

A CHALLENGE GRANT- BICYCLE SAFETY TRAINING USING ADVANCED WEB-BASED DISTANT LEARNING TOOLS

FINAL REPORT
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Submitted
by

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16. Abstract The New Jersey Department of Transportation (NJDOT) Research Division wanted to develop, implement, and maintain an advanced bicycle-safety-training course for elementary school students. The system integrated the latest distant learning tools, specifically interactive evaluation and testing capabilities. The goal was to deliver a complete bicycle-safety training system on a CD-ROM, which used advanced multi-media features such as video, animation and smart traffic templates to test and evaluate student's knowledge of the course's content. This document outlines the requirements for a CD-Rom based Multimedia Course on Bicycle Safety, sponsored by NJDOT and developed by Rutgers CAIT and ATC Brunswick.		13. Type of Report and Period Covered Final Report 1/01/2001 - 4/30/2002	
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TABLE OF CONTENTS

	<u>Page</u>
Abstract	1
Background.....	1
Features and Goals	2
Features of Application	2
Goals of Application.....	2
Description of Environments.....	2
General Constraints	3
Visual Constraints	3
Design Constraints	3
Logical Model.....	3
User Profiles	3
Access to Course and Test Entities.....	3
Software Requirements.....	5
Use Case Specification	11
Use Case Starting the Application.....	11
Use Case Taking The Lesson with Arbitrary Topic Access.....	11
Use Case Taking the Lesson Without Arbitrary Topic Access.....	12
Use Case Taking the Test.....	12
Use Case Quitting the Application.....	12
Conclusion.....	13
Appendix Images from CD-ROM	14

LIST OF FIGURES

Figure 1 Access Scheme.....	4
Figure 2 Cover of Jewel Case.....	14
Figure 3 Label on CD-ROM.....	15
Figure 4 Opening Navigation Screen (Animated Lesson Icons are Located Along the Bicycle Path)	16
Figure 5 Lesson I. Selecting the Proper Equipment (Parts of Bicycle, Helmet, Clothing Accessories, etc.)	17
Figure 6 Lesson II. Basic Skills (Mounting, Dismounting, Balance, Turning, Breaking, Following Distance, etc.)	18
Figure 7 Lesson III. The Poor Visibility Environment (Weather Conditions, Night Bicycling)	19
Figure 8 Lesson IV. Rules of the Road (Right-of-Way, Intersections, Signs, Pedestrians, Traffic Lights, etc.).....	20
Figure 9 Lesson V. Avoiding Accidents (Clues and Tips on How to Avoid Accidents and Common Hazards).....	21
Figure 10 Lesson VI. Maintenance & Bicycle Repairs (Parts of the Bicycles and their Mechanical Conditions).....	22
Figure 11 Lesson VII Bicycle Safety Test (Overall Evaluation of Students Understanding of Previous Six Lessons).....	23

LIST OF TABLES

Table 1 Definitions	v
Table 2 Acronyms	v
Table 3 Functional Requirements.....	5
Table 4 Performance Requirements.....	7
Table 5 Interface Requirements.....	7
Table 6 Test Requirements.....	11
Table 7 Documentation Requirements	11

Table 1 Definitions

Definition	Description
Application	The Application being developed - interactive animated multimedia application of material on Bicycle Safety.
Course	Part of the Application - Interactive animated multimedia presentation of Bicycle Safety learning material.
Test	Part of the Application - Interactive animated multimedia presentation of a sequence of basic Bicycle Safety issues, in a form of a question/task.
Trainee	User (7-10 year old child) interacting with the course and the test.
Lesson	Section of the Course, devoted to specific topic of Bicycle Safety
Test Question	Section of the Test, devoted to testing Trainee's knowledge of a specific Bicycle Safety issue, in a form of a question/task.
Lesson Environment	Is the feature of the Lesson describing the place where the Lesson is set. Environment defines the Lesson's multimedia entities (background, icons, sounds, etc.) and content.
Topic	Bicycle Safety issue or several issues related to the same theme, e.g. "Nighttime Biking"
Interactive Animation	Animation of an object, which is triggered by the user interaction, e.g. mouse rollover
Non-interactive Animation	Animation of an object, which does not require a user interaction.
Main Hero	Is an animated character, which represents Trainee in the learning environment of the Application.

Table 2 Acronyms

Acronym	Description
"NJ DOT"	Is representative of New Jersey Department of Transportation
"Rutgers CAIT"	Is representative of the Center for Advanced Infrastructure & Transportation Rutgers, The state University
"ATC BRUNSWICK"	Is representative of Advanced Technology Concepts the Company hired to Develop Bicycle Safety Project
"BS_SRD"	Is representative of the project name "Bicycle Safety Software Requirement Document"
"BS_URD"	Is representative of the project name "Bicycle Safety User Requirement Document"

ABSTRACT

The New Jersey Department of Transportation (NJDOT) Research Division wanted to develop, implement, and maintain an advanced bicycle-safety-training course for elementary school students. The system integrated the latest distant learning tools, specifically interactive evaluation and testing capabilities. The goal was to deliver a complete bicycle-safety training system on a CD-ROM, which used advanced multi-media features such as video, animation and smart traffic templates to test and evaluate student's knowledge of the course's content.

This document outlines the requirements for a CD-Rom based Multimedia Course on Bicycle Safety, sponsored by NJDOT and developed by Rutgers CAIT and ATC Brunswick.

BACKGROUND

Many organizations are faced with an increasing need for training while their training budgets have been substantially reduced. As a result, training professionals are looking for alternative approaches to meet their training needs. One alternative, which is gaining broad acceptance, is multi-media training delivered in such mediums as CD-ROMs. This technology has been evolving over the last decade and is now at a stage that it can be used efficiently for real-time applications. The driving forces for this technology are at present, the multi-media technology for course content generation and presentation, and the Internet as the on-line course delivery system.

