

**INDIANA UNIVERSITY-PURDUE UNIVERSITY FORT WAYNE  
SCHOOL OF EDUCATION  
In collaboration with the  
SCHOOL OF ENGINEERING, TECHNOLOGY, and COMPUTER SCIENCE**

**EDUA F500 LEGO Robotic Design for Teachers**

**COURSE SYLLABUS**

**Summer Teacher Workshop 2003**

**EDUA F500 Meets from 8 – 12:00 (lunch) and 12:30 - 4:00 p.m. on June 19, 20, 23, 24, 25, and 26 in room ET 315**

**COURSE TITLE AND DESCRIPTION:** EDUA F500 LEGO Robotic Design for Teachers (Grad. Cr. 3)

This course is for teachers interested in learning how use an interdisciplinary curricular teaching strategy, Problem-based Learning (PBL), while engaging in using teacher/student user-friendly LEGO robots. Children from grades K – 12 and above can use these teacher/student user-friendly LEGO robot kits. Using LEGO Robotics kits, the teachers will also learn how LEGO Robots can be used to help explain concepts in technology and other science-related fields. Teachers will work together with peers to create PBL lesson/unit plans and be assisted in designing, building, and programming mobile LEGO robots for use in their classrooms. Teachers will also then be shown how to easily publish course-related materials on the World Wide Web. Plus, due to the generous support of ITT Industries, every teacher will be given a LEGO Robotics Kit to take back to his or her classroom.

**INSTRUCTOR INFORMATION**

Jeffrey A. Nowak, Ph.D.  
Assistant Professor of Science Education  
Office: Neff Hall, Room 240A  
Office Hours: 4:30 pm – 5:30 pm  
Telephone: Office (219) 481-6960  
E-mail: nowakj@ipfw.edu

Carlos Pomalaza-Ráez, Ph.D.  
Professor of Electrical Engineering  
Office: ET Building, Room 327H  
Office Hours: 4:30 pm – 5:30 pm  
Telephone: Office (219) 481-6353  
E-mail: raez@ipfw.edu

**THE MISSION OF THE IPFW SCHOOL OF EDUCATION  
ADOPTED JANUARY 10, 1996**

**“To prepare professionals in teaching, counseling and leadership who demonstrate the capacity and willingness to continuously improve schools and related entities so that they become more effective with their clients by:**

- 1 – Becoming more caring, humane, and functional citizens in a global, multicultural, democratic society;**
- 2 – Improving the human condition by creating positive learning environments;**
- 3 – Becoming change agents by demonstrating reflective professional practice;**
- 4 – Solving client problems through clear, creative analyses;**
- 5 – Assessing client performance, creating and executing effective teaching, counseling and educational leadership, by utilizing a variety of methodologies reflecting current related research;**
- 6 – Utilizing interdisciplinary scholarship, demonstrating technological, and critical literacies, and effectively communicating with all stakeholders.**

**IPFW SCHOOL OF EDUCATION CONCEPTUAL FRAMEWORK: A LEARNING AND LEADERSHIP MODEL**

We in the school of education are committed to the following conceptual framework for our programs:

**1. Democracy & Community**

Effective educators<sup>1</sup>, such as teachers, counselors, and administrators need to be a part of a dynamic educational community as a model for the climate of community they hope to create. To do this, these educators need an understanding of the moral, cultural, social, political, and economic foundations of our society. **Consequently, the SOE should foster a democratic, just, inclusive learning community among its students, faculty, and staff, and with all other stakeholders in the educational enterprise.**

## 2. Habits of Mind

Effective educators realize that knowledge alone is not sufficient. They practice critical reflection in all endeavors. Within the context of a compassionate, caring community, educators foster habits of mind necessary to engage learners, such as investigating, inquiring, challenging, critiquing, questioning, and evaluating. **Consequently, the SOE must integrate critical habits of mind in all aspects of the teaching/learning process.**

## 3. Pedagogy

Effective educators need to understand multiple approaches to pedagogy as well as the multiple roles of the teacher, such as facilitator, guide, role model, scholar, and motivator. Educators appreciate and are receptive to the diverse perspectives, modes of understanding, and social circumstances that they and their students bring to the educational setting. **Consequently, the SOE needs to prepare educators to understand and use pedagogy creatively and thereby ensure active learning, conceptual understanding, and meaningful growth.**

