AN INTELLIGENT TRAINING SYSTEM BASED ON PERSONALIZED CURRICULUM SEQUENCING TO DETERMINE THE LEARNING STYLE

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ABSTRACT

This research addresses the design of an intelligent training system to be more personalized based on the learning style of the learner and through the ordering of the course content (curriculum sequencing) without the intervention of the learner. It contains a personalized pre-test to determine the learning style by the system according to a set of weighted If-then rules to select the learning path (theory, example and practical) or (example, practical and theory) or (practical, theory and example) before taking the course. The system has been built according to its components with the help of ASP.Net programming language. The system was evaluated by a set of indicators to demonstrate its validity in the training field, the integrity of the system’s design and to save the pedagogical principles.

KEYWORDS: Intelligent Training System, Learning Style, Curriculum Sequencing, Personalized.

1. INTRODUCTION

One of the most important aims of artificial intelligence technologies in education is to employ techniques and methods in learning programs called (Computer Assisted Instruction (CAI)) which give it new abilities that increase its effectiveness and interact learning ability in a way that we can describe it to be intelligent, or what we call as intelligent tutoring systems, and they are considered as the first and the main application of the artificial intelligence in the learning process.

The importance of intelligent tutoring systems lies in its ability in presenting an individual learning in a way that resembles the teacher's style. To reach this level of learning the intelligent tutoring systems use a complex representation of knowledge related to content which is taught, teaching strategies implied in them and the learner who the learning process is directed to so that they should identify three main sides which are: What is being taught? How it is taught? To whom it is taught?
2. Research problem
Interaction and communication have long been regarded as important factors for successful eLearning. Although the technology and facilities were available previously, there was no effective use of them to achieve widespread progress in people’s learning. There are still many unresolved issues concerned with web-based instruction, particularly in the suitability of transferring material from existing courses to electronic courses without change.

Although there are many intelligent tutoring systems using learning styles, but there are many educational sites contain learning materials that simply transform traditional learning material directly to an electronic format without considering the pedagogical principles involved. These systems do not analyze the learner personality to obtain an effective learning. This may cause a lack of educational attainment and interaction.

3. Research objective
This research aims at making eLearning materials more personalized based on the learning style of the learner, and through the ordering of the course content (curriculum sequencing). Three different styles (Theorist, Reflector or Activist) were considered to design an intelligent training system with the help of its structure. An evaluation method is also considered to evaluate the system.

4. Research methodology
In this research, an intelligent learning system has been designed according to the components based on training courses materials and using artificial intelligence techniques. The system takes into account the curriculum sequence determined by the learner’s background and personalization considering a set of weighted If-then rules to determine the learning path (theory, example and practical) or (example, practical and theory) or (practical, theory and example). The above three paths are consecutively called (Theorist, Reflector, Activist) according to Honey & Mumford in 1982, who created a personalized test of (60) questions to be answered by the learners to determine the above learning style. The system design was created with the help of ASP.NET technology. It was evaluated by a set of criteria to demonstrate its validity in the training field. 60 students of Ain shams institute, computer department, in Tripoli- Libya, were selected to test the system by answering 10 questions (standards) represent the evaluation method during the use of the system.
5. Learning styles

Learning styles are based on the research results of cognitive psychology about processing information, active learning and the structure of information. The learners prefer intuitively some forms of information and a specific way of action over others when reaching quality learning. Learning styles are not strict and do not outline each other. It means that a person might prefer some learning style over others but also use aspects of other styles. The learners possess several learning styles and can mix them together to obtain the most suitable combination for each learning event. Honey and Mumford's learning style model includes four key stages of learning styles:

- Activist
- Reflector
- Theorist
- Pragmatist

5.1 The activist:
Activists like to be involved in new experiences. They are open minded and enthusiastic about new ideas but get bored with implementation. They enjoy doing things and tend to act first and consider the implications afterwards. They like working with others but tend to hog the limelight.

5.2 The Reflector
Reflectors like to stand back and look at a situation from different perspectives. They like to collect data and think about it carefully before coming to any conclusions. They enjoy observing others and will listen to their views before offering their own.

