4 Presentation Resources

Learning Outcomes:

- Describe what is a presentation resource;
- List different forms of presentation resources;
- Distinguish between presentation resources as a supplement to teaching and those for self-learning;
- Distinguish between external representation and a learner's knowledge; and
- Demonstrate understanding of visuals and interactivity as key affordances of representational technologies for design of presentation resources.

4.1 What Is a Presentation Resource?

A presentation resource is a digital media for education designed to explicitly present certain declarative knowledge (facts and information) with the intention for learners to remember, understand and reproduce that content as it was originally presented. Underlining assumption is that learning occurs by transfer of information, that is, by explicit teaching and presentation of content designed, arranged and presented for learners to internalize. Such an approach is associated with traditional teaching and learning practices, or so-called, instructivist pedagogy where teaching is based on a teacher (or technology and other resources) being a source of providing students with information (curriculum content segmented and arranged) in a ready-made format for passive learning (see Reeves 1998). Reeves writes:

D. Churchill, *Digital Resources for Learning*, Springer Texts in Education,
DOI 10.1007/978-981-10-3776-4_4

> These goals and objectives are drawn from a domain of knowledge, e.g., algebra, or extracted from observations of the behaviors of experts within a given domain, e.g., surgeons. Once goals and objectives are delineated, they are sequenced into learning hierarchies, generally representing a progression from lower to higher order learning. Then, direct instruction is designed to address each of the objectives in the hierarchy, often employing instructional strategies derived from behavioral psychology. Relatively little emphasis is put on the learner per se who is usually viewed as a passive recipient of instruction. CBE based on instructivist pedagogy generally treats learners as empty vessels to be filled with learning. Direct instruction demands that content be sharply defined and that instructional strategies focus as directly on prespecified content as possible.

Although there are educational contexts and content knowledge when direct presentation works effectively (e.g., presentation of facts and certain declarative information), this will be less than effective for achieving deep conceptual knowledge and new literacies and skills. Other forms of digital resources for learning, combined with learning activities, would be much more effective as a contemporary relevant strategy for the development of intellectually strong and contemporary relevant graduates.

Readers might be confused about differences between presentation and information display resources as both of these resources essentially deliver declarative information. We need to understand that this difference between information displays and presentation resources has to do with teacher-centered/instructivist pedagogy versus learning-centered pedagogy, or direct teaching vs. activity-based learning. Information displays are designed to display certain information in an organized way so that they can be used to mediate a learning activity. The primary purpose is not to consume and remember or understand the displayed information alone, rather the idea is to use that information to inform one's actions within a learning activity. Presentation resources, on the other hand, present information, which has been organized, simplified, and presented in segments and in ways in which learners' cognitive processing, that is, remembering, of that information is maximized. Information displays, unlike presentation resources, are not so much concerned with who the learners are specifically, their learning pace, age etc., rather, at the center of its design is how to effectively organize as much of the information as possible on a screen, and in a way that it is easier for someone to navigate, explore, and use it in learning activities. Furthermore, information displays are the only type of digital resource for learning that might not be originally designed for educational purposes. This means that a teacher and students can harvest such material from the Internet and other sources for use in their teaching and learning. Essentially, many web pages, journal articles, infographics, YouTube videos, etc., might be used as information resources in learning activities. However, in the context of this book, we are asking an important question "how to better design information resources given contemporary interactive and visual affordances of representational technology?" so that these can find effective utility in learning activities. Table 4.1 presents some essential differences between a presentation and an information display resources.

