weSPOT Inquiry-Based Learning Model clarification

Project Acronym:	weSPOT
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weSPOT IBL model clarification

The weSPOT inquiry-based learning model presented in figure 1, consists of six phases, placed within the context, that mirror the phases that researchers need to go through in order to conduct their research.

Each phase also consists of a number of activities and it aims to support the teachers and students in their inquiries by providing a suggestive "check list". The teachers can start from the problem phase but also from any other phase depending on their lesson focus. Not all phases and sub-phases need to be completed for a successful inquiry. The teachers and the learners can choose the ones that fit their needs.

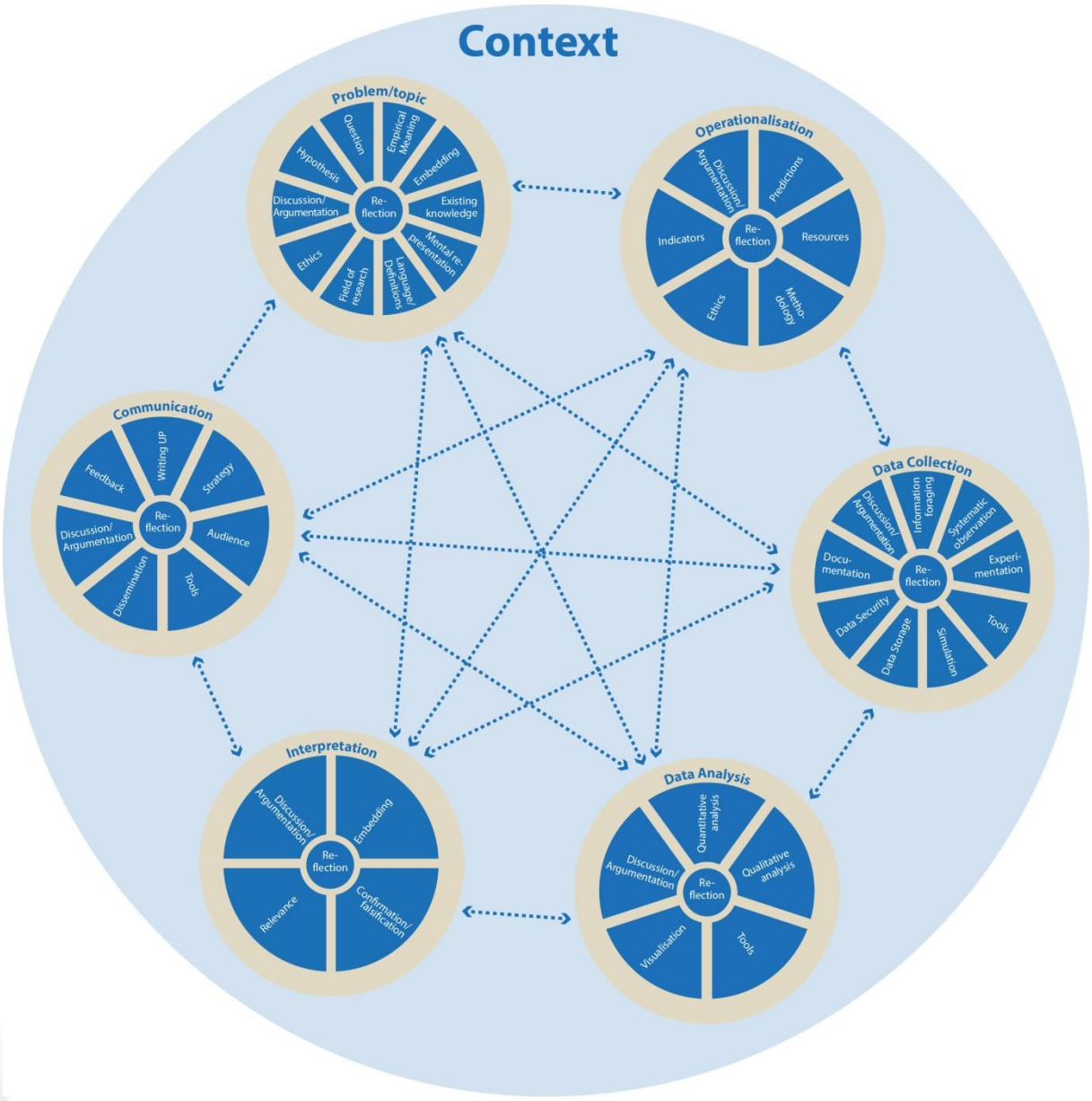

Figure 1: weSPOT inquiry based learning model

The weSPOT inquiry-based learning model consists of the following phases:

Context

Context refers to the physical or theoretical settings of the whole inquiry process. The teacher here can place the inquiry within the curriculum or the physical context they are working on.