## 4. Knowledge

Effective educators need to be well-grounded in the content which they expect to teach. Educators need to understand how knowledge is constructed, how the processes of inquiry are applied, how domains of knowledge are established, how disciplines can be integrated and most effectively communicated to their students. Educators also need understanding of themselves, of communities in which they intend to teach, and of students. **Consequently, the SOE should immerse educators in nurturing learning communities that deepen knowledge, and encourage on-going intellectual, emotional, and personal growth.**

## 5. Experience

Effective educators learn their craft through experiences in actual educational settings. Through on-site campus activities and field-based experiences students will observe and emulate exemplary teaching and learning. These educators will practice, collaborate, and interact with practitioners and their students. **Consequently, the SOE must integrate field and /or clinical experiences that reflect the diversity of educators, students, and schools into all aspects of the curriculum, and help educators to assess and reflect on those experiences.**

## 6. Leadership

Effective educators are leaders. They have developed educational and social visions informed by historical and cultural perspectives. They strive to set the highest goals for themselves and inspire students to do likewise. Educators are enriched by the convergence of knowledge, theory, and practice as they optimistically face the educational challenges of the twenty-first century. **Consequently, the SOE must provide opportunities for educators to develop as leaders in their profession and in their communities.**

<sup>1</sup> *Educator* is broadly defined as pre-service and in-service teachers, administrators, and counselors.

## GENERAL OVERVIEW OF THE COURSE

Robotics involve a wide range of disciplines, including computer science, physics, math, biology, psychology, engineering, and art. Robotic projects help to have fresh ideas for creating better learning environment for students and will provide tools for teachers to use. The use of this technology will strengthen the math and science content in the K-12 curricula.

The implementation and delivery of this course will be a joint effort of faculty of the School of Education and the School of Engineering, Technology, and Computer Science. There is great need of cooperative efforts of this nature. While engineers have all the necessary skills about technical subjects they lack the educational delivery methods and knowledge that education professionals have. If as an educational institution we are going to address the problem of shortage of people with technical skills and lack of awareness of science and technology in the society in general it is of paramount importance to have programs in the K-12 curriculum that directly addressed these issues. This course aims to combine the expertise of faculty from the School of Education and the School of Engineering to provide teachers with the knowledge and the material that will improve the technical and science content of the K-12 curriculum.

## CROSS-INDEXING COURSE OBJECTIVES TO INTASC AND IPSB

As the state of Indiana moves to alter its certification/licensing requirements to more adequately reflect national standards, course objectives and activities are expected to reflect these changes. This syllabus reflects two such sources. They are: (1) The Interstate New Teacher Assessment and Support Consortium (INTASC) Model Standards for Beginning Teacher Licensing and Development (1992) published by the Council of Chief State School Officers, and (2) Indiana Professional Standards Board (IPSB) Standards for Teachers of Science (1997).

### INTASC Standards

The teacher understands...

1. The central concepts, tools of inquiry and structures of the discipline(s) he or she teaches and can create learning experiences that make these aspects of the subject matter meaningful for students.
2. How children learn and develop, and can provide learning opportunities that support their intellectual, social, and personal development.
3. How students differ in their approaches to learning and create instructional opportunities that are adapted to diverse learners.
4. A variety of instructional strategies to encourage students' development of critical thinking, problem solving, and performance skills.
5. Individual and group motivation and behavior to create a learning environment that encourages positive social interaction, active engagement in learning, and self-motivation.
6. Knowledge of effective verbal, nonverbal, and media communication techniques to foster active inquiry, collaboration, and supportive interaction in the classroom.
7. Planning instruction based upon the knowledge of subject matter, students, the community, and curriculum goals.
8. How to use formal and informal assessment strategies to evaluate the effects and ensure the continuous intellectual, social and physical development of the learner.
9. How to be a reflective practitioner who continually evaluates the effects of his/her choices and actions on others (students, parents, and other professionals in the learning community) and who actively seeks out opportunities to grow professionally.
10. The knowledge to foster relationships with school colleagues, parents, and agencies in the larger community to support students' learning and well-being.

### IPSB Standards

The teacher of science *and technology* understands...