In this book, presentation resources are defined as digital media primarily and intentionally designed for either of the following two purposes:

Table 4.1 Comparison between presentation and information display digital resources for learning

Presentation resource	Information display
• A learner remembers information that is presented	• A learner uses information to accomplish a task specified by a learning activity
• Information is being presented for transfer	• Information is being displayed to inform a learning activity
• Content is presented temporally in a number of sequential screens	• Information is presented spatially, mostly in a single screen
• Navigation includes movement forward and backward to next chunk of content, selecting blocks of content from a central menu, or scrolling along a timeline	• Navigation is arranged to allow access to information chunks from within a single display
• Targets achievement of a specific learning outcome	• No learning outcome is targeted. This is determined by a learning activity where that information is to be used
• Intentionally designed for the purpose of teaching	• Not essentially designed for the purpose of teaching or learning, but it can be used in that context

(a) *An instructional presentation resource*—supplements and assists a teacher/lecturer/trainer/instructor to transfer certain knowledge to learners (such as is the case with PowerPoint, Prezi, Google Slides, Zoho Presentation, Haiku Desk or Keynote presentations), or

(b) *A self-learning presentation resource*—independently assist learners in self-consuming content of a screen and learning specific content being presented and reinforced—such as is the case with Computer-based/Managed Tutorials/Instructions (CBT/CMI), learning objects, recorded lectures, e-books, instructional videos, and screen capture recordings.

4.2 An Instructional Presentation Resource

An instructional presentation resource is a resource designed to support teacher presentations (e.g., a PowerPoint or Keynote slides used in a lecture). Traditional teacher-directed or instructivist practices are dominated with the presentation of content in an attempt to transfer knowledge from a source (teacher or a digital resource), through medium (technology) and messages (language and other modalities), to a passive recipient (a learner considered to be 'an empty vessel' to be 'filled' with that content knowledge). Most of what has been going on in such situations includes a teacher presenting certain content knowledge through direct teaching, often supported by audio-visual resources (digital and non-digital), and periodically checking if learners are learning by posing questions, or requiring them to complete worksheets (reinforcement), and subsequently preparing them to pass tests and exams. Knowledge content is explicitly presented/declared in a form, which is simplified and organized in a way that makes it easier for learners to remember it. Often, during such instructional situation, learners are taking notes, rephrasing and describing things in ways that they can be later studied, or use it to further independently consult other individuals in their networks, and learning material such worksheets, textbooks and web sites. A digital resource for learning used in such situations is a presentation resource that supplements a teacher. Contemporary technology enables students to record teachers' explanations, or their own observations, e.g., via recording features of a mobile device and note taking Apps. Skilled teachers will use a variety of strategies to help learners to remain focused during lectures, such as, well designed audio-visuals, various forms of attention grabbers, and asking or inviting questions. Technology can help to collect learners' answers and present summaries. However, no matter what means of presentation and supporting techniques are used, what can be achieved through such approaches is primarily declarative knowledge and surface learning, rather than deep conceptual knowledge. Even though information about a concept is provided to a learner in a presentation resource that does not constitute learning and the development of conceptual knowledge. Rather, that is a presentation of information and facts about a concept. Learning concepts requires conceptual knowledge construction and changes through active intellectual engagement. In other sections of this book, we look into more details about conceptual knowledge and explore suitable forms of digital resources for learning of this kind of curriculum content.

Activity 4.1
Search Slideshare.net, identify presentations which demonstrate good instructional, presentational and visual design. Select one of these best examples, and describe your choice.

Let us look more specifically at some of the key aspects of design of presentation resources for supplementing a teacher. This book does not intend to discuss the design of presentations in great details, as we are more concerned with the transformation of traditional teaching practice and adoption of learning centered approaches. In this context, we give more attention to digital resources for learning such as concept representations. Skills in the design of presentations that supplement teaching should be an integral competency of contemporary teachers and, thus, this should be a discussion at a more fundamental level of a teacher education program. However, here are some main points related to the effective design of presentations:

- *Presentation screen design*—
  - *Design of a presentation's opening and closing screens*—Opening screen (also called a title screen) should be designed to capture attention and get

learners focused and prepared for the main content to be presented. This screen might be designed to include a powerful visual representation that associates an audience of learners with the main ideas to follow in the presentation. This might set the overall look and feel (treatment), and include metaphorical representation of interface (which would be followed throughout the presentation in other screens as a tool that reminds learners about the main topic under the study). Furthermore, a supplementary screen might list the main points to be addressed in the presentation, and refer to prior knowledge required for learning the current topic. The closing screen might summarize the main points of the topic, and the final screen might include contact information of the presenter and credits to any copyrighted resources and reading material.

