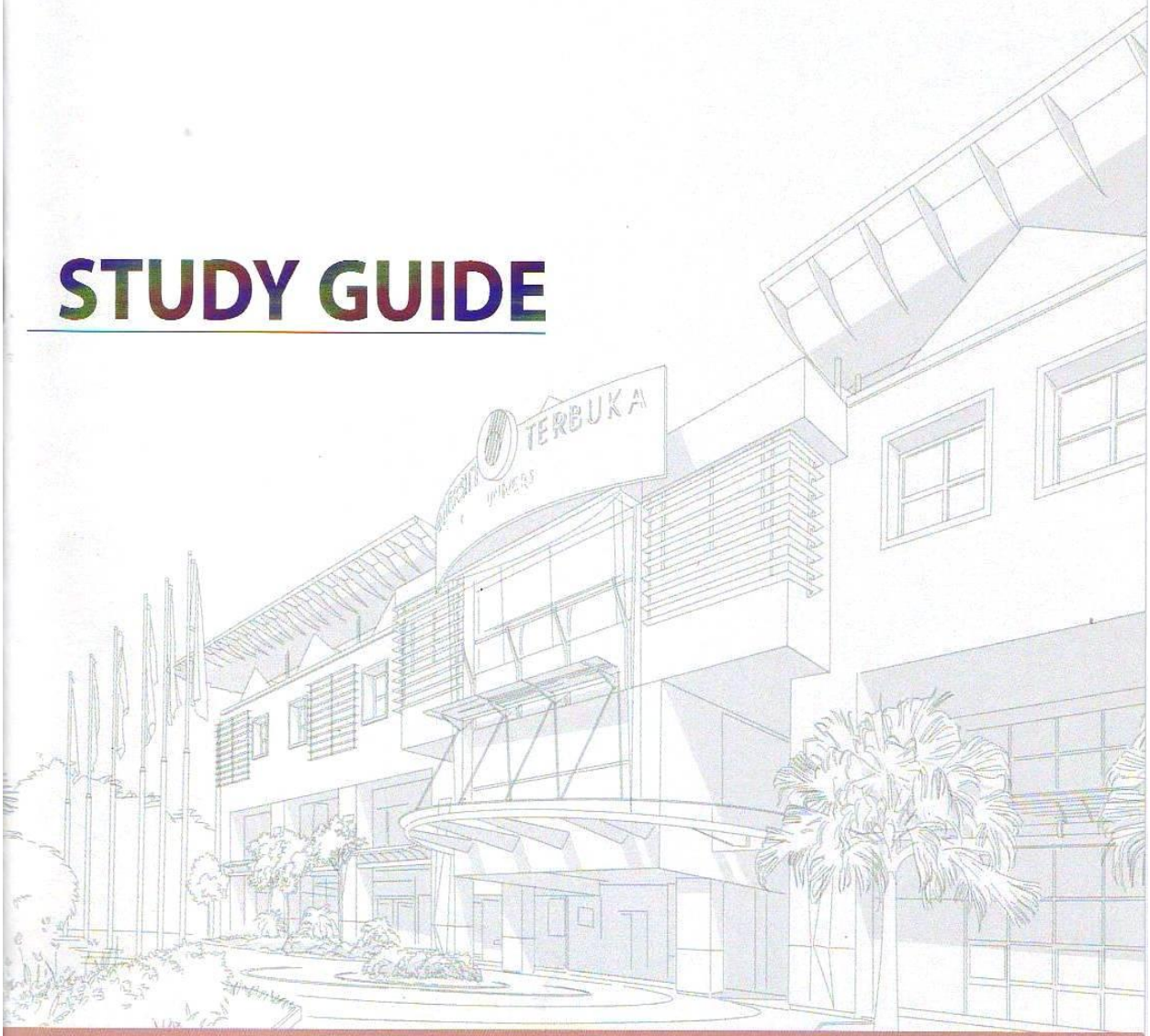
OPEN UNIVERSITY MALAYSIA

STUDY GUIDE



FACULTY OF EDUCATION AND LANGUAGES

HBEC2703
Science in Early Childhood Education

First Edition

OPEN UNIVERSITY MALAYSIA

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STUDY GUIDE

HBEC2703 Science in Early Childhood Education

First Edition

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Open University Malaysia

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Contents

COURSE INTRODUCTION

Course Synopsis

This course is designed to provide theoretical and practical knowledge for teaching science in early childhood contexts. Learners will develop teaching strategies which promote thinking and problem-solving skills in young children; utilise observation and task assessment as a basis for planning discovery experiences for the children and select as well as prepare developmentally appropriate materials to support the learning of scientific concepts.

Course Aims

The broad aims of this course are to:

1. Outline appropriate science concepts for young children;
2. Introduce the excitement and extensiveness of scientific experiences for young children;
3. Organise sequential approaches to creating developmentally appropriate science lessons for children in early childhood years; and
4. Plan meaningful scientific experiences for children through a play-based curriculum which is also integrated with other curricular areas.

Course Outcomes

At the completion of this course, it is expected that you will be able to:

1. Describe the scientific process and its application to the early childhood indoor and outdoor learning environments which are related to science;
2. Explain how to promote children's cognitive development and understanding of their world through active, hands-on exploration of scientific concepts and processes;
3. Utilise a constructivist approach and apply principles of inquiry-based learning to early childhood science instruction;

4. Create, evaluate and select developmentally appropriate materials, equipment and environments to support the learning of scientific concepts; and

5. Utilise observation and assessment as a basis for planning discovery experiences for the individual child.

Course Load

It is a standard OUM practice that learners accumulate 40 study hours for every credit hour. As such, for a three-credit hour course, you are expected to spend at least 120 hours of learning. Table 1 gives an estimation of how the 120 hours could be accumulated.

Table 1: Allocation of Study Hours

Activities	No of Hours
Reading the module and completing the exercises	60
Attending 5 tutorial sessions (2 hours for each session)	10
Engage in online discussion	15
Completing assignment	20
Revision	15
Total	**120**

COURSE REQUIREMENTS

Prerequisites or co-requisites

HBEC2203.