1. the central concepts, tools of inquiry, and the history and nature of science in order to create learning experiences that make these aspects of science meaningful for the student.
2. how students learn science *and technology* provides learning opportunities that support their intellectual, social, and personal development.
3. how students differ in their approaches to learning science *and technology* creates instructional opportunities that are adapted to diverse learners.
4. using a variety of instructional strategies to encourage students' development of conceptual understanding, inquiry skills, and scientific habits of mind.
5. using individual and group motivation and behavior to create science *and technology* learning environments that encourage positive social interaction and active engagement in learning.
6. using a variety of communication techniques to foster equity, inquiry, collaboration, and supportive interaction in the classroom.
7. planning meaningful science *and technology* instruction based upon knowledge of science, technology, students, the community, science curricula and curriculum goals.
8. using a variety of authentic and equitable assessment strategies to evaluate and ensure the continuous intellectual, social, and personal development of the learner.
9. how an effective practitioner continually evaluates the effects of his/her choices and actions on others, and actively pursues opportunities to grow professionally.
10. that, in order to support student learning and well-being, the teacher of science *and technology* fosters relationships with students and their families, colleagues, and concerned others.

## **F500 COURSE OBJECTIVES**

The INTASC, National Science Education Standards (<http://www.nap.edu/readingroom/books/nses/html/>), American Association for the Advancement of Science (AAAS) Benchmarks (<http://www.project2061.org/tools/benchol/bolframe.html>), National Educational Technology Standards (<http://cnets.iste.org/profiles.htm>), and the Indiana Academic Standards 2000 for Science ([http://www.doe.state.in.us/standards/standards2000\\_science.html](http://www.doe.state.in.us/standards/standards2000_science.html)) will be emphasized throughout class meetings, assignments, and field experiences. The IPSB and INTASC standards are specifically cross-referenced below. This course is designed to assist you in reaching the following objectives:

1. \* Read about and experience activities that will cause you to reflect on your beliefs about teaching, learning, science and technology. (INTASC & IPSB 1-10)
2. \* Demonstrate growth in reflective practices. (INTASC & IPSB 1-10)
3. \* Learn to plan and implement thematic inquiry and problem-solving lessons which integrate science, other disciplines, and technology across the K-12 curriculum. (INTASC & IPSB 1-10)
4. \* Learn to evaluate your growth in planning and conducting scientific inquiry with students. (INTASC & IPSB 8, 9)
5. \* Learn to assess the growth of K-12 school pupils within the integrated science and technology curriculum. (INTASC & IPSB 6-9)
6. \* Develop a positive attitude toward students and school personnel. (INTASC & IPSB 2-10)
7. \* Learn to function within the K-12 school classroom. (INTASC & IPSB 1-9)

\*These objectives deal with multiculturalism, global perspectives, and diversity.

## **TEXTBOOK AND RESOURCES**

### **Required For All Students**

- 1.) Cyr, Martha N. 1999. ROBOLAB: Getting Started 2. LEGO DACTA, Denmark.

### **Optional**

- 2.) Erwin, Benjamin. K-12 Education and Systems Engineering: A New perspective. Proceedings of the American Society of Engineering Education National Conference, July 1998, Seattle, WA, session 1280.
- 3.) Martin, Fred. The Art of LEGO Design. The Robotics Practitioner: The Journal for Robot Builders, volume 1, number 2, Spring 1995.
- 4.) Kafai, Y., and Resnick, M., eds. Constructionist in Practice: Designing, Thinking, and Learning in a Digital World. Mahwah, NJ: Lawrence Erlbaum. (1996).
- 5.) Resnick, M., Martin, F., Sargent, R., and Silverman, B. Programmable Bricks: Toys to Think With. IBM Systems Journal, vol. 35, no. 3-4, pp. 443-452. (1996).

## **EXPECTATIONS OF ALL STUDENTS**

Demonstrate a professional attitude by:

- Attending all classes;
- Actively participating in class discussions and activities;
- Reading, reflecting upon, and completing activities;
- Submitting quality work in a timely fashion;
- Collaborating with and supporting peers.

Egregious spelling, punctuation, and grammatical errors will result in the lowering of a paper's grade. A few minor errors will result in the grade be lowered by 5% of the total score (i.e., 85% to 80%). Numerous or significant errors will result in the grade being lowered by 10% of the total score (i.e., 85% to 75%). Please proofread your papers prior to their submission. Students who desire assistance in the preparation of their papers may contact the Writing Center (see information below). Please note that the Writing Center is not a proofreading service. Peer reviewers should fulfill this function.