This project developed and delivered a multi purpose multi media based bicycle-safety training system. This system consists of three parts:

- A multi media based bicycle safety training course. The delivery medium being a CD-ROM.
- A series of interactive activities to teach and test the trainees' response to different questions, and so forth.
- An interactive evaluation and testing system.

FEATURES AND GOALS

Features of Application

- Application is a CD-ROM based e-learning tool.
- Application has an interface, attractive for 7-10 year old children.
- Application offers both learning material and a test.
- Application is interactive.

Goals of Application

- The objective of the Bicycle Safety e-learning system is to teach 7-10 year old children the basics of Safe Bicycle Riding (developing cycling skills, good judgment, and how to follow the rules-of-the-road), as a result, we foresee many collisions and accidents being avoided.

Description of Environments

- The Application is intended to be used at home, and in schools.
- The Application will be run stand-alone.
- The minimal Hardware Requirements for the Application are: IBM PC compatible computer, Pentium 100, 16 MB RAM, 1 MB Video, 5 Mb Hard drive space, 2X or higher CD-ROM drive.
- The Software Requirements for the Application are: OS Windows 95/98/NT/2000/XP.

GENERAL CONSTRAINTS

Visual Constraints

The Application must be delivered in a format, which makes it most appealing and engaging for Users within the age group of 7-10 years old.

This suggests the usage of the following multimedia items, including, but not limited to:

- Main hero. Trainee identifies himself/herself with the main hero.
- Large number of animations, Icons, and characters.
- Sound effects.

Design Constraints

- Product is delivered on a CD-ROM.
- It is recommended to avoid or minimize excessive hardware and software requirements. For example, minimize the usage of drivers, plug-ins, etc.
- It is recommended to build the product such that it can be partially delivered online via HTTP.
- It is recommended to build the product such that it may be used in elementary and middle schools via the school network. For example, application can be installed/copied onto the server and then run on the several students' workstations over the network.

LOGICAL MODEL

User Profiles

- Users will be both male and female.
- Users will range in the ages of between 7 and 10 years.
- User may or may not be a resident of New Jersey.
- User may be interested in getting certification for completing course.

Access to Course and Test Entities

- Introduction is presented one the Application is started. Introduction is skippable.
- Full Access to the Main Screen is granted once the Introduction is completed or skipped.
- Full access to Individual lessons in the Course is granted from the Main Screen.
- Full access to the Test is granted from the Main Screen.
- Access to test entities (questions) is sequential – Trainee must complete a question before going to the next one.

Access model to lessons and test questions is presented below:

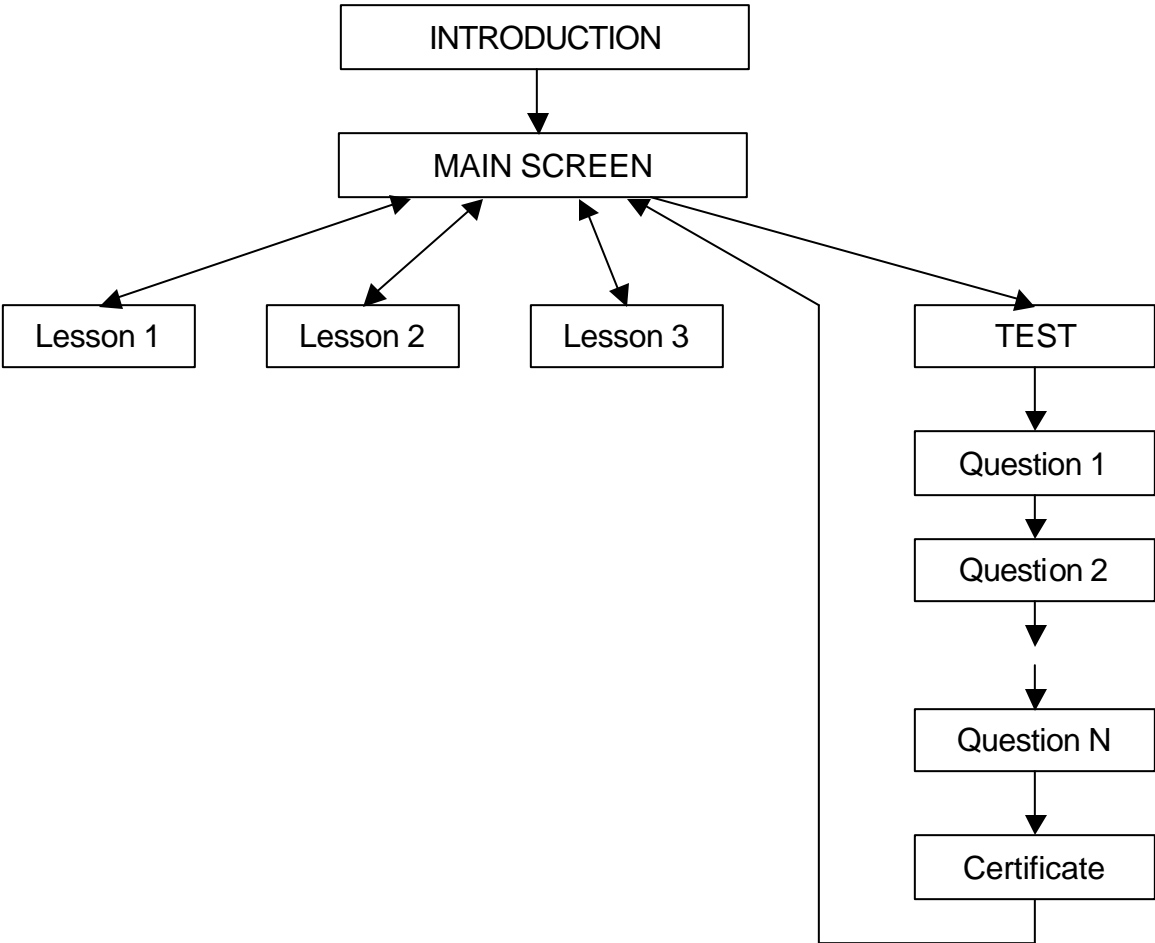


Figure 1 Access Scheme

SOFTWARE REQUIREMENTS

Table 3 Functional Requirements

Id	Description	References
FR_001	Application starts once CD-ROM is inserted	URD: FR_001
FR_002	Introduction is presented to the Trainee after the Application is started	URD: DR_002
FR_003	Introduction is skippable	URD: DR_002
FR_004	Trainee is presented the Main Screen after the Introduction is presented or skipped	URD: FR_002
FR_005	Course content is into 6 Lessons by the environment criteria – each Lesson is set in its own environment, different from the others.	URD: FR_003
FR_006	Each Lesson is can be started from the Main Screen without restrictions and/or prerequisites	URD: FR_004
FR_007	Lesson covers one or more topics.	URD: FR_005
FR_008	Topics in each Lesson are those that can be presented in that Lesson Environment.	URD: FR_005
FR_009	In some Lessons Topics or groups of Topics may be accessed arbitrarily by the Trainee.	URD: FR_005, IR_004, IR_005
FR_010	In some Lessons Topics are browsed sequentially – Trainee can access a Topic only from the adjacent Topics.	URD: FR_005, IR_005
FR_011	Upon completing a Lesson Trainee returns to the Main Screen	URD: FR_006
FR_012	Crucial Bicycle Safety issues are defined as Test questions.	URD: FR_007
FR_013	Sequence of Test Questions forms a Test.	
FR_014	Test can be accessed without restrictions and/or prerequisites from the Main Screen	URD: FR_008
FR_015	Test questions are multiple choice – one correct answer out of two.	URD: IR_006, IR_007
FR_016	If Trainee's response to a Test question is incorrect, he/she is prompted about that.	URD: FR_010, IR_008

FR_017	If Trainee's response to a Test question is incorrect, correct response is presented before going to the subsequent Test question	URD: FR_010, IR_008
FR_018	If Trainee's response is correct, he/she is prompted about that.	URD: FR_011, IR_008
FR_019	Upon the completion of the Test Trainee is asked if he/she wants to be issued a Certificate.	URD: FR_011
FR_020	If Trainee selects not to be issued a Certificate, he/she is transferred into the Main Screen.	URD: FR_011
FR_021	If Trainee selects to be issued a Certificate, he/she is requested to submit his/her name.	URD: FR_011
FR_022	Upon submission of the name Trainee is presented with a Certificate.	URD: FR_011
FR_023	Certificate includes Trainee's name	URD: FR_012
FR_024	If Trainee scores less than 50% on the Test, a Certificate of 0 th Degree is issued	URD: FR_013
FR_025	If Trainee scores 50-70% on the Test, a Certificate of 3 rd Degree is issued	URD: FR_013
FR_026	If Trainee scores 70-90% on the Test, a Certificate of 2 nd Degree is issued	URD: FR_013
FR_027	If Trainee scores 90-100% on the Test, a Certificate of 1 st Degree is issued	URD: FR_013
FR_028	Trainee can print a copy of a Certificate on a local printer	URD: FR_014
FR_029	After being presented with a Certificate Trainee is returned to the Main Screen	URD: FR_015
FR_030	Trainee can quit the Application from the Main Screen	URD: FR_016, IR_009

Table 4 Performance Requirements

Id	Description	References
PR_001	The delay between the inserting the CD-ROM and starting the course should not exceed 15 seconds	URD: PR_001
PR_002	The delay between user's click on the lesson/test icon and starting the lesson/test should not exceed 5 seconds	URD: PR_002
PR_003	The response time to mouse click or keyboard press within the Lesson/Test should be instant (less than 1 second)	URD: PR_003

Table 5 Interface Requirements

Id	Description	References
IR_001	Narrated Introduction is presented by an animated character.	URD: DR_002
IR_002	A button allowing to skip the Introduction is offered.	URD: DR_002
IR_003	The Main Hero is present in the application. Trainee identifies himself/herself with the main Hero.	URD: IR_001
IR_004	Main Screen depicts a bicycle path.	URD: IR_001
IR_005	Main Screen contains a number of interactively and non-interactively animated entities.	URD: IR_001
IR_006	Lesson is represented on the Main Screen by an Icon. By clicking on the icon, Trainee accesses the corresponding Lesson.	URD: IR_002, FR_004
IR_007	Lesson icons are non-interactively animated.	URD: IR_001
IR_008	Lesson icons respond to mouse rollover with a sound effect.	URD: IR_001
IR_009	Lesson icons are placed along the bicycle path on the Main Screen.	URD: IR_001, IR_002
IR_010	Main Hero transverses the bicycle path to the clicked Lesson icon from the previous Lesson icon.	URD: IR_001, IR_002