COURSE RESOURCES AND REQUIREMENTS

Set Textbook(s)

Davis, G. A., & Keller, J. D. (2009). *Exploring science and mathematics in a child's world* (1st ed.). New Jersey: Pearson Education.

Harlan, J. D., & Rivkin, M. S. (2012). *Science experiences for the early childhood years: An integrated affective approach* (10th ed.). New Jersey: Pearson.

Essential References

Lind, K. K. (2000). *Exploring science in early childhood education* (1st ed.). New York: Delmar Thomson Learning.

Settlage, J., & Southerland, S. A. (2007). *Teaching science to every child* (1st ed.). New York: Routledge Taylor and Francis Group.

Extra Recommended Reading

Martin, D. J. (2001). *Constructing early childhood science* (1st ed.). New York: Delmar Thomson Learning.

Martin, R., Sexton, C., & Franklin, T. (2009). *Teaching science for all children: Inquiry methods for constructing understanding* (4th ed.). Boston: Pearson Education and Allyn and Bacon.

ASSESSMENT

Assessment Format

Grades will be determined with the following criteria being considered:

Assignments/Projects 30%

- Child Directed Science Project Part 1 & 2 (Individual)
- Tutor-generated assessments
  (e.g. reflection, essay, structured questions, unit tests)

Assignment Question(s)

Child Directed Science Project

Part 1: Project Plan
Develop and submit plans for a child directed science activity area or box for your classroom. The format will be distributed during class. Inform the lecturer of your plans and arrange for a time/space for you to implement your lesson.

Part 2: Project Implementation and Reflection Paper
Implement your approved plan and submit a reflection paper on the experience. The criteria for the paper will be distributed in class.

Final Examination

Final Examinations 70% (2½ hours)

- Part A: 20 Multiple-choice questions (20%)
- Part B: Answer all short answer questions (30%)
- Part C: Answer 2 of 3 essay type questions (20%)

Late Submission of Assignment(s)

Failure to submit an assignment by the due date without the granting of an official extension of time by your course tutor will incur a penalty.

Weekly Study Guide

Week 1

Topic 1: Introduction

Reading Materials

Davis, G. A., & Keller, J. D. (2009). *Exploring science and mathematics in a child's world* (1st ed.) (pp. 1-8 and pp. 15-20). New Jersey: Pearson Education.

Harlan, J. D., & Rivkin, M. S. (2012). *Science experiences for the early childhood years: An integrated affective approach* (10th ed.) (pp. 3-14). New Jersey: Pearson.

e-Content

Cleminson, A. (2006). *Abstract*. Retrieved April 12, 2012, from http://onlinelibrary.wiley.com/doi/10.1002/tea.3660270504/abstract.

Kay, A. (2003). *Background on how children learn*. Retrieved April 12, 2012, from http://www.vpri.org/pdf/m2003002_how.pdf.

Longwood University. *Teaching the science process skills*. Retrieved April 12, 2012, from http://www.longwood.edu.

Questacon – The National Science and Technology Centre. *Why science & play?* Retrieved April 12, 2012, from http://scienceplay.questacon.edu.au/why.html.

Scientific skills: Science process skills. Retrieved April 12, 2012, from www.sabah.edu.my/cwr005/SPS/SPS2.PPT.

Wilson, R. (2008). *Promoting the development of scientific thinking*. Retrieved April 12, 2012, from http://www.earlychildhoodnews.com/earlychildhood/article_view.aspx?ArticleId=409.

Study Notes

Key concepts and key words with brief explanation.

How Young Children Learn

Scientific Skills: Observation – classification – compare and contrast – predict – communicate – make inference.

Play and Learning Science

An Integrated Science Learning Framework

Brief explanation of core ideas

This introductory topic raises questions such as – What is science in early childhood? What are the goals of early childhood science education? What should be done to enhance early years' science? How do children learn scientific concepts? Children are active participants in their own development and learning. Learning involves the child's construction of knowledge, not an adult's imposition of information. It is important for children to have opportunities to construct their own knowledge through exploration, interaction with materials and imitation of role models. In order to construct scientific concepts, children's scientific skills need to be enhanced. These skills are observing, classifying, communicating, measuring, predicting, inferring, hypothesising, planning, investigating, explaining, interpreting and raising questions. As children experience the world, they feel anxious, curious and construct their own meanings. With appropriate stimulation and support, their innate natural tendency and desire to understand the world is organised into careful ways of collecting, analysing and sharing the resulting information, which is called science (Harlan & Rivkin, 2012).

As child educators, you are to cultivate children into critical thinkers and creative problem solvers. You must direct their experiences and observations to their immediate world. You are also invited to reawaken your own senses and experience the perceptual world of the child (Davis & Keller, 2009). As play is a natural tendency for children's learning, the development of scientific attitudes in young children should be built into play activities. Play activities could be broadly structured as an ongoing and integral part of the science opportunities that are on offer to the children in the same way that topics are planned throughout a year.

In another respect, integrating meaningful science experiences with other curricular areas will help enhance children's mental performance. Integrating lessons will allow a teacher to include multiple pathways to science learning. In this topic, you will examine an interdisciplinary fashion in teaching science.

Study Questions

1. Define the term "scientific concept".

2. How does understanding how children learn help teachers construct classroom environments that encourage children's natural curiosities and interests?

3. What do you understand by learning science through play?

4. Describe a scenario in which a young child might demonstrate understanding of scientific skills such as observing, classifying, communicating and interpreting.

5. Explain how science may be integrated into another early childhood curriculum area.

Frequently Asked Questions

1. How do children learn science?

2. What are science process skills?

3. What sort of questions do children ask when they learn science?

4. Why science and play?

5. How can we integrate meaningful science experiences with other curriculum areas?

Suggested Activities

1. To see how the processes are used in investigating scientific phenomena, you may involve children in investigating factors that influence how fast parachutes fall for example.

2. Interview three mothers of children aged two to eight. Ask them if they realise some home activities are basic to the construction of science concepts and note their responses. Did you find that these mothers appreciated the value of children's play activities in science concept development? Discuss the results among your classmates.