5.3 The Theorist
Theorists adapt and integrate observations into complex and logically sound theories. They think problems through in a step-by-step way. They tend to be perfectionists who like to fit things into a rational scheme. They tend to be detached and analytical rather than subjective or emotive in their thinking.
5.4 The Pragmatist

Pragmatists are keen to try things out. They want concepts that can be applied to their job. They tend to be impatient with lengthy discussions and are practical and down to earth.

6. Intelligent tutoring systems

Intelligent tutoring systems (ITSs) are computer programs that are designed to incorporate techniques from the artificial intelligence (AI) community in order to provide tutors, which know what they teach, who they teach and how to teach it. AI attempts to produce in a computer behavior which, if performed by a human, would be described as intelligent: ITSs may similarly be thought of as attempts to produce in a computer behavior which, if performed by a human, would be described as 'good teaching'. The design and development of such tutors lie at the intersection of computer science, cognitive psychology and educational research; this intersecting area is normally referred to as cognitive science.

7. Structure of Intelligent tutoring Systems

Existing ITSs vary in architecture. In fact, it is almost a rarity to find two ITSs based on the same architecture. ITSs consist of at least three basic components.

1. The domain (expert knowledge) module.
2. The learner (student) module.
3. The tutoring module.
4. The user interface module.

![ITS Architecture](image)

**Figure (1) ITS architecture**

7.1 The domain module

The domain module function can be determined inside the intelligent tutoring system as follows:

1. A source of generating, learning, explaining content and examples related to the subject or the curriculum which the intelligent tutoring system teaches.
2. A source of generating questions and problems that the system presents to the learner as exercises or tests to solve them.

3. A source of generating ideal solutions and answers of questions and problems related to learning subject and determining and illustrating different behavior, procedures and directions that can be used in implementing these solutions and answers especially those directed from the system to the learner or the opposite as the human teacher.

4. A standard that we can evaluate and correct the learner's answer through it. Not only evaluates the final results the learner reaches, but it evaluates all procedures and the learner performance to reach to the solution through comparing the learner's correct answer generated by the intelligent tutoring system.

5. A source of generating required illustrations, explanations, and justifications to answer two important questions in learning. These question are (why and how), why do we use a certain method or strategy to solve a problem? How do we reach to the solution?

7.2 The Learner Module

The intelligent tutorial system can perform a set of important functions through the learning module as follows:

1. Determining the present knowledge case of the learner and his progressive level in learning a certain subject.

2. Recording the learning progressive of the learner in the system, the learner's mistakes during learning and all required teaching and learning knowledge that the intelligent tutoring system needs in order to accommodate the teaching with the learner's needs.

3. Providing scales and indicators about the learner's behavior continuously like the way of moving between subjects and links inside the system, the approaches to learn a certain subject, and the arrangement and so on.

4. Knowing and differentiating between misconceptions and missing conceptions for the learner.

5. Determining the learner's performance in answering questions and problems that the system presents, the time, degree of correctness, ratio of correct and false answers, number of trials, and amount of helps, hints and the explanation the learner needs.
7.3 The tutoring module

We can summarize the tutorial module functions in the intelligent tutoring system in the following points.

1. The controller among other comprising modules of the intelligent tutoring system.
2. Makes teaching decisions to the learner like determining suitable style and teaching method for the suitable amount of time for him. It also determines the following teaching procedure according to the individual learner's abilities.
3. Reduces the difference or the gap between the expert knowledge in the domain module and the stored learner's knowledge in the learner module to the highest extent or removing that difference completely.

7.4 The user interface module

We can summarize the user interface function in intelligent tutoring system as follows:

1. Relating the learner and the learning system from one side and the different parts and components of the programs from the other side.
2. Giving the intelligent tutoring system the ability of bidirectional mixed dialogue between it and the learner.
3. Involving and integrating the learner in the learning process through attractive displaying means as well as the flexibility and variance of displaying the learning materials in a suitable way to the learner's individuality and needs, and arguing with him with the natural language that he understands.
4. Presenting various styles of questions and problems and ways of answering them through the real pragmatic situations.