- *Design a master slide with consistency (also called a template slide)*—A master slide is like a container that consistently frames every new slide to be filled in with content. Designing such a template slide can greatly facilitate the development of overall presentation and provide consistency for every subsequent screen to be designed.
- *The master slide* should include areas for session headings, main content presentation areas for elements such as text, images, tables and a footer, determined background and color scheme to be used, text format (headings, subheadings, main content, meta-text, highlights, clues, signals and pointers), and navigation areas.

- *Content structuring and presentation*—A teacher as a designer must determine all content to be included in the presentation. Further decisions regard how that content will be presented, represented and structured. Most often, images and text are used to supplement each other and provide a supporting tool for the presenter to emphasize the main points, provide summaries, illustrates ideas, and provide examples and analogies. Later in this book, we will examine some theoretical ideas regarding the use of visuals, textual and verbal signals in communicating instructional content. Also, determining if additional content can be useful and included in the notes attached to slides. This area might contain pointers to additional resources, key questions to pay attention to, and any other additional content as determined by the teacher.
- *Navigation*—To determine navigation strategy, forward and backward buttons, main menu button, hyperlinks, and develop main menu structure if required.
- *Technical issues*—These issues address technical specifications, such as, duration of the presentation, number of colors to be used in the design, size of the presentation area, types of fonts available to the system, resolution of graphics, frame rate and size of animation, video codex, and audio format.

Presentation development software such as PowerPoint and Keynote provide templates, which can be used to easily populate with one’s own content. Also, numerous templates are available for download from the Internet. However, the author of this book recommends that templates are not the best solution, and attempts should be made to be original and innovative in developing our own designs for particular contexts and content.

Emerging possibilities for presentations, such as Prezi, bring about a new concept for design. All content is structured in a single display, and navigation occurs by zooming on specific areas of display, and 'flying' to other areas based on backward or forward navigation. In addition, there are emerging forms of interactivity with technology that permit presenters to navigate between screens of content by using hands instead of a mouse or pointers (e.g., by using Myo device attached to an arm). These limit existing, while creating new design possibilities. Furthermore, emerging cloud-based tools for the design of presentations (e.g., Google Presentation and Zoho Presentation) bring the design to an online environment, enabling co-design and social discourse during the development.

4.3 Presentation Resource for Self-learning

In addition to presentation resources designed to supplement direct teaching/lecturing, technology affords the design of presentation resources for self-learning through the presentation of declarative knowledge content, that is, learning without a teacher, anytime and anywhere. Such resources contain all necessary information, explanations, and elaborations, and integrate representational modalities to enhance the effectiveness of presentation. Interactivity is most often used to facilitate navigation through the content, although the content representation itself can be significantly enhanced by use of interactive features. Even though such resources can contain elements of, for example, a concept representation resource (which can support concept learning), the original intention of a designer is to facilitate direct teaching and achieve learning by having students understand, remember and recall declarative knowledge content presented in a learner controlled pace. In certain cases, elements of practice resources are built in the design, in order to reinforce remembering and understanding of the content being presented.

Broadly speaking, this form of presentation resource can be (a) temporal media such as videos, (b) sequential media such as e-books, and (c) programmed media such as courseware or computer based or managed instruction. Although all of these are different media types, in the context of this book, they are united under the same category of digital resources for learning based on their intended purpose to communicate declarative knowledge content. Once again, digital resources for learning are not classified according to media types, but according to the forms of curriculum knowledge content they represent. Presentation resources are designed to represent declarative knowledge.