Week 2

Topic 2: Guiding Science Learning in the Early Years

Reading Materials

Davis, G. A., & Keller, J. D. (2009). *Exploring science and mathematics in a child's world* (1st ed.) (pp. 21- 35 and pp. 36-48). New Jersey: Pearson Education.

Harlan, J. D., & Rivkin, M. S. (2012). *Science experiences for the early childhood years: An integrated affective approach* (10th ed.) (pp. 16-26 and pp. 28-46). New Jersey: Pearson.

e-Content

Chalufour, I. (2010). *Learning to teach science: Strategies that support teacher practice.* Retrieved April 12, 2012, from http://ecrp.uiuc.edu/beyond/seed/chalufour.html.

Early Childhood Australia. *Being, belonging and becoming: The early years learning framework.* Retrieved April 12, 2012, from http://www.earlychildhoodaustralia.org.au/resource_themes/eylf_early_years_learning_framework.html.

Gilson, K., & Cherry, V. (2002, May). *Science in the preschool classroom.* Retrieved April 12, 2012, from http://www.pbs.org/teachers/earlychildhood/articles/science.html.

Watters, J. J., & Diezmann, C. M. (1998). *This is nothing like school: Discourse and the social environment as key components in learning science. Early Childhood Development and Care* 140 (pp. 73-84). Retrieved April 12, 2012, from http://eprints.qut.edu.au/2697/1/2697_2.pdf.

Wilson, R. (2008). *Promoting the development of scientific thinking.* Retrieved April 12, 2012, from http://www.earlychildhoodnews.com/earlychildhood/article_view.aspx?ArticleId=409.

Study Notes

Key concepts and key words with brief explanation:

Approaches in Teaching and Learning Sciences: Cognitive developmental theories – teaching style – indirect and direct teaching – learning to question – leading discussion – children's questions and curiosities – encouraging wonder and discovery – problem-solving styles.

Environments that Promote Science Learning: Affective approach – nurturing child development – valuing children and childhood – providing emotional security.

Roles of Teachers, Families and Communities

Brief explanation of core ideas

In the second week of learning this course, you will be exposed to a brief review of cognitive developmental theories and its consequences to teaching strategies. Understanding the characteristic ways children feel about themselves will also be emphasised as these are significant elements that can develop personal confidence and competence in children in order to nurture them to be nurtured as scientists.

Emphasis is also placed on creating an early childhood setting environment that supports creativity, inquiry and problem-solving ability with interesting materials to explore and examine. Furthermore, children feel safe and secure when they are among people who treat them with respectful care. A bond of personal interest and caring, a positive teaching attitude and authentic interest in finding out more about something is crucial to sustain children's curiosity and initiative in discovering science (Harlan & Rivkin, 2012). Teachers are capable of maintaining a warm and accepting classroom atmosphere to develop lifelong relationships with the children to be explorers and discoverers who wonder about natural phenomena. In another respect, the power of parental support is considered as a vital motivating factor for children's immediate learning achievement. Communities also have unique roles.

Study Questions

1. Discuss how you would relate the domain specific cognition theory and the situated cognition theory to the conceptualisation of how children's mind work.

2. What distinguishes divergent questions from convergent questions?

3. Describe the teacher's role in a classroom that embodies and promotes the ideas espoused in this section.

4. Identify roles of the teacher in fostering scientific inquiry and problem-solving techniques.

5. Describe ways in which children can be helped to develop a positive attitude towards appreciation of the scientific process.

6. What are some ways which can be suggested to include families in your exploration in science so that children can see how their experiences in school are extensions of their daily life?

Frequently Asked Questions

1. What is the teacher's role?

2. What kinds of environment promote science learning?

3. What are the implications of cognitive developmental theories in teaching science?

4. How will children learn to value science?

5. How can parents participate in facilitating children's inquiries during science?

6. How can teachers organise community resources?

Week 3

Topic 3: Approaches and Models of Teaching Science

Reading Materials

Martin, D.J. (2001). *Constructing early childhood science* (1st ed.) (pp. 183-210 and pp. 345-360). New York: Delmar Thomson Learning.

e-Content

Brickman, P., Gormally, C., Armstrong, N., & Hallar, B. (2009). Effects of inquiry-based learning on students' science literacy skills and confidence. *International Journal for the Scholarship of Teaching and Learning* (Vol. 3, No. 2. Retrieved April 12, 2012, from http://academics.georgiasouthern.edu/ijsotl/v3n2/articles/PDFs/Article_Brickman.pdf.

Concept to Classroom. (2004). Educational Broadcasting Corporation. *In the classroom: A video journey*. Retrieved April 12, 2012, from http://www.thirteen.org/edonline/concept2class/interdisciplinary/demonstration.html.

Concept to Classroom. (2004). Educational Broadcasting Corporation. *What is inquiry-based learning?* Retrieved April 12, 2012, from http://www.thirteen.org/edonline/concept2class/inquiry/index.html.

Keogh, B., & Naylor, S. (1996). *Teaching and learning in science: A new perspective.* Retrieved April 12, 2012, from http://www.leeds.ac.uk/educol/documents/000000115.htm.

Loepp, F. L. (1999). *Models of curriculum integration.* Retrieved April 12, 2012, from http://scholar.lib.vt.edu/.

Saskatoon Public Schools. *Interdisciplinary approach to teaching and learning*. (2012). Retrieved April 12, 2012, from http://olc.spsd.sk.ca/de/pd/instr/strats/interdis/index.html.

Ullrich, K. *Constructivism and the 5 E Model Science Lesson*. Retrieved April 12, 2012, from http://cte.jhu.edu/techacademy/fellows/ullrich/webquest/mkuindex.html.

Study Notes

Key concepts and key words with brief explanation.

Constructivism: Nature of constructivism – schema – assimilation – accommodation – cognitive equilibration – self-constructed conceptualisations.

Process oriented Inquiry: skills of inquiry – attitudes of inquiry – doing inquiry – discovery methodology – guided inquiry methodology.

