support. This position is contrary to Blake (2002, p. 21) who says that a biology approach ignores '… skills development and values clarification', and 'Much more important is a focus supporting their confidence and skills to access this information either via the Internet or through a health professional'. A CD-Rom can address this need to cover 'decision-making, negotiation and assertiveness …' (Blake, 2002, p. 21). This may require further support for primary school students; however, for student teachers, a CD-Rom is able to incorporate both social biology and human negotiation skills, depending on the educational objectives used in tandem with an exploration of real-life scenarios as discussed above.

Reflection-in-action

Interactive multimedia materials are said to lack the dynamics of real-time face-to-face human engagement, during which the teacher can respond to learner needs 'on the fly' as the learning situation unfolds. Schon (1983, p. 50) would probably refer to this as 'reflection-in-action', whereby, in the professional teacher's skill, many quality judgements are made instantaneously and are dependent on 'tacit recognition, judgements and skilful performances' which are often difficult to articulate, but result in skilful action or response by the teacher. Thus, in designing educational IMM, the difficulties that students may encounter, and the importance of constructive feedback, needs to be predicted, and the multimedia module designed to cater for these predictions as accurately as possible, as a means of substitution of the teacher and his/her reflection-in-action (see Marton *et al.*, 1997; Prosser & Trigwell, 1999).

Teaching in higher education using IMM

Some of the more recent literature on teaching in higher education acknowledges IMM, but frequently fails to address it in detail. For example, Biggs (1999) does not appear to address it at all, while Rowland (2000) gives it minimal recognition and appears to refer only to emailing. Prosser and Trigwell, (1999, p. 169) skim over IMM by stating:

> We acknowledge that the use of technology in learning and teaching is assuming increasing importance in higher education, but we assert that the principles and ideas for which we have argued underlie all good teaching. All of our principles apply to such learning and teaching environments.

Similarly, Blake (2002) on sex and relationships education includes a minimal critique of technology, and mentions briefly only information communication technology, videos and the Internet (see Goldman & Hocking, 1999, 2000, 2001). The teacher's role in the interactive multimedia milieu may be seen, then, as a manager of knowledge, a facilitator who provides advice in exploration, a guide, a helper and an assistant (See Marton *et al.*, 1997; Prosser & Trigwell, 1999) as well as an educational designer where teacher support for student learning can occur.

Conclusion

Interactive multimedia has enormous potential for enhancing the learning of adults and children in sexuality education. The confidential non-threatening, non-judgemental, private environment offered is advantageous because it can cater for students' varying learning styles, privacy, and sexual ignorance, to maximise opportunities for students to explore and learn. Here, a module designed as one part of the human relationships education subject in a CD-Rom for Bachelor of Education (Primary) students at an Australian university is analysed in terms of the principles of a constructivist approach, Bloom's higher level thinking skills, and the pedagogical renegotiations involved.

Undoubtedly, there are other pedagogies and interactivities that can be used in teaching about sexuality. However, the variety chosen here has a three-fold aim; to enhance student teachers' own learning about knowledge of sexual intercourse within relevant contexts; to encourage a more informed pedagogical approach to sex education; and to enhance student teachers' understanding of the significance of addressing sexuality in the primary school classroom (see Berson & Berson, 1999; Goldman, 2004). Biggs (1999, p. 2) states, 'there is no single all-purpose best method of teaching. Teaching is individual'. This characteristic may be said to apply also to this module from our CD-Rom where pedagogical variety is one of its characteristics, addressing a medley of student teachers' learning styles.

To answer the question posed earlier, then, as to how viable IMM on CD-Rom is for sex education, the reply appears to be that it is able to include a wide variety of currently used pedagogies, and can also accommodate, where appropriate, the development of genuine 'human-presence-at-a-distance' engagement (Light & Cox, 2001, p. 157) using new technologies such as camera phones. Further, as Light and Cox (2001, p. 167) note:

> … new technology is not another way of extending educational delivery, but is in itself a defining cultural and social feature of our increasingly unpredictable, changeable and contestable world. Its very application is now a necessary part of higher education's role in preparing students for the culture of the future, as it rapidly becomes the present. In this way, innovation, itself, becomes 'content' in the higher education curriculum, its very use a model for students to critically and creatively reconstruct for themselves in their own learning.

In light of this, sex education on IMM, including CD-Rom, needs to be positioned within the new technological paradigm to assert its viability, longevity and importance for both student teachers and all primary school students.

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