Problem

- **Embedding**
  The students or the teacher need to place the topic in the current state of research and discoveries by comparing and relating it to other similar topics and theories.
- **Existing knowledge**
  Refers to what the students know already about the topic/problem
- **Mental representation**
  The students need to create a clear understanding of the topic in their mind
- **Language/definitions**
  The students and the teachers need to use the right language for the field (e.g. physics, biology etc.) and know the necessary definitions.
- **Field of research**
  The teacher or students need to place it in the appropriate field e.g. biology, chemistry etc.
- **Ethics**
  The teacher or students need to think about possible ethical implications of their inquiry. For example, if there are people involved or animal in the inquiry what are the things one needs to avoid?
- **Empirical meaning**
  Here, students and teachers need to check if empirical evidence be obtained to prove or reject the question or hypothesis chosen to pursue or if the question or hypothesis are verifiable or provable by means of observation or experiment.
- **Discussion/Argumentaion**
  Students and/or teachers need to provide arguments to support their decisions.
- **Question**
  Formulate an inquiry question. The question should not be very general and should be possible to be answered empirically. Good scientific questions have real answers, are testable and have a hypothesis that is falsifiable. For example,
  Does exposure to ultraviolet radiation cause increased risk of skin cancer?
- **Hypothesis**
  A scientific hypothesis needs to falsifiable. That means that an experiment could show that the hypothesis is false. An example of such hypothesis is: If I raise the temperature of a cup of water, then the amount of sugar that can be dissolved in it will be increased.
- **Reflection**

The students need to be aware of their own learning, need to rethink what they have done so far and make changes if needed.

Operationalisation

- **Indicators**

  Students specify the measurable aspects of the research and identify what is going to be measured and how. For example, thermometer readings would be indicators of temperature.
- **Predictions**

  Prediction specifies how one can demonstrate that a hypothesis is true. Here students state their null hypothesis and the alternative hypothesis. A null hypothesis is the assumption that the hypothesis is false. The alternative hypothesis is the desired outcome. Example: In a hypothesis like: "the more sunlight a tomato plant receives, the larger the tomatoes will grow", the predictions will be: "the more sunlight the tomato plants will receive their size will increase", "the more sunlight the tomato plants will receive their size will not increase".
- **Resources**

  What resources students will need to conduct their inquiry e.g. library, textbooks, technology, tools etc.
- **Methodology (of data collection and processing)**

  Decide on the best method to conduct the inquiry, e.g. qualitative or quantitative, experiment or observation etc.
- **Ethics (Ethical issues)**

  Same as in the previous phase
- **Discussion/Argumentaion**

  Same as in the previous phase
- **Reflection**

  Same as in the previous phase

Data collection

- **Information foraging**

  Validate the information. Is it reliable and trustworthy? Who wrote it? Is it enough that something has been published to make valid? Answers to such questions will allow students to access the accuracy and strength of the obtained information.
- **Systematic observation**

  Conduct an observation if that the best approach for the inquiry.
- **Experimentation**

  Conduct an experimentation if that the best approach for the inquiry.
- **Tools**

  Think and decide what tools you need to collect the obtained data, e.g. thermometer, camera etc.
- **Simulation**

Conduct a simulation if that the best approach for the inquiry. Simulations can include mathematical simulations, statistical simulations, computer simulations, etc.

- **Data storage**
  Where do I keep the obtained data? In a cabinet, in a computer etc.
- **Data security**
  Data needs to be kept safe and secure. Students decide on how to do that. For example, is it going to be kept in a password protected computer, will it be encrypted, will be kept in a locked cabinet etc.
- **Documentation**
  Students need to keep a journal of all their activities.
- **Discussion/Argumentation**
  Same as in the previous phase
- **Reflection**
  Same as in the previous phase

Data Analysis

- **Quantitative analysis**
  Perform quantitative analysis.
- **Qualitative analysis**
  Perform qualitative analysis
- **Tools**
  Decide on the tools you need to perform the analysis.
- **Visualisation**
  Decide how will you represent the obtained data visually, what type of graphs are you going to use, pie chart, bar chart etc.
- **Discussion/Argumentaion**
  Same as in the previous phase
- **Reflection**
  Same as in the previous phase

Interpretation

- **Embedding**
  Present the obtained results in relation to existing theories, other results and domain knowledge and show the relation between them.
- **Confirmation/falsification**
  Confirm or reject the inquiry hypothesis and/or null or the alternate hypothesis.
- **Relevance (of the results)**
  Show the value and the meaning of the obtained results compared to other current research.
- **Discussion/Argumentation**
  Same as in the previous phase
- **Reflection**

Same as in the previous phase

Communication

- **Strategy**

  Think about how best to disseminate the results by thinking about the audience, the events the number of people you would like to reach etc.
- **Audience**

  Decide who you are going to present your work to, to your fellow students, teacher, parents, scientists etc.
- **Tools**

  What tools do you need to use in order to present your work, e.g. PowerPoint, pen and paper, projector etc.
- **Dissemination (Events/Presentation/Publication)**

  What events will be the most appropriate for your work to be presented at, e.g. conferences, presentation at school, journals etc.
- **Discussion/Argumentaion**

  Same as in the previous phase
- **Feedback (Receiving and reacting)**

  How can you use the feedback to improve your work? Should you make changes? Is it going to be part of future work? Include comments into your discussion? Etc.
- **Writing up**

  Write your report, presentation, paper etc.
- **Reflection**

  Review and re-evaluate everything you have done in this phase but also everything you have done during your inquiry to make sure that you avoided any major mistakes.