Interdisciplinary integration model: Interdisciplinary Curriculum – Interdisciplinary Model.

Brief explanation of core ideas

In this section, you will be exposed to various approaches and models in teaching and learning sciences, mainly constructivism, process-oriented inquiry and interdisciplinary integration model.

1. Children attach meaning to new experiences based on the backgrounds of experience and knowledge they bring to the class. There are different experiences and different prior understandings present among the children in an early childhood class concerning virtually every topic you choose to bring up, whether it deals with life science, physical science, earth and space science or something else. The notion that children bring their own knowledge and representations from their own experiences and thoughts is called constructivism. According to its principles, each learner must construct meaning for himself or herself. This approach is somewhat related to Piaget's theory of cognitive development which theorised that the construction occurs through taking new information into existing schemata through assimilation, opening new schemata through accommodation and achieving equilibration by connecting the schemata in ways that are sensible but unique to the individual. In order to encourage extensive, rich and valid constructions, teachers of early childhood science should expose children to many new experiences.

2. Process-oriented inquiry is a guided inquiry methodology whereby children investigate phenomena the way scientists do. They apply the processes of science in an inquiry format to investigate questions, situations, and other scientific phenomena the teacher suggests and that they themselves pose as a result of the initial exposure planned by teachers. In the process-oriented inquiry approach, materials are presented to children. The teachers can foster such inquiry by building

on children's spontaneous exploration and gradually guiding them to become more focused and systematic in their observations and investigations. Developing children's inquiry skills is a fundamental goal of an early childhood science program. Children need many opportunities to develop and use these skills. But these skills should not be taught in isolation from interesting topics and ideas and children's ongoing play. Rather, children need to develop their abilities to use inquiry in the context of their experiences with interesting materials and meaningful science ideas.

3. Science is interdisciplinary in nature. It also relative to other subjects and it is interdisciplinary relative to itself. The early childhood teachers should integrate all traditional subjects in an interdisciplinary approach to ensure meaningfulness of the topic being studied without separating the components artificially into separate and seemingly unrelated disciplines. In this section, you will explore ways you can approach early childhood science education from an integrated interdisciplinary approach.

Study Questions

1. How will you assess if children are developing science concepts and skills?

2. Write a description of each of the three approaches of teaching and learning sciences described in this section.

3. Observe a group of children doing a science activity. Record the informal science discoveries they make.

4. What strategies could you use to integrate subject areas into science? Give an example?

5. How constructivism does relate to cognitive learning theories?

6. Select a science topic such as farm animals; explain how you can shift from the compartmentalised approach to an integrated, holistic approach to learning.

Frequently Asked Questions

1. What do you understand by constructivism?

2. What distinguish constructivism from inquiry-based learning?

3. Define each of these terms and give examples of each: assimilation – accommodation – equilibration.

4. How do children learn scientific concepts in inquiry-based approach?

5. What distinguishes the fractionalised approach from the Interdisciplinary Model?

6. Explain why it is important to include more than one discipline in an area of study?

Week 4

Topic 4: Planning Science Lessons

Reading Materials

Davis, G. A., & Keller, J. D. (2009). *Exploring science and mathematics in a child's world* (1st. ed.) (pp. 36-48 and pp.86-112). New Jersey: Pearson Education.

Lind, K. K. (2000). *Exploring science in early childhood education* (5th ed.) (pp. 25-40 and pp. 76-86). Albany, NY: Thompson Delmar Learning.

e-Content

Britz, J. (1993). *Problem solving in early childhood classrooms*. ERIC Digest. Retrieved April 13, 2012, from http://www.ericdigests.org/1993/early.htm.

Charlesworth, R., & Lind, K. K. (2009). *Math & science for young children – Google books result.* Retrieved April 13, 2012, from http://books.google.com.my.

Creative preschool Teaching Themes.com. (2010). *Preschool science lesson plans and activities at science centre*. Retrieved April 13, 2012, from http://www.creative-preschool-teaching-themes.com/science-lesson-plans. html.

Neil, M., Lyn, D., Rupert, W., & Claire, S. (2004). *Reasoning as a scientist: Ways of helping children to use language to learn science.* British Educational Research Journal (Vol. 30 (3)). Retrieved April 13, 2012, from http://thinkingtogether.educ.cam.ac.uk/publications/journals/Mercer_et_al_BERJ_04.pdf.

Study Notes

Key concepts and key words with brief explanation.

Organising for Teaching Science: Planning for developing science concepts – strategy of webbing in unit planning – criteria for developing concept explorations

Choice of Instructional strategies: Problem solving as the basic approach – The 6 steps: assessment as children play by observation – choosing objectives – planning experiences – selecting materials – teaching process – evaluating what has the children learned

Lesson Planning: Basic Science Lesson Plan Components – Assessing the Unit Plan – resource unit - teaching unit – textbook unit – open-ended and narrow questions

Brief explanation of care-ideas

Providing children with a variety of ways to learn science is crucial. Even very young children have developed definite patterns in the way they learn. The design and nature of experiences that early childhood educators offer their children to help them develop scientific concept should be problem solving.

1. Effective teaching requires teachers to organise what they plan to teach that depends largely on their teaching situation. One technique that might help teachers organising their thoughts is webbing. A web depicts a variety of possible concepts and curricular experiences that the teachers might use to develop concepts. It's all beginning by making each web of the science concepts you want to teach. After selecting the concepts you plan to develop, begin adding appropriate activities to achieve your goal. The webbed units that you have developed are a long-term plan for organising science experiences around a specific topic. In other respect, a quality concept exploration has several criteria that cause it to be a productive experience for children: provide solid science content, consider the appropriate level of child development, integrates science and mathematics, is guided by the child's world, incorporates children's literature, actively involves children and is founded on a safe environment.