8. Designing the System

8.1 Designing user interface Module

According to the design of the user interface module of the intelligent tutoring systems whereas the main attributes: linking between the different parts of the system, facilitates the interaction between the learner and the system, and let the learner initiates the learning process, we designed the following windows to be the part the learner to realize and deal directly with. It is considered as a dialogue and a connection windows between the learner and the system. It allows the learner to interact with the other modules of the intelligent tutoring system (domain module, tutorial module, learner module):
1. Main window.
2. Personal testing window.
3. Practical window (course content).
4. Example window (course content).
5. Theory window (course content).
7. Evaluation window

8.1.1. Main window of the system:

It is designed to introduce the learning system. It contains a link to enter and take a personalized test to determine the learning style by the system according to a set of weighted if-then rules to determine the learning path (theory, example and practical) or (example, practical and theory) or (practical, theory and example) as shown in figure (2).

![Figure (2) main window](image)

8.2. Designing Tutorial Module

This module represents the teacher module that contains the techniques and knowledge of teaching strategies according to the two main attributes: determine teaching strategy and determine the next step of teaching.

8.2.1. Teaching Strategy of the system

The system identifies the strategy based on the scientific background and personality, as a behavior, of the learner according to Honey and Mumford model without the intervention of the learner. In 1982, Honey and Mumford designed a questionnaire, to be answered by the learner, consists of 60 questions that are considered as indicators for criteria of determining
the suitable style by analyzing the learner’s personality and background. A test (figure 5 - Appendix) given to each learner to determine the sequence of the curriculum as follows:

Table (1) Three possibilities strategy

<table>
<thead>
<tr>
<th>Possibility</th>
<th>Learning Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activist</td>
<td>Practical-Example-Theory, or;</td>
</tr>
<tr>
<td>Reflector</td>
<td>Example-Theory-Practical, or;</td>
</tr>
<tr>
<td>Theorist</td>
<td>Theory-Practical-Example</td>
</tr>
</tbody>
</table>

8.3 Designing Learner Module

In the design of this module, we considered the following attributes customized to this module as an artificial processes:

1. Create an individual teaching environment suitable for every learner:
   We designed an individual teaching environment starting with the registration and login windows, testing and evaluating windows and the individual curriculum pages.

2. Determine the progressive history of the learner:
   We designed a window containing the course start date, the course end date, evaluating results as knowledge level, recent access point while receiving the course and determining the personalized style in the guided system.

3. Store and present the learner's knowledge to be able to make the required inference:
   One of the knowledge representing techniques is the logic. We design three curriculum sequences (theory, example and practical) in away the learner receives the learning process in integrate methodology that provides knowledge acquisition. Furthermore, another technique is the logical inference that was achieved in the system when using if-then rules to determine the priority of the curriculum sequencing.

4. Diagnose mistakes that can happen:
   We designed a diagnose system as messages appear to the learner when the answer is incorrect.
8.4 Designing Domain Module

This module is considered as the part of the curriculum or learning content, which is required to be taught. It generates correct and evaluates answers of various problems related to the learning subject.

8.4.1 Curriculum design

We designed the curriculum content as a knowledge base, which stores the content in separate files according to the variety of subject. ASP.NET technology was the technique responsible for this design. It allows the learner to recall any material stored in the files’ knowledge base and display it over the specific page.

Figure (4) Curriculum design

8.4.2 Questions and Answers Design

In the end of each lesson, there are questions to be displayed to the learner. Then the system evaluates the answers by matching the learner’s answers to the answers stored in the knowledge base. We used if-then rules to determine whether the learner’s answers are correct or not which are embedded in the programming codes. The learner transfers to the next lesson when passing the test. In the end of the course, there will be a final test, which determines the result of the course.
9. Determining Learning Styles

Honey & Mumford said that we can merge the activist style and pragmatist style together because the coincide with each other in tends , desires , and capabilities in addition to the two styles resemblance of features . Therefore, We can look at the four previous mentioned styles as three styles that match to the learner module styles. The 60 questions allocated 20 questions for each style. Answers can be used to their learning style . The learner answers these questions(true and false) in a way that coincides with his tends, abilities, and experiments in the learning process. The result's accuracy depends on the questionnaire's answers accuracy.

![Figure (5) personalized pre-test](image)

10. Determining the Suitable Learning Style Technique:

The indicators (60 questions) are divided in a way that is suitable for the three learning styles, 20 questions are allocated to each style as shown in table (2). Determining the suitable style is through the questions that their numbering are also shown in table (2).