IR_011	The appearance of Main Hero changes depending on a clicked Lesson Icon.	URD: IR_001, IR_002
IR_012	The appearance of the Lesson Icon is directly related to the Environment of a Lesson	URD: IR_001, IR_002
IR_013	The Lesson Background is directly related to the Environment of a Lesson	URD: IR_001, IR_003
IR_014	If Lesson contains Topics or groups of Topics which can be accessed arbitrarily, Lesson Plan is displayed to the User.	URD: IR_001, IR_003, IR_004, IR_005
IR_015	Lesson Plan has “Main Screen” icon, which takes the Trainee back to the Main Screen	URD: IR_001, IR_003, IR_004, IR_005
IR_016	If Lesson does not contain Topics or groups of Topics which can be accessed arbitrarily, Trainee is displayed the first issue of the first Topic in the Lesson.	URD: IR_001, IR_003, IR_005
IR_017	If Lesson contains Topics or groups of Topics which can be accessed arbitrarily, each Topic or Group of Topics has its own icon on the Lesson Plan and can be accessed by mouse left-click on that icon.	URD: IR_001, IR_003, IR_004, IR_005
IR_018	Within a Topic or a group of Topics, presentation of material on an issue is linked to the previous presentation on another issue by a “Previous” button.	URD: IR_001, IR_003, IR_004, IR_005
IR_019	If issue is first for that Topic, and Topics or groups of Topics may be accessed arbitrarily, Trainee is displayed a Lesson Plan, when clicking a “Previous” Button.	URD: IR_001, IR_003, IR_004, IR_005
IR_020	If issue is first for that Topic, and Topics or groups of Topics may not be accessed arbitrarily, Trainee is displayed a Main Screen, when clicking a “Previous” Button.	URD: IR_001, IR_003, IR_005
IR_021	Within a Topic or a group of Topics, presentation of material on an issue is linked to the next presentation on another issue by a “Next” button.	URD: IR_001, IR_003, IR_004, IR_005

IR_022	If issue is last for that Topic, and Topics or groups of Topics may be accessed arbitrarily, Trainee is displayed a Lesson Plan, when clicking a “Next” button.	URD: IR_001, IR_003, IR_004, IR_005
IR_023	If issue is last for that Topic, and Topics or groups of Topics may not be accessed arbitrarily, Trainee is displayed a Main Screen, when clicking a “Next” button.	URD: IR_001, IR_003, IR_005
IR_024	The Bicycle Safety content on each issue is presented using narrations, animations, sound effects and images.	URD: IR_001, IR_003, IR_005
IR_025	There must be at least 1 animated object on the screen during the presentation of an issue, interactive or non-interactive.	URD: IR_001, IR_003, IR_005
IR_026	Some issues are presented in a form of interactive animated games, when applicable.	URD: IR_001, IR_010, IR_011
IR_027	Using keyboard may be employed in the interactive games.	URD: IR_001, IR_011
IR_028	In presenting some issues, user interactivity is added, such that Trainee can control the information he gets.	URD: IR_001, IR_005, IR_010, IR_011
IR_029	When user interactivity is required in an issue, user is prompted prior to beginning the presentation on that issue.	URD: DR_002
IR_030	The animated narrated characters may be added into some environments, which provide Bicycle Safety information on the presented issue.	URD: IR_001, IR_003
IR_031	Animated Main Hero appears in presentation of some issues.	URD: IR_001, IR_003
IR_032	The Test has its own icon on the Main Screen. It can be accessed by left mouse click on that icon.	URD: IR_001, IR_002
IR_033	Test icon is non-interactively animated.	URD: IR_001, IR_002
IR_034	Test icon produces a sound effect on a rollover.	URD: IR_001, IR_002

IR_035	Test Environment is a bicycle path, which the Trainee must transverse by answering test questions sequentially.	URD: IR_001
IR_036	Trainee is presented a Test introduction before the Test starts. Introduction provided information about the Test to the Trainee.	URD: IR_001, DR_002
IR_037	Test questions are depicted as icons along the bicycle path in the Test environment.	URD: IR_001
IR_038	Test question icons are not clickable.	URD: IR_001
IR_039	Main Hero transverses the bicycle path in the Test Environment, after a question is complete and before next question starts.	URD: IR_001
IR_040	A test question is presented using animations, narrations, sound effects, images and text.	URD: IR_001, IR_007
IR_041	Trainee is provided information on what actions must be performed to answer a test question.	URD: DR_002
IR_042	A prompt of the correctness of a test question is presented using animations, narrations, sound effects, images and text.	URD: IR_001, FR_010
IR_043	Certificate may not contain animation.	URD: IR_001, FR_011, FR_014
IR_044	Certificates of different degrees may be accompanied by the different musical background.	URD: IR_001, FR_013
IR_045	A "Quit" icon is present on the Main Screen, which enables the Trainee to quit the Application.	URD: IR_010, IR_011, FR_016

Table 6 Test Requirements

Id	Description	References
TR_001	Quality Assurance must be carried out by ATC Brunswick, Rutgers CAIT and NJDOT.	URD: TR_001
TR_002	Bugs found during QA will be reported to ATC Brunswick and fixed prior to the Release	URD: TR_002
TR_003	Bugs reported after the Product Release will be fixed in subsequent Releases if any.	URD: TR_003

Table 7 Documentation Requirements

Id	Description	References
DR_001	Instructions on how to run CD-ROM and the System Requirements must be published on the CD-ROM jewel case insert.	URD: DR_001
DR_002	Information, necessary to make Trainee able to sufficiently interact with the Application, must be provided to the Trainee.	URD: DR_002
DR_003	Frequently Asked Questions file will be generated based on customer feedback and available online via Internet.	URD: DR_003

USE CASE SPECIFICATION

Use Case Starting the Application

1. Trainee inserts the CD-ROM into the CD-ROM drive.
2. Introduction is presented to the Trainee.
3. Main Screen is displayed and the Application awaits Trainee's selection – Lesson, Test or Quit.