2. A problem-solving approach, as a choice of instructional strategies emphasizes children working independently and in groups, while the teacher serves as a facilitator. This section presents an overview of the four stages of problem solving cycle for children that includes the definition of the problem, the development of the procedure, the

conduct of the procedure and the conclusions that can be drawn through this process. Your goal as a teacher is not to change children's problem solving styles, instead, you should help each individual child develop strong skills by having numerous activities representing in each of the four areas of problem solving. In planning concepts experiences, six questions must be answered: where is the child now? (Assessment by observation), what should she or he learn next? (choosing objectives), what should the child do to accomplish these objectives? (plan experiences), which materials should be used to carry through the plan? (Select materials), do the plan and the materials fit? (conduct the planned activities with the child), and has the child learned something from the activities? (evaluate).

3. The lesson plan is necessary component of the unit. It helps you plan the experiences that will aid in concept development. A basic science lesson plan components should include concept, objective, materials, procedure and extension. In addition, planning for assessment is necessary to teach a lesson or unit effectively. You should reflect and assess your unit plan before you begin teaching the unit. Asking relevant questions such as children's past experiences, the science process skills used in the lesson and the developmentally appropriate content for the children, will help evaluate your work. In other respect, you may also develop resource units as extensive collection of activities and design a teaching unit plan to develop a science concept, objectives, materials, activities and evaluation procedures for a specific group of children. Extending the textbook in a textbook unit is another possibility. Then, when teaching the whole class, start with a narrow questions followed by open-ended questions.

Study Questions

1. What is webbing, and how can it be applied in designing a science unit?

2. List in order the six steps involved in planning concept experiences for young children and define each of the steps.

3. Discuss how you would apply the problem-solving cycle as identified in this topic as you conceptualise and develop one of the concept explorations.

4. List the major components of a lesson plan for science and describe the importance of each component.

5. What is unit? List three basic types of units and describe how they are used.

6. Explain the difference between narrow and open-ended questions and how each is used.

Frequently Asked Questions

1. What do you understand by effective teaching?
2. What is webbing?
3. How do you describe a quality concept exploration?
4. What is a problem-solving approach in learning science?
5. What are the components included in a basic science lesson plan?

Week 5

Topic 5: Technology and Literacy in Early Childhood Science Education

Reading Materials

Martin, D. J. (2001). *Constructing early childhood science* (1st ed.) (pp. 295-343). New York: Delmar Thomson Learning.

e-Content

Douglas. C. (1999). *Dialogue on early childhood science, mathematics, and technology education.* Retrieved April 13, 2012, from http://www.project2061.org/publications/earlychild/online/experience/clements.htm.

Judy, V. S., Debbie, E., & Jennifer, E. (2001). Technology *in early childhood education: Finding the balance.* Retrieved April 13, 2012, from http://www.netc.org/earlyconnections/byrequest.pdf.

Rob. D. (2003). *How's Your TQ? (Technology Quotient).* Retrieved April 13, 2012, from http://robdarrow.wikispaces.com.

Technology in early childhood program serving children from birth through age 8. Retrieved April 13, 2012, from http://larrycuban.files.wordpress.com/2011/11/draft-technology-in-early-childhood-programs-4-29-2011-1.pdf

Study Notes

Key concepts and key words with brief explanation.

Computer-based Technology: A technology inventory - CD Information Programs – word processing and desktop publishing – spreadsheets and graphing applications – databases – electronic mail – the internet and the World Wide Web – computer software- video in early childhood science classroom:

Reading and Writing in Science: the use children's literature in presenting scientific factual information – evaluating children's literature for early childhood science program – children's magazines – science textbooks and the activity-oriented series – gain skills in the abstract of written language

Brief explanation of care ideas

1. In this section, students will examine a variety of computer applications and ways they can use them to foster the process-oriented inquiry in early childhood science education program. As children nowadays sometimes know more about technology than their teachers, a technology inventory relating to educational technology quotient is presented in the starting point of this section to find out your level of proficiency in variety of instructional technologies commonly used in school today. Computers are part of the young child's world. Children should be introduced to these technological resources in the preschool years, and this equipment should be integrated into the science curriculum.

2. This section will also investigate ways in which reading and writing can be incorporated into the process-oriented inquiry science program to foster children's inquiries and help them construct personal and valid conceptualisations of scientific concepts. Children's literature and magazines can be used to introduce science lesson or to set the stage for a discussion or subsequent investigation. Some process-oriented activities can be conducted using story-books such as Jack and the Beanstalk, Goldilocks etc to present factual information and providing practices in the processes.

   Besides, science lessons can also help young children gain familiarity and skills in the abstract of the written language as well the understanding that writing is both convenient and necessary. Some ways in which writing can be incorporated in early childhood science education program include recording children's responses, science journals and creative writing.

Study Questions

1. How should children learn about computer and other technological equipment in science activities?
2. Why should teachers be cautious about selecting and using computer software?
3. Why should teachers be proficient in the use of technology in classroom science practice?
4. How can teachers encourage young children to think about their work from the perspective of design technology as well as from the perspective of science inquiry?
5. Explain how can teachers incorporate reading and writing in the early childhood science program?

Frequently Asked Questions

1. What is educational technology quotient?
2. Why use computer-based technology in early childhood science education?
3. How to use desktop publishing program and word processing in teaching science to young children?
4. What is meant by "incorporating reading and writing in the early childhood science program"?

Week 6

Topic 6: Life Science Concepts, Experiences and Integrating Activities

Reading Materials

Davis, G. A., & Keller, J. D. (2009). *Exploring science and mathematics in a child's world* (1st ed.) (pp. 141-155 and pp. 177-192). New Jersey: Pearson Education.

Harlan, J. D., & Rivkin, M. S. (2012). *Science experiences for the early childhood years: An integrated affective approach* (10th ed.) (pp.53-134). New Jersey: Pearson.

Lind, K. K. (2000). *Exploring science in early childhood education* (1st ed.) (pp. 194-209). New York: Delmar Thomson Learning.

e-Content

Ashbrook, P. (2011). *Early childhood teachers respond to request for resources on earth and life science*. Retrieved April 13, 2012, from http://nstacommunities.org/blog/2011/11/15/early-childhood-teachers-respond-to-request-for-resources-on-earth-and-life-science/.