<table>
<thead>
<tr>
<th>Activist</th>
<th>Reflector</th>
<th>Theorist</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>13</td>
<td>9</td>
</tr>
<tr>
<td>14</td>
<td>20</td>
<td>11</td>
</tr>
<tr>
<td>18</td>
<td>22</td>
<td>15</td>
</tr>
</tbody>
</table>
Table (3) Determining the learning style preference

<table>
<thead>
<tr>
<th>General Norms</th>
<th>Activist</th>
<th>Reflector</th>
<th>Theorist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very strong preference</td>
<td>13-20</td>
<td>18-20</td>
<td>16-20</td>
</tr>
<tr>
<td>Strong preference</td>
<td>11-12</td>
<td>15-17</td>
<td>14-15</td>
</tr>
<tr>
<td>Moderate preference</td>
<td>7-10</td>
<td>12-14</td>
<td>11-13</td>
</tr>
<tr>
<td>Low preference</td>
<td>4-6</td>
<td>9-11</td>
<td>8-10</td>
</tr>
<tr>
<td>Very low preference</td>
<td>0-3</td>
<td>0-8</td>
<td>0-7</td>
</tr>
</tbody>
</table>

The highest result to each style of learning style is 20 points, which determines the suitable learning style.

After determining the curriculum sequencing, the learner takes the training course that he has already registered and according to the sequence.
11. Evaluation of the System

The following indicators used to evaluate the system: Table (4) Evaluation indicators

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Definition</th>
<th>Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simplicity</td>
<td>The state or quality of being simple</td>
<td>• Easy and simplicity of use of the system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• stops and difficulties during use of the system</td>
</tr>
<tr>
<td>Integrity</td>
<td>A concept of consistency of actions, values, methods, measures, principles, expectations, and outcomes</td>
<td>• system assistance in determining the learning strategy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Structure of system design</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• access to positions of movement within the system</td>
</tr>
<tr>
<td>Reliability</td>
<td>The ability of a person or system to perform and maintain its functions in routine circumstances</td>
<td>• Structure of system design</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The extent to respond to the style and speed of curriculum display</td>
</tr>
<tr>
<td>Educational attainment</td>
<td>Refers to the highest level of schooling that a person has reached. It refers to the number of grades completed or the institutions attended and certificates or degrees obtained</td>
<td>• Easy access and acquisition to the learning level</td>
</tr>
<tr>
<td>Ability</td>
<td>Means having the power to do something or to perform a certain action. If one does not have the ability to do something, it means he lacks the required knowledge, strength, or resources to do that action</td>
<td>• system's ability to attract your attention</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The system's ability to create new horizons for thought</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Structure of system design</td>
</tr>
<tr>
<td>Interaction</td>
<td>Means a mutual action occurs as two or more objects have an effect upon one another</td>
<td>• The extent to respond to the style and speed of curriculum display</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Harmony with the sequence of he curriculum topics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• stops and difficulties during use of the system</td>
</tr>
</tbody>
</table>
### 11.1. Normal distribution test

Table (5) Normal distribution test

<table>
<thead>
<tr>
<th>System Evaluation</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Kolmogorov-Smirnov</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Easy and simplicity of use of the system</td>
<td>3.9</td>
<td>0.838</td>
<td>0.281</td>
<td>0.000</td>
</tr>
<tr>
<td>2 System's ability to attract your attention</td>
<td>3.767</td>
<td>0.89</td>
<td>0.27</td>
<td>0.000</td>
</tr>
<tr>
<td>3 Easy access and acquisition to the learning level</td>
<td>3.6</td>
<td>0.718</td>
<td>0.311</td>
<td>0.000</td>
</tr>
<tr>
<td>4 System assistance in determining the learning strategy</td>
<td>4.467</td>
<td>0.623</td>
<td>0.337</td>
<td>0.000</td>
</tr>
<tr>
<td>5 The system's ability to create new horizons for thought</td>
<td>3.367</td>
<td>0.758</td>
<td>0.286</td>
<td>0.000</td>
</tr>
<tr>
<td>6 Structure of system design</td>
<td>3.9</td>
<td>0.752</td>
<td>0.286</td>
<td>0.000</td>
</tr>
<tr>
<td>7 Access to positions of movement within the system</td>
<td>4.167</td>
<td>0.587</td>
<td>0.345</td>
<td>0.000</td>
</tr>
<tr>
<td>8 The extent to respond to the style and speed of curriculum display</td>
<td>3.667</td>
<td>0.795</td>
<td>0.329</td>
<td>0.000</td>
</tr>
<tr>
<td>9 Harmony with the sequence of the curriculum topics</td>
<td>3.4</td>
<td>0.924</td>
<td>0.309</td>
<td>0.000</td>
</tr>
<tr>
<td>10 Stops and difficulties during use of the system</td>
<td>4.8</td>
<td>0.403</td>
<td>0.49</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>3.9</td>
<td>0.283</td>
<td>0.117</td>
<td>0.039</td>
</tr>
</tbody>
</table>