Use Case Taking The Lesson with Arbitrary Topic Access

1. Trainee clicks on one of the Lesson icons on the Main Screen.
2. Trainee is displayed a Lesson Plan, on which icons of different Topics or groups of Topics are presented.
3. Trainee clicks on an icon and is displayed the first issue of the Topic or a group of Topics.
4. Trainee browses through issues within the Topic or a group of Topics using "Previous" and "Next" buttons.
5. "Previous" button in the first issue takes the Trainee back to the Lesson Plan.

6. "Next" button in the last issue takes the Trainee back to the Lesson Plan.
7. Trainee quits to the Main Screen by clicking on the "Main Screen" icon on the Lesson Plan.

Use Case Taking the Lesson Without Arbitrary Topic Access

1. Trainee clicks on one of the Lesson icons on the Main Screen.
2. Trainee is displayed a first issue of a first Topic.
3. Trainee browses through issues within the Topic or a group of Topics using "Previous" and "Next" buttons.
4. "Previous" button in the first issue takes the Trainee back to the Main Screen.
5. "Next" button in the last issue takes the Trainee back to the Main Screen.

Use Case Taking the Test

1. Trainee clicks on the Test icon on the Main Screen.
2. Trainee is presented with a Test Introduction.
3. Test Environment is displayed to the Trainee.
4. Test question and two possible answers are displayed to the Trainee and Trainee is requested to select a correct answer.
5. Trainee chooses an answer.
6. If selected answer is correct, Trainee is prompted about the correct answer and next Test question is displayed.
7. If selected answer is incorrect, Trainee is prompted about the incorrect answer, correct answer is shown, and next Test question is displayed.
8. When last Test question is completed, Trainee is asked if he/she wants to get a certificate.
9. If Trainee responds positively, he/she is requested to enter his/her name, and the printable Certificate of certain appearance is displayed.
10. Trainee is prompted about the completion of the Test, Test environment is closed, and Trainee is taken to the Main Screen.

Use Case Quitting the Application

1. Trainee clicks on the "Quit" icon on the main Screen.
2. Trainee is requested the confirmation of his/her decision to quit the application.
3. If Trainee's response is negative, he/she is returned to the Main Screen.
4. If Trainee's response is positive, the Application is closed and Trainee is returned to the Operating System.

CONCLUSION

The NJDOT Research Division Bike Safety CD-ROM projects was created to develop an innovative and effective tool for educating the public in making bicycling a safe, secure, and enjoyable experience for all roadway users. The CD-ROM has been created to implement an advanced bicycle safety training course for elementary and middle school students. This technology based training product is tailored toward individual trainees, providing them with a self-pace of learning that utilizes their expertise, experience, and knowledge. It is based on a multi-media system with a CD-ROM delivery mechanism. The system integrates the latest distant learning tools, specifically evaluation and testing capabilities, thus providing an effective, advanced and easy to use learning tool for bicycle safety. The training program, which takes advantage of interactive-based technologies, can make learning “fun and stimulating” and encourages students to learn at their own pace, while getting recognition for their training through certificates of completion.

APPENDIX IMAGES FROM CD-ROM



Figure 2 Cover of Jewel Case

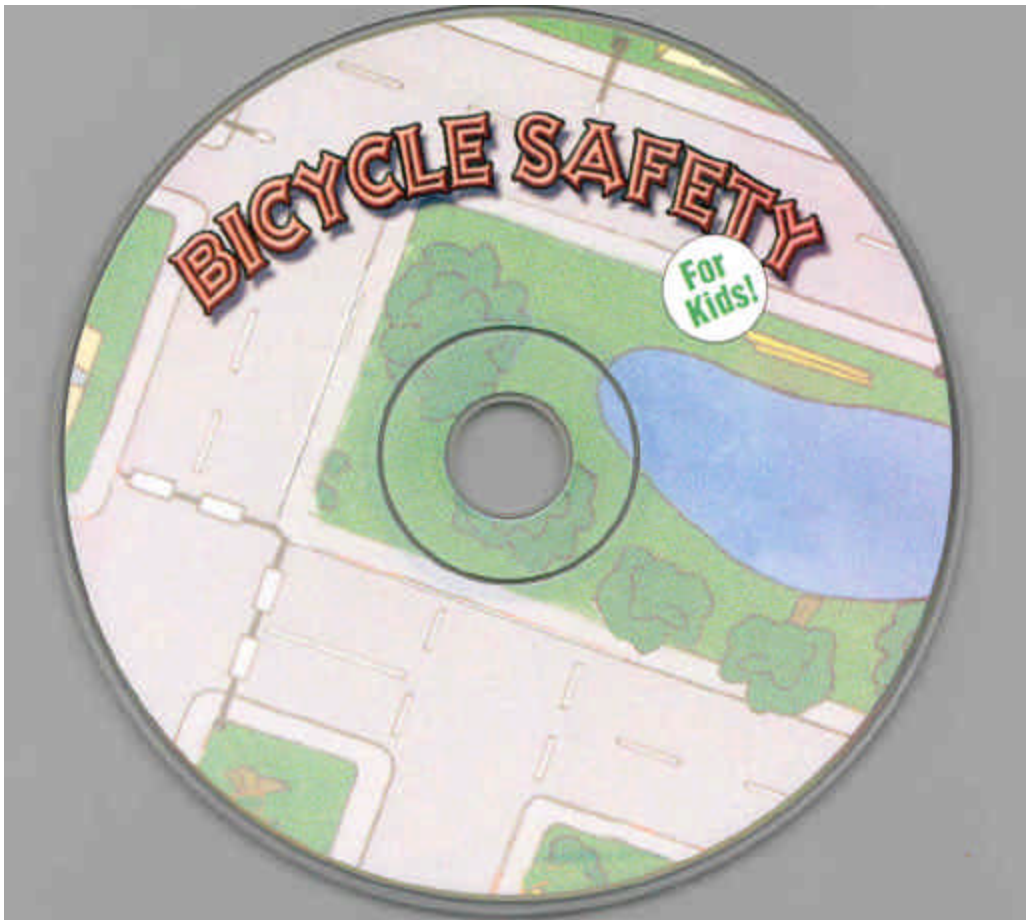


Figure 3 Label on CD-ROM



Figure 4 Opening Navigation Screen (Animated Lesson Icons are Located Along the Bicycle Path)



Figure 5 Lesson I. Selecting the Proper Equipment (Parts of Bicycle, Helmet, Clothing Accessories, etc.)