Bosse, S., Jacobs, G., & Anderson, T. L. (2009). *Science in the air.* Retrieved April 13, 2012, from http://www.naeyc.org/files/yc/file/200911/BosseWeb1109.pdf.

Wehrell-Grabowski, D. (2010). *Fall and autumn science activities for the early childhood classroom.* Retrieved April 13, 2012, from http://www.drdianateachertraining.com/tag/preschool-science/.

Study Notes

Key concepts and key words with brief explanation.

The Human Body: each person is unique – bones support us – muscle moves our bones – the heart and lungs keep us alive – senses inform us.

Health and Nutrition: our bodies need care – health habits – we are what we eat – additional mineral activities.

Plants: many kind and form of plants - most plants make seeds for new plants - seeds grow into plants with roots, stems, leaves, and flowers.

Animals: many kinds of animals – animal moves in different ways – many animals make shelters to rear their young – each animal needs its own kind of food – humans and animals often live together.

Brief explanation of care ideas

In this week, you will develop an understanding of life science concepts that are appropriate for children at their early childhood stage. They will also be exposed to the development of structured and unstructured life science learning activities with nursery and kindergarten age children.

1. The goal of this section is to introduce to child educators how they can help children learn to value themselves as unique individuals, begin to recognise body structures and system, and care for their own bodies. The teachers will be exposed to some integrated activities that will help children respect their amazing bodies and appreciate what they themselves can do to promote their own well-being. Activities that allow children explore their senses will tell them what's going on around us.

2. Concepts in health and nutrition need to be introduced to young children so they will learn how to take care of their bodies and develop beneficial lifelong habits at an early age. Therefore, this section exposed early childhood educators to some experiences that will help them enhancing children's learning about themselves through exploring the human diet, major food groups and the human body.

3. Another aspect in learning life science concept is exploring the living things called plants. The first suggested experience will be limited by climate to areas where deciduous trees grow. The concluding experiences with seeds and plant growing should be possible anywhere. Suggestions for seedling care and for transplanting are also included in this section.

4. The last topic of this section presented some discussions about types and different movement of animals, their own kind of food, their need for shelters and issue on humans and animals often live together. The experiences that follow use insects, worms, fish, wild birds and picture to illustrate concepts. The integrated activities suggested in this section can expand the knowledge of the creature lovers and soften the feeling of anxious children into moderate respect for the useful and beautiful small animal around us.

Study Questions

1. List life science concepts that are appropriate for early childhood education.
2. What planning strategy can you use to develop a life science teaching unit?
3. What makes animals different from human being?
4. What are questions you should ask yourself as you prepare for an animal in your classroom?
5. Why should we include health and nutrition concepts in the study of science in early childhood education?
6. What is an insect?
7. How does an animal move? What kind of food does animal eat?
8. Why do people have pets?

Frequently Asked Questions

1. How does our heart help us breathing?
2. What keep bones strong and are all muscles alike?
3. How much air can our lung takes in?
4. How can we see germs?
5. How can we take care of our teeth?
6. How to prove that plant is a living thing?

7. How do the parts of different plants look?
8. What can we find about fruit seeds?
9. How do plants take up water?

Week 7

Topic 7: Environmental Science Concepts, Experiences and Integrating Activities

Reading Materials

Davis, G. A., & Keller, J. D. (2009). *Exploring science and mathematics in a child's world* (1st ed.) (pp. 115-137, 159-173, 197-208 and pp. 253-285). New Jersey: Pearson Education.

Harlan, J. D., & Rivkin, M. S. (2012). *Science experiences for the early childhood years: An integrated affective approach* (10th ed.) (pp.135-209 and pp. 290-310). New Jersey: Pearson.

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Study Notes

Key concepts and key words with brief explanation.

Air and Water: air is real; it takes up space – water has weight –air presses everything on all sides – water goes into the air - moving air pushes things – water can change forms reversibly – air slows moving objects – water is a solvent for many materials – living things need air to survive – water cling to itself and to other materials and moves into other materials.

Weather: the sun warms earth – changing air temperatures make the wind – evaporation and condensation cause precipitation – raindrops can break up sunlight – weather can be measured lighting is static electricity – changed electron make sparks when they jump.

Rocks and Minerals: rocks formation – rock slowly change by wearing way – crumbled rocks and dead plans make soil – old plants and animals left prints in rocks – minerals from crystals.

Our Environment: we are interconnected with all the natural elements of the environment – there is an interconnectedness among things: plants, animals, air water, weather, rocks and ourselves – the environment is where we are – we can work together to sustain the environment by reducing, rethinking, reusing and recycling.

Brief explanation of care ideas

In the seventh week of this course, you will be exposed to earth and space science investigations for early childhood age children. Structured, unstructured and integrated earth and space science activities will be developed and you will also design environmental awareness investigations for early childhood age children.

1. Children's sensory experiences develop their curiosity level. As air is an invisible element, it's really intrigue them to explore more. The integrated activities in this section are designed to explore some main concepts about air such as the attributes of air, the importance of air to the living things etc. as stated under the key concepts above.

   As crucial as air, all living things also need water to survive. To learn more about this fascinating substance, children should be given opportunities to pour, spray and splash in delightful way. In this topic, you will be exposed to experiences conducting activities with children in exploring various concepts about water such as its forms, its characteristics and its attributes.

2. In exploring some main concepts about weather, you will be exposed to activities in which children feel the sun's effects, observe the effect of warm-air movement, observe a small cloud in a cup, simulate a rainbow, record the weather and imitate the movement of earth around the sun.

3. Activities related to rocks and minerals in this chapter explore the concepts and basic information about rock formation. Other suggested experiences include grinding soft rocks, breaking rocks open to compare the fresh surfaces with the worn exteriors, pulverizing rock to compare it with complex soil, and forming crystals.

4. Sunlight, air, water, weather, rocks, plants, animals, and people are the primary natural elements of the environment that are accessible to children. Helping young children develop lasting affection for nature, by exploring and playing in it, is the necessary first step toward understanding the environment. The concepts of environment in this chapter are explored through various kinds of activities; some of them can be used as an introduction to the year's science study. The most important thing to bear in mind is that the student teachers of young children should know the suitable approach appropriateness to the age of children in conducting activities with them particularly because the broad topic of the environment is complex.