4.3.1 Video Presentation

There are various possibilities for the design of instructional videos. These include, at least, the following:

- *Video recorded lectures*—This can be achieved by using special lecture recoding platforms such as Panopto and Echo360, recording via online conferencing and real-time teaching environments such as Blackboard Collaborate or Adobe Connect, or by using screen recoding tools, such as TechSmith Camtasia.
- *Digital picture stories*—These are video compositions composed essentially of static images/photographs transiting from one to another, and accompanying narrations, text and background music.
- *Video records*—These are instructions recorded with a video camera, and special equipment such as microscopes, telescopes and remote cameras. Post-production using special software such as iMovie, allow the integration of recoded videos with graphics, animation, titles, audio and special effects. Special tools can be used to edit audio separately from the video (e.g., Audacity), and then merge it together with the video in a final product.
- *Animations*—This can include cartoons, animated sequences and diagrams, illustrated and animated processes, step-motion animation, and 3-dimensional animation.

4.3.2 E-Book Presentation

E-books are digital media that uses the same parading as traditional books for content presentation and navigation, with the exception and advantage that it can be delivered to a broad audience via the Internet, and deployed via a spectrum of devices such as a computer, mobile devices and wearables. Furthermore, the design of e-books can include all forms of digital media content, and include advanced interactive features and assist learners to, for example, highlight, annotate and save text for later uses, search content for keywords, bookmark pages, or listen to an electronic voice reading the text. However, designing an e-book should not simply be scanning pages from a traditional printed text and making these available as an online document, at least, not in the context of education. Contemporary technology allows easy conversion of analogue to digital, however, the design of e-books must leverage on representational affordances of contemporary technologies for learning. Contemporary tools, such as Apple iBook Author allow teachers to easily create e-books, integrating even some advanced interactive features with ease, such as interactive images, and deploy these via a variety of devices including iPods and iPads. Applications such as iBook Author, free teachers from the burden of technical complexity, and empower them to think about the design of content, rather than to struggle with complex technical issues.

4.3.3 Computer-Based Instructional Presentation

The third form of presentation resources for self-learning are programmed or authored media, such as, courseware or computer-based or managed instruction (CBI/CMI). Development of CBI courseware is based on traditional instructional design models such as the 'Systematic Design of Instruction' by Dick and Carey (1978, 1985, 1990, 1996), and builds on the theoretical constructs such as Gagné's 'Nine Events of Instruction' (Gagné et al. 1992). CBI courseware can be very complex, including elements of programmed instruction, intelligent tutorials and all forms of representations, expensive and sophisticated to produce. Essentially, the main idea on CBI courseware is that a computer is a teaching machine, enabling learners to learn at their own pace through pathways managed by the underlining structure. Table 4.2 shows main elements of a CBI courseware, and provides information regarding key features of each of these.

Although CBI courseware development processes can vary, depending on the context and purpose of development (e.g., commercial development, development of an external client, in-house development, or a simple development by an individual teacher), Fig. 4.1 shows an example of how it might occur from an initial meeting of the development team to the final summative evaluation.

Activity 4.2
Instructional design is a critical step in the overall design of presentation resources for self-learning. Examine instructional design models listed at http://www.instructionaldesign.org/models/ *and search the Internet for other resources. Which of the models listed appears most appropriate for the development of resources to support learning-centred as opposed to teacher-directed practice? Try to design an information display showing such a model.*

4.3.4 Learning Object

The author of this book previously argued the idea of a 'learning object' as an appropriate representation of digital resources for learning. However, his arguments and provision of an alternative definition of what a learning object might be, made no significant impact. Extensive, but most often less the useful discussions in the literature, and widely-spread disagreement of what a learning object might be, and how these can be classified, led the author to abound the use of this term, and adoption of the more generally understood term 'Digital Resources for Leaning' and, in a way, submerging learning objects under these as one of the possible forms of educational content in this current book.