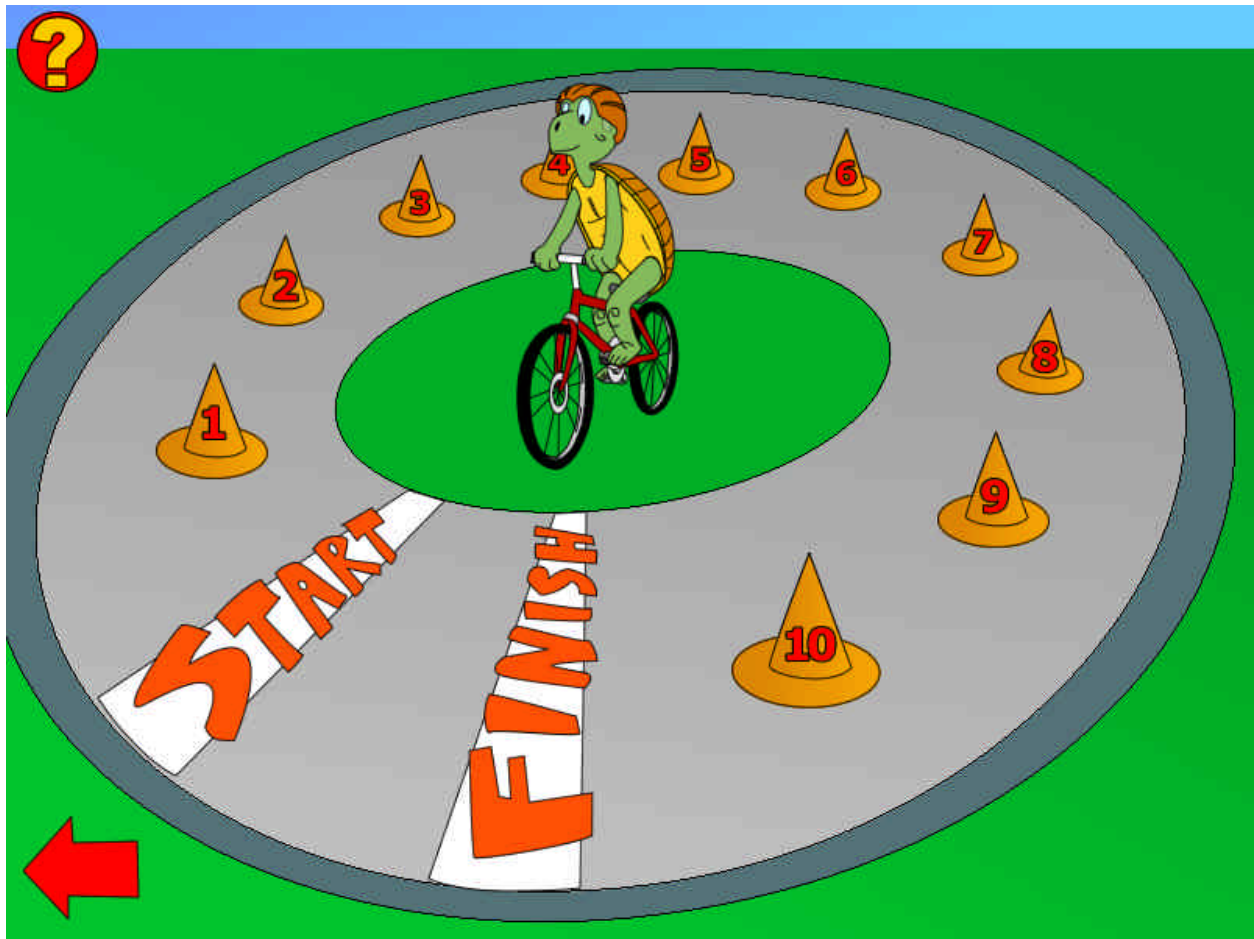


Figure 6 Lesson II. Basic Skills (Mounting, Dismounting, Balance, Turning, Breaking, Following Distance, etc.)



Figure 7 Lesson III. The Poor Visibility Environment (Weather Conditions, Night Bicycling)



Figure 8 Lesson IV. Rules of the Road (Right-of-Way, Intersections, Signs, Pedestrians, Traffic Lights, etc.)