The statistical significance of all values of variables follows the normal distribution, where for all values (sig. < 0.05), with (Mean=3.9) and (Standard Deviation= 0.283) which is very small and indicates to a high homogeneity in the sample response. Therefore, T- test is used to determine the fundamental differences between the sample’s mean and the standard average (standard average=3) (five scales).

### 11.2. T- Test

Table (6) T-Test

<table>
<thead>
<tr>
<th>System Evaluation</th>
<th>Mean</th>
<th>Standard Average</th>
<th>Difference between Mean and Standard Average</th>
<th>S.D</th>
<th>T-Test</th>
<th>Sig.</th>
<th>Sig. Deference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.9</td>
<td>3</td>
<td>0.9</td>
<td>0.283</td>
<td>24.688</td>
<td>0.00</td>
<td>Significant</td>
</tr>
</tbody>
</table>

Results in Table (5) show that the average value of the responses of the respondents is (3.9) which is greater than the standard average (3) (five scales), and the value of the differences is (0.9). To determine the significance of these differences, the calculated test value (24.688) is bigger than the test spreadsheet value (1.96), and sig. =0.00 < 0.05 which refer to the significance of these differences. In conclusion, the respondents assess was high.
11.4. Component’s evaluation

Based on the design of the system’s components and their attributes explained in item (7), and according to the (Mean) value for each standard in table (5), we referred the following attributes to each component and to the standard (s) shown in table (5):

Table (6) Component’s evaluation

<table>
<thead>
<tr>
<th>Component</th>
<th>Attributes</th>
<th>No. of standard from (Table 5)</th>
<th>Design assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domain module</td>
<td>1. Analyzing and describing the scientific material</td>
<td>8 and 9</td>
<td>Achieved</td>
</tr>
<tr>
<td></td>
<td>2. Evaluating the learner</td>
<td>3</td>
<td>Achieved</td>
</tr>
<tr>
<td>Tutorial module</td>
<td>3. Determine teaching strategy</td>
<td>4 and 9</td>
<td>Achieved</td>
</tr>
<tr>
<td></td>
<td>4. Determine the next step of teaching</td>
<td>4 and 5</td>
<td>Achieved</td>
</tr>
<tr>
<td>Learner module</td>
<td>5. Diagnose mistakes that can happen</td>
<td>4 and 7</td>
<td>Achieved</td>
</tr>
<tr>
<td></td>
<td>6. Select individual environment for the learner</td>
<td>6 and 10</td>
<td>Achieved</td>
</tr>
<tr>
<td>User interface module</td>
<td>7. Linking between the parts of the system</td>
<td>6, 7 and 8</td>
<td>Achieved</td>
</tr>
<tr>
<td></td>
<td>8. The interaction between the learner and the system</td>
<td>1, 6 and 7</td>
<td>Achieved</td>
</tr>
</tbody>
</table>

Table (8) shows the system design evaluation according to its structure. In general, the design assessment is achieved according to the Mean value of each standard compared to the standard average (Mean > standard average).
12. Conclusion

The design of an intelligent education system usually takes into account the learner's learning strategy. In our design considering the architecture of the intelligent education system, we identified a learning strategy (style) based on training curriculum, which is called curriculum sequencing. This strategy involves three styles (Theorist, Reflector, and Activist). The system identifies this style based on the scientific background and personality, as a behavior, of the learner according to Honey and Mumford model without the intervention of the learner. According to the evaluation results, a set of indicators (simplicity, integrity, reliability, educational attainment, ability and interaction) used to demonstrate the system validity in the training field, and the integrity of the system’s design. The method that this system has been designed by analyzing the learner personality was to obtain an effective learning and to save the pedagogical principles.