**Assigned papers should be typed with one-inch margins on all sides and in the 12-point size Times New Roman font.** The style for all papers is APA (American Psychological Association) unless otherwise noted or accepted by the instructor. **All work utilizing ideas from other sources must be fully referenced.**

### THE IPFW WRITING CENTER

Whether you are honing an honors essay or struggling with the fundamentals of writing, **The Writing Center** can help you write more effective papers and gain confidence in your writing. Bring your written assignment, due dates, questions, ideas, and draft (if you have one). Writing Center consultants help you discover strategies for: analyzing your purpose and audience; generating, organizing, and developing ideas; writing more effective sentences and strengthening word choice; researching and documenting sources; and editing and proofreading your own work. Sign up for appointments on the bulletin board outside Kettler 234 or register for online consultations at [www.ipfw.edu/engl/wchome.htm](http://www.ipfw.edu/engl/wchome.htm). *Closed Saturdays.*

### COURSE GRADING AND CRITERIA

The course grade is to be determined based on the following:

<u>Percent</u>	<u>Assignments</u>	<u>Assigned Date – Due Date</u>
10%	a.) Build and Program a Simple Robot	June 19 – June 20
30%	b.) Personal LEGO Robotics Teacher Website w/PBL Unit	June 20 – June 25
30%	c.) PBL Unit	June 20 – June 25
30%	d.) FLL Challenge Missions	June 23 – June 26

Your grade will be based on the following plan:

<u>Grade*</u>	<u>Range</u>
A	90 – 100 %
B	80 – 89%
C	70 – 79%
D	60 – 69%
F	Below 60%

All assignments are to be turned in on time. Unless otherwise agreed upon by the instructor, the final score on assignments will be lowered by 10% for each day late.

*\* Regular class attendance is required.* Participation is expected. **More than ONE absence will result in the reduction of the final grade by one full letter grade (A ® B, B ® C, etc.). Leaving class early or arriving late counts as a partial absence.** If an absence is necessary, please notify the instructor in advance by phone call. This is a professional courtesy and in no way guarantees an absence will be excused. In any case it is the responsibility of the student to make up missed activities and hand in all assignments on time.

### OPEN INVITATION

If at any time you consider yourself lost, overwhelmed, disgruntled, or just generally confused, please make an appointment and come and talk to me. If you drop by, I'll see you as my schedule allows. I'm here to assist you in learning to become the most competent teacher you wish to be. We all need help at some point, so don't delay if you find yourself in difficult circumstances.

### POLICIES

The instructor will adhere to all IPFW policies pertaining to attendance, make-up tests, cheating/plagiarism as well as withdrawal, incompletes and the final exams. Students are expected to be familiar with these policies. Late assignments must be cleared with the instructor, preferable prior to the due dates unless the instructor agrees with the students that an unusual or emergency situation was present and the cause of the late assignment.

## ACCESS

If you have or acquire a disability that may impair your ability to perform any assignment or activity in this course, please notify the instructor. For example, hearing impaired students may sit closer to the front of the room. If you would like to know what special services and accommodations might be available to you, you may direct your questions to Susan Borrer, Director of Services for Students with Disabilities at 219/481-6657.

## ISSUES RELATED TO DIVERSITY AND MULTICULTURALISM

Issues related to pupil diversity will be addressed in this course. These concern concepts which deal with the cultural backgrounds of learners and concerns with the variation in contexts from which students come and in which schooling occurs.

The assumption applied in this course is that differences in contexts result in significant variations in how students, parents and educators view their world. Unless those who develop and implement curriculum understand and include these differences, schools are much more apt to be sterile places where large groups of students are failed rather than places where all children can be successful.

## LEGO Robotics EDUA F500 LEGO Robotic Design for Teachers Schedule

Time	June 19	June 20	June 23	June 24	June 25	June 26
8:00-9:30	Introduction to Lego Robotics	Build & program the Scooter	Team Robot Introduction	Team Robot More missions	Team Robot All Missions	Team Robot Test & Debug
9:30-9:45	Discussion	Discussion	Discussion	Discussion	Discussion	Discussion
9:45-11:30	Introduction to Lego building	Test and Debug the Scooter	Curriculum Development	Curriculum Development	Curriculum Development	Web Site Design Posting
12:00-12:30	Lunch break	Lunch break	Lunch Break	Lunch Break	Lunch Break	Lunch Break
12:30-2:00	Introduction to RoboLab	RoboLab Programming	Team Robot First Mission	Team Robot Test & Debug	Team Robot Design Critique	Team Robot Demonstration
2:00-2:15	Discussion	Discussion	Discussion	Discussion	Discussion	Discussion
2:15-4:00	Web Site Design Issues	Curriculum Issues	Web Site Design	Web Site Design	Web Site Design	Curriculum Presentation

Microsoft Word documents will be converted to Adobe Acrobat (\*.pdf) files for posting on web pages. Students will be provided with web space where they may post (FTP) their assignments.