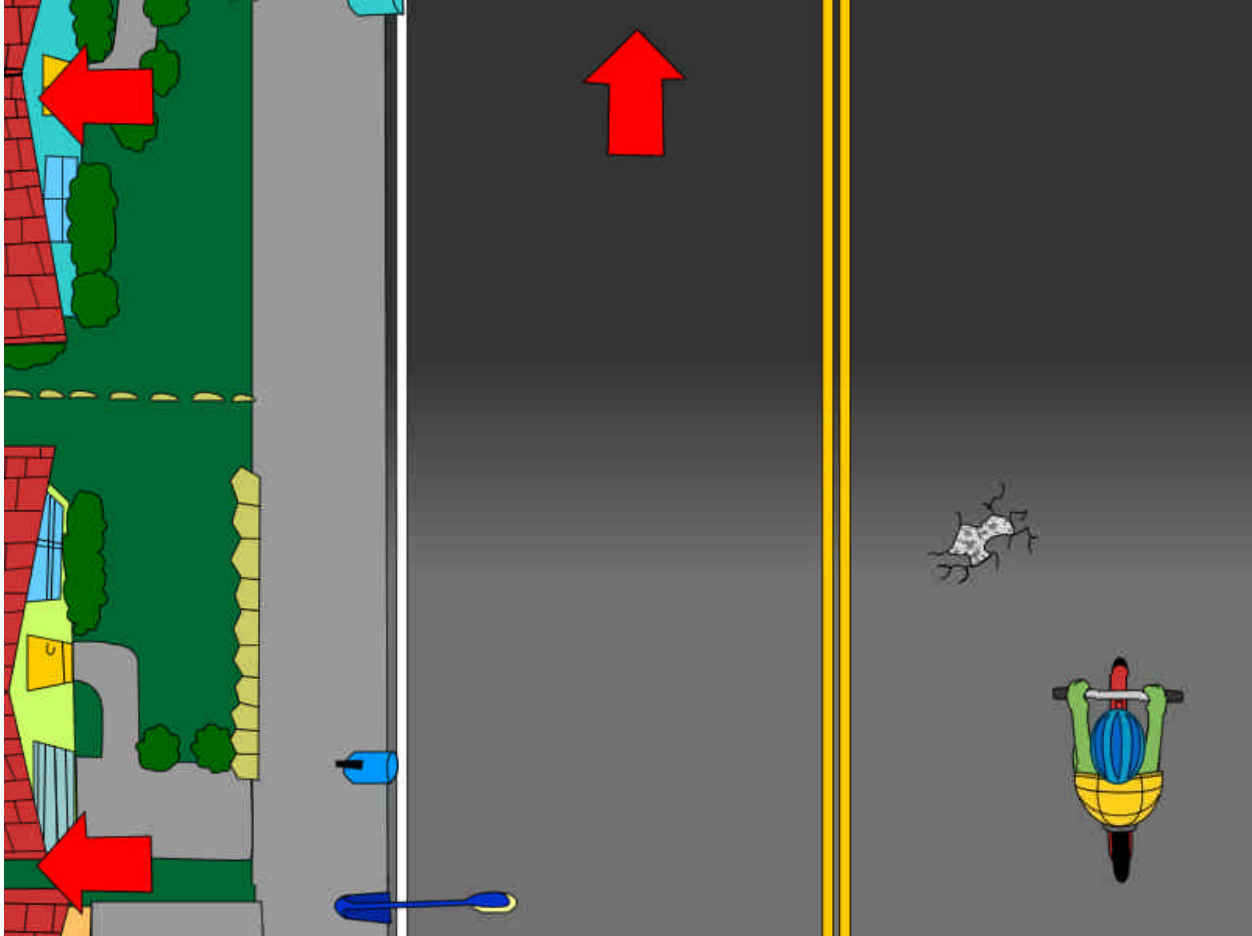


Figure 9 Lesson V. Avoiding Accidents (Clues and Tips on How to Avoid Accidents and Common Hazards)