13. Future work

Future work will include experimental investigations to verify the identified relationship between learning styles and Cognitive Traits. Furthermore, future work will deal with the question of how strongly the cognitive traits interact with the learning styles. Analyzing the tracked data from a system that incorporates cognitive traits as well as learning styles will deliver a detailed insight into the interrelation of cognitive traits and learning styles. In addition, future work will include further investigations concerning other cognitive traits, such as inductive reasoning skills, associative learning skills, and information processing speed.

References


Appendix A

Honey & Mumford questionnaire

1. I have strong beliefs about what is right and wrong, good and bad
2. I often act without considering the possible consequences
3. I tend to solve problems using a step-by-step approach
4. I believe that formal procedures and policies restrict people
5. I often find that actions based on feelings are as sound as those based on careful thought and analysis
6. I like the sort of work where I have time for thorough preparation and implementation
7. I regularly question people about their basic assumptions
8. I actively seek out new experiences
9. I am keen on self-discipline such as watching my diet, taking regular exercise, sticking to a fixed routine etc.
10. I take pride in doing a thorough job
11. I get on best with logical, analytical people and less well with spontaneous, "irrational" people
12. I take care over the interpretation of data available to me and avoid jumping to conclusions
13. I like to reach a decision carefully after weighing up many alternatives
14. I'm attracted more to novel, unusual ideas than to practical ones
15. I don't like disorganized things and prefer to fit things into a coherent pattern
16. I like to relate my actions to a general principle
17. I tend to have distant, rather formal relationships with people at work
18. I thrive on the challenge of tackling something new and different
19. I enjoy fun-loving, spontaneous people
20. I pay meticulous attention to detail before coming to a conclusion
21. I find it difficult to produce ideas on impulse
22. I am careful not to jump to conclusions too quickly
23. I prefer to have as many sources of information as possible - the more data to mull over the better
24. Flippant people who don't take things seriously enough usually irritate me
25. I listen to other people's point of view before putting my own forward
26. I tend to be open about how I'm feeling
27. In discussions I enjoy watching the maneuverings of the other participants
28. I prefer to respond to events on a spontaneous, flexible basis rather than plan things out in advance
29. It worries me if I have to rush out a piece of work to meet a tight deadline
30. Quiet, thoughtful people tend to make me feel uneasy
31. I often get irritated by people who want to rush things
32. It is more important to enjoy the present moment than to think about the past or future
33. I think that decisions based on a thorough analysis of all the information are sounder than those based on intuition
34. I tend to be a perfectionist
35. In discussions I usually produce lots of spontaneous ideas
36. More often than not, rules are there to be broken
37. I prefer to stand back from a situation and consider all the perspectives
38. I can often see inconsistencies and weaknesses in other people's arguments
39. On balance I talk more than I listen
40. I believe that rational, logical thinking should win the day
41. I tend to discuss specific things with people rather than engaging in social discussion
42. If I have a report to write I tend to produce lots of drafts before settling on the final version
43. I am keen to reach answers via a logical approach
44. I enjoy being the one that talks a lot
45. I like to ponder many alternatives before making up my mind
46. In discussions with people I often find I am the most dispassionate and objective
47. In discussions I'm more likely to adopt a "low profile" than to take the lead and do most of the talking
48. I like to be able to relate current actions to a longer-term bigger picture
49. When things go wrong I am happy to shrug it off and "put it down to experience"
50. It's best to think carefully before taking action
51. On balance I do the listening rather than the talking
52. I tend to be tough on people who find it difficult to adopt a logical approach
53. I find the formality of having specific objectives and plans stifling
54. I'm usually one of the people who put life into a party
55. I quickly get bored with methodical, detailed work
56. I am keen on exploring the basic assumptions, principles and theories underpinning things and events
57. I'm always interested to find out what people think
58. I like meetings to be run on methodical lines, sticking to laid down agenda, etc
59. I steer clear of subjective or ambiguous topics
60. I enjoy the drama and excitement of a crisis situation

Appendix B

Evaluation standards (questions)

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<tr>
<th>v. week</th>
<th>week</th>
<th>medium</th>
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