Study Questions

1. What is the purpose of introducing young children to earth science concepts?

2. List three earth and space science concepts appropriate for early childhood age children and create a planning web for teaching at least one of these concepts.

3. What are basic approaches used to teach environmental education?

4. What types of questions will you ask to help children generate a list of characteristics that can be used to classify rocks into different groups?

5. Select an environmental topic and concept, and prepare a learning cycle lesson to teach that idea. Teach it to the children.

6. What types of learning experience will you design for children to present a lesson on weather or air or water? How do you plan to apply what you know about Piaget's theory of development to the teaching of one of the environmental element?

7. How can we encourage families to model environmentally sensitive values?

Frequently Asked Questions

1. What makes up the environment?
2. What lives in the ground and above our heads?
3. Can we reduce waste and use water more carefully?
4. Does recycling happen in nature?
5. What is the meaning of safety precautions in the context of food experiences?

Week 8

Topic 8: Physical Science Concepts, Experiences and Integrating Activities

Reading Materials

Davis, G. A., & Keller, J. D. (2009). *Exploring science and mathematics in a child's world* (1st ed.) (pp. 213-231 and pp. 273-349). New Jersey: Pearson Education.

Harlan, J. D., & Rivkin, M. S. (2012). *Science experiences for the early childhood years: An integrated affective approach* (10th ed.) (pp.210-289). New Jersey: Pearson.

Lind, K. K. (2000). *Exploring science in early childhood education* (1st ed.) (pp.210-221). New York: Delmar Thomson Learning.

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Office of Head start (OHS). *Marvelous explorations through science and stories (MESS).* Retrieved April 13, 2012, from http://eclkc.ohs.acf.hhs.gov/hslc/tta-system/teaching/eecd/Domains%20of%20Child%20Development/Science/PhysicalScience.htm.

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Worth, K. (2010). Science in early childhood classrooms: Content and process. Retrieved April 13, 2012, from http://ecrp.uiuc.edu/beyond/seed/worth.html.

Study Notes

Key concepts and key words with brief explanation.

Magnetism: Magnets attract some things but not others – magnets vary in strength – magnets pull through some materials – one magnet can be used to make another magnet – magnet are strongest at each end – each end of a magnet act differently.

The Effects of Gravity: gravity pulls on everything

Simple Machines: friction can heat, slow and wear away objects – a lever helps lift objects – a ramp shares the work of lifting – a screw is a curved ramp – simple machines help move things along – some wheels turn alone; some turn together – single wheels can turn other wheels – single wheel can help us pull down to lift up.

Sound: Sounds are made when something vibrates – sound travels through many things – vibrating objects of different sizes make different sounds.

Light and shadow: nothing can be seen without light in everyday experience – light appears to travel in a straight line – shadows are made when light beam are blocked – night is earth's shadow – everything we see reflects some light – light contains many colours - bending light beam make things look different.

Brief explanation of care ideas

Physical science experiences are fun and exciting for early childhood age children. In this section, you will be designing physical science investigations appropriate for early childhood classroom and develop structured, unstructured and integrated physical science activities with children.

1. This section suggests how student teachers will conduct experiment with children with familiar objects to see what magnets will pull and what they will pull through, make temporary magnets, and discover how opposite magnetic poles affect each other. For all magnetic experiences, teachers should take a cautious that computers, discs, peripherals, credit cards, and tapes rely on magnetic force to operate.

2. In learning the effects of gravity, teachers should aware how to draw children's attention to an ever-present effect that is rarely noticed or labelled calls for more preliminary description than you usually offer to action-loving children. This section suggested a story that provides basic information as a gravity experience. The active experience s

should involve measuring and comparing gravity's pull on objects, exploring pendulums, and bringing things into balance.

3. The simple machines experiments illustrate the lever, ramp, screw, wheel and axle, and pulley. Teachers should know how to invite interest in the complex machine children have previously taken for granted. Providing activities to move and lift things with simple machines will make children proudly learn the concepts.

4. The experiences with sound can be started with a group activity to clarify the term vibration and to establish the idea that vibrations cause sounds. Following that, teachers should prepare children to experience vibrations, experiment with media through which sound travels, and relating the pitch of sound to the size of vibrating objects. Thus the sound concepts are explored.

5. Through everyday experience, children may have knowledge that nothing can be seen without light. In order to investigate and explore more concepts a about light and shadow, teachers should provide experiences that capture some children's closest attention that help to allay their worries about darkness and the absence of light. In this chapter, teachers will also be exposed to different kind of integrated activities to lead into experiences with light.

Study Questions

1. Give at least two reasons why children at early childhood stage should explore physical science activities.

2. List the major concept area in physical science that is appropriate for nursery and kindergarten children. Pick five concepts that are about the same topic, such as states of matter, and develop some integrated activities for teaching those topics.

3. Identify a lesson that you plan to use in teaching physical science concept in early childhood classroom. Using your understanding of age-appropriate science teaching and learning, explain your rationale for selecting the content and teaching strategies in the lesson.

4. What are the concepts of magnets that underlie the experiences in this topic?

5. What should be involved in providing experiences for children on the effects of gravity?

6. What kind of questions can you ask the children in using gravity pull as a topic to stimulate creative thinking?

7. What illustrates a simple machine experiment?

8. Why should we let children watch the repair and maintenance of classroom and playground equipment whatever possible?

9. How do the concepts of sound can be explored?

10. What kind of activities can be conducted to investigate the concepts of light and shadow?

Frequently Asked Questions

1. What will magnets attract and how can we make a magnet?

2. How strong are magnets of different shapes?

3. How can we become aware of gravity pulling on us?

4. How do pendulums work?

5. What are the advantages and disadvantages of friction?

6. How does a pulley help us lift things?

7. How do gears work?

8. What's happening when we see things vibrate?

9. How do different vibrating string lengths sound?

10. What is echo?

11. Which things let light pass through?

12. Why do we have day and night?

Week 9

Topic 9: Assessing Science Learning in the Early Years

Reading Materials

Lind, K. K. (2000). *Exploring science in early childhood education* (1st ed.) (pp. 41-51). New York: Delmar Thomson Learning.