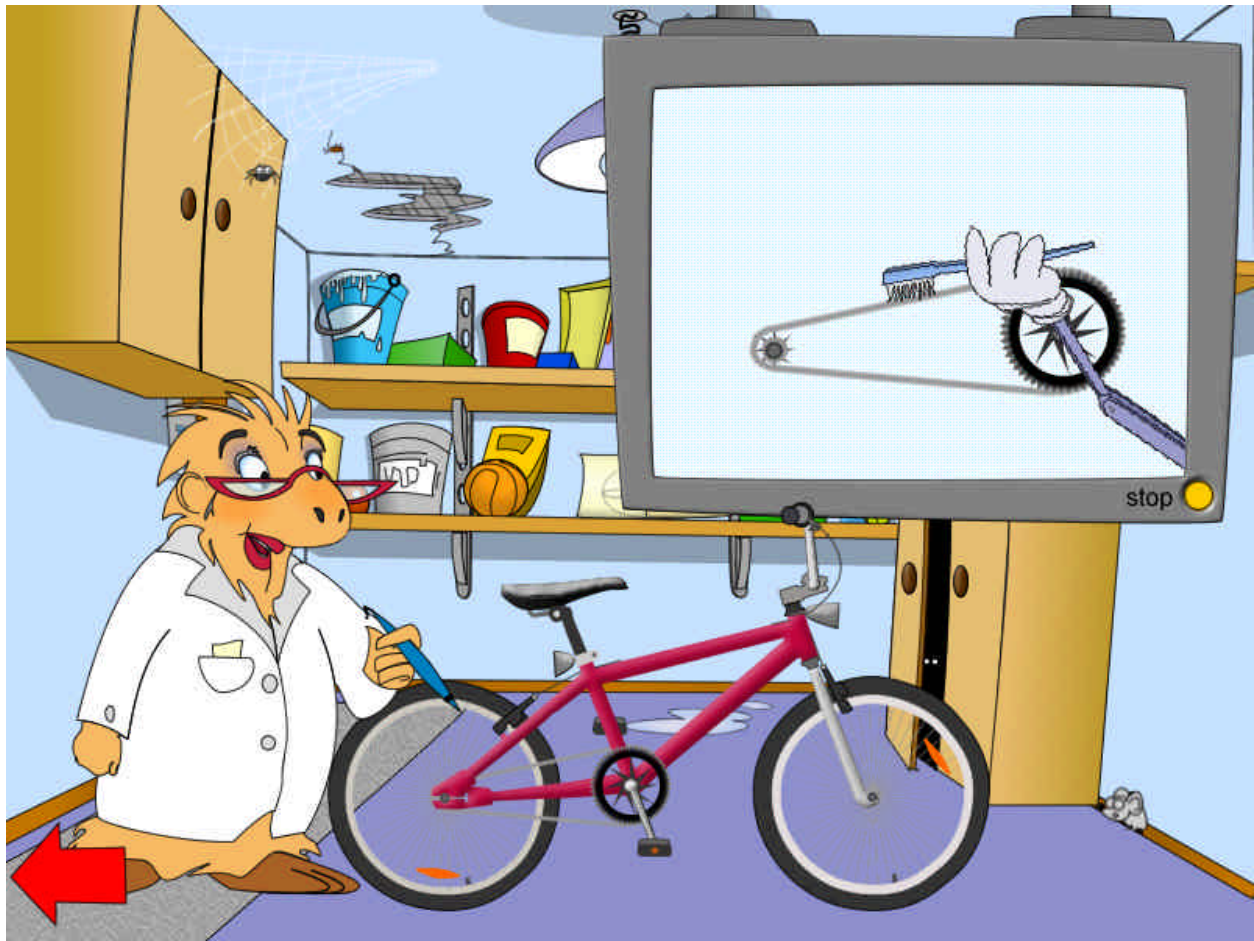


Figure 10 Lesson VI. Maintenance & Bicycle Repairs (Parts of the Bicycles and their Mechanical Conditions)

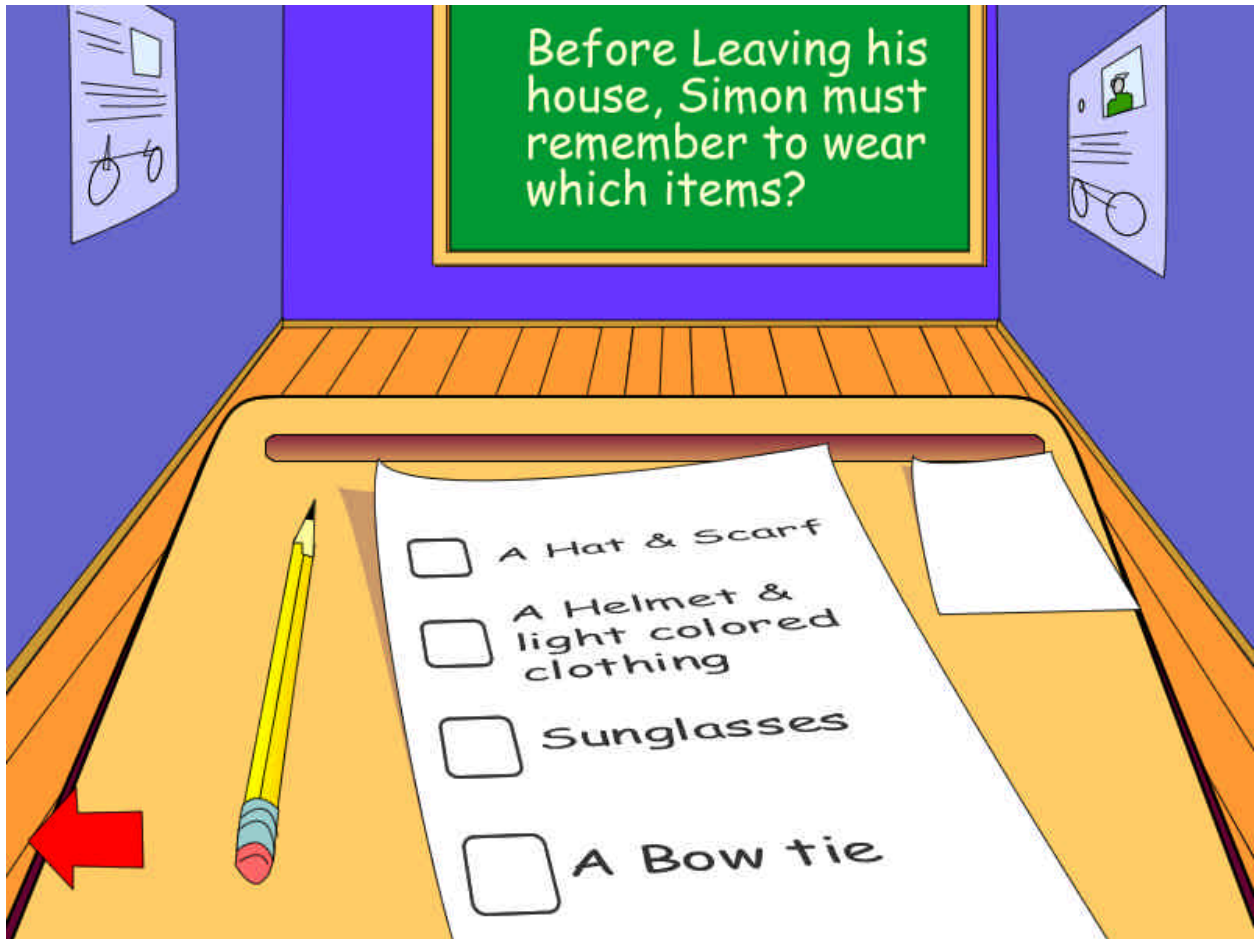


Figure 11 Lesson VII Bicycle Safety Test (Overall Evaluation of Students Understanding of Previous Six Lessons)