Martin, D. J. (2001). *Constructing early childhood science* (1st ed.) (pp. 235 – 252). New York: Delmar Thomson Learning.

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Chittenden, E., & Jones, J. (1998). Dialogue on early childhood *science, mathematics and technology education.* Retrieved April 13, 2012, from http://www.project2061.org/publications/earlychild/online/experience/cjones.htm.

Coffey, J., Douglas, R., & Stearns, C. (2008). *Assessing science learning: Perspectives from research and practice.* Retrieved April 13, 2012, from http://books.google.com.my.

Study Notes

Key concepts and key words with brief explanation.

Child's Level of Concept Development: assessment methods – observational assessment – interview assessment – assessment task file – record keeping and reporting.

Assessment of scientific skills: assessing process skills – assessing inquiry – assessing attitude – assessing content - early childhood education science portfolio.

Brief explanation of care ideas

1. In this section, you should learn, gain knowledge and be able to perform the following aspects:
   - Explain child's level of concept development
   - Explain the value of commercial assessment instruments for concept assessment
   - Make a developmental assessment task file
   - Assess the concept development level of young children
   - Understand how to record, report and evaluate using naturalistic/performance-based assessment
   - Explain the advantages of portfolio assessment

2. Assessment in early childhood settings need not be mercurial. Children's level of concept development is determined by seeing which concept tasks they are able to perform independently. In this topic, you will also consider ways in which process-oriented inquiry teachers can construct authentic assessments of the accomplishments of children in their classes. In this respect, the question raised is: What is assessed in early childhood science education? Should we assess children's understanding of the content?

   A primary goal of early childhood science education is for children to become increasingly proficient in their use of their scientific process skills. In process-oriented inquiry, children use the processes to inquire into scientific phenomena. Assessing attitude is also crucial as attitude is a person's disposition or feelings towards something. Besides, even though the goal of science education is for children to learn how to do

science rather than to learn about science, assessing the science content acquired by children is of public sentiment.

Study Questions

1. Explain why it is important to make assessment the first step in teaching science.

2. How can early childhood teachers recognise and utilise observation records most effectively in assessing children's use of scientific concepts?

3. What are the components of a portfolio? How can portfolios be incorporated into the science curricula?

Frequently Asked Questions

1. What is authentic assessment?

2. What is observational assessment?

3. What is the purpose of interview assessment?

4. What contains a record folder?

5. How to assess children's attitudes towards science?

Week 10

Topic 10: Science Education and Learner Differences

Reading Materials

Harlan, J. D., & Rivkin, M. S. (2012). *Science experiences for the early childhood years: An integrated affective approach* (10th ed.) (pp.39-44). New Jersey: Pearson.

Martin, D. J. (2001). *Constructing early childhood science* (1st ed.) (pp. 211 – 233). New York: Delmar Thomson Learning.

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Balm, S. D. (n.d.). *Kindergarten science objectives lesson plans from a multiple intelligences perspective.* Retrieved April 13, 2012, from http://www.paec.org/david/ttt/scimipri.pdf.

Cunconan-Lahr, R. L., & Stifel, S. (2007). *Questions to consider in UDL observations of early childhood environments.* Retrieved April 13, 2012, from http://www.pakeys.org/uploadedContent/Docs/Higher%20Ed/CunconanLahr%20Kennedy%20Stifel%20Universal%20Design%20for%20Learning%20handout%202.pdf.

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Study Notes

Key concepts and key words with brief explanation.

Learning Modalities: learning experience for visual learners – learning experience for auditory learners – learning experience for kinaesthetic learners – locus of control – gender bias.

Cultural Differences: multicultural approach to teaching and learning science.

Multiple Intelligences: spatial – bodily kinaesthetic – musical –linguistic – logical mathematics – interpersonal – intrapersonal – naturalist
Science Education for Children with Disabilities.

Brief explanation of care ideas

It is a major goal of science education that all children have equal opportunity to learn science and that all children achieve scientific literacy regardless of their differences and diversity. As you recall from what you have learned throughout the course, children learn by attaching new experiences to previous ones. These prior experiences vary enormously from one child to another. Therefore, it is useful to consider some ways in which children are different that have an effect on how they learn science.

1. The three modalities described in this section are visual (seeing), auditory (hearing) and kinaesthetic (feeling or using any of many senses included in the sense of touch). Another learner difference that influence children's science learning is locus of control. People with an internal locus of control believe they control the outcomes of their actions, and people with an external locus of control believe the outcomes of their actions are controlled by external factors such as luck, other people or their own helplessness. In early childhood science classrooms, teachers should get an idea of the children's dominant learning modality, so that they can prepare different learning experiences through which different learners can learn best. Early childhood educators should also be aware of strategies to avoid gender bias in early childhood science education.

2. Pertaining to individual differences in learning, children of different cultures also have different ways of approaching learning. General characteristics of effective multicultural teaching in early childhood science classrooms are essentially the same as those of constructivist inquiry teaching, which you have learned earlier.

3. In early childhood science education, good teachers will encourage children to use their predominant intelligences to guide their constructions and reconstructions of scientific concepts. This is explored in the last week of learning this course.

4. The process-oriented inquiry approach to science education, which you have been exposed to earlier in this course, has encouraged the qualities which have been identified as necessary for teaching children with disabilities.

Study Questions

1. Explain how young children are different in acquiring scientific knowledge.

2. Write a description of each of the three modalities described in this section.

3. Describe the advantages of using multiple intelligent approaches in teaching science in early childhood classrooms.

4. List some approaches that can be used in teaching science to children with disabilities.

Frequently Asked Questions

1. What is learning modalities?

2. What is meant by locus of control?

3. Explain what multiple intelligences are.

4. What is gender bias in teaching science?

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