Initially, the concept of the learning object emerged from the traditional, direct instruction courseware design ideas and professionals that attempted to articulate

Table 4.2 Main elements and key features of a CBI courseware

Main elements	Key features
Opening screens	• Gaining attention by using an interesting opening • Login and collecting information about a learner: user name, id, class and password (unless this is automatically determined by a learning management system used to deliver the CBI) • Automatically record date and time of access • Inform a learner about a lesson and objectives • Inform a learner how to use the courseware • Provide main navigation structure • Read record of previous use by the same learner—It is possible to begin from the point where a user left the courseware on the last visit
Main content and navigation	• Content navigation through paging structure: go from previous to current to next page, go to recently visited page, go to first or last page, search pages for a keyword • Keep information about pages visited and time spent at each page/section • Keep information about sections completed • Inform a learner about current page/pages visited/sections completed, pages left before completion of a section • Pages might contain multimedia elements and interactive components to enhance representation of curriculum content • Provide a map of a section with indication of visited areas
Programmed instruction	• Keep track of completed sections • Prevent users from entering one section without completing the other section • Allow access to quiz when all sections are completed, restrict to a single access to a quiz • Sections might follow with some drill and practice questions and remediation • Questions might preside a sections—used to identify 'advanced standing' or readiness for access to a section (pre-testing)
Quiz/Test	• Variety of questions: MCQ, true-false, fill-in-the-blank, match-and-marking, short answer, auditory, moving objects (e.g., puzzle) • Variety of interactions for questions: key-press, hot-spot, clickable-object, text-entry, target-area, pull-down, drag-slider • Randomize questions and their content to prevent copying or allowing multiple practices of a same question with different configuration • Present only certain number question from the bank of questions • Use of representations within questions • Enhanced interactivity in presentation of questions (e.g., use measuring tools, manipulation of parameters) • Allow access to external tools, sites, information • Provide feedback: if wrong: why is it wrong, hints about what to do to correct it, what to do next; if correct: acknowledge correctness, reinstate the correct answer, provide additional information, inform about what to do next

(continued)

Table 4.2 (continued)

Main elements	Key features
	• Allow each question to appear once, or allow multiple accesses to same questions until "mastery" is achieved • Track information about questions attended, results, time spent on a question, number of tries before getting the correct answer • Inform a learner about questions attended, time spent, time remaining to complete, and number of attempts and tries left
Record and presentation of results	• Present a learner with quantitative feedback: scores, grade, questions attempted and number of questions answered correctly or incorrectly, date of access, time spent within a lesson or a quiz • Present a learner with a certificate, voucher, or/and credit points • Present a learner with qualitative feedback: comment about performance, what to do next to improve performance or remediation • Record results in an external document or in a database (on the local machine, over the network/internet in a database or within the data-base of a learning management system)

more effective and economical strategies for the design, management and reuse of training/educational materials over computer-based networks. One of the dominant initial ideas was that curriculum content can be broken down into small, reusable instructional components that address a specific learning objective, and that could be tagged with metadata descriptors and deposited in digital libraries for primarily machine-driven and automated reuse (see Cisco Systems 2001; IMS Global Learning Consortium 2002). Up-to-date, there have been numerous other attempts to further define or redefine a learning object, and currently, there is a spectrum of, sometimes diverging views of what it might be. Here are some of these definitions presenting a variety of views of what a learning object may be:

- Any entity, digital or non-digital which can be used, re-used or referenced during technology-supported learning (IEEE 2001);
- Any digital resource used to support learning (Wiley 2000);
- Any digital resource used to mediate learning (Wiley and Edwards 2002);
- Small, stand-alone unit of instruction (Haamel and Jones, in ECC 2003);
- An instructional component that includes an instruction that teaches a specific learning objective and an assessment that measures achievement (NetG, in Wiley 2000);
- A collection of 7 $\pm$ 2 information objects, each containing content, practice and assessment components (Cisco Systems 2001);
- A reusable digital resource built in a lesson or a group of lessons (McGreal 2004);
- A combination of a knowledge object and a strategic object (Merrill 2000);
- A content object with a pedagogical component (Clifford 2002);
- An interactive practice exercise (Dunning 2002, in McGreal 2004);
- A virtual simulation resource for learning (Tubelo et al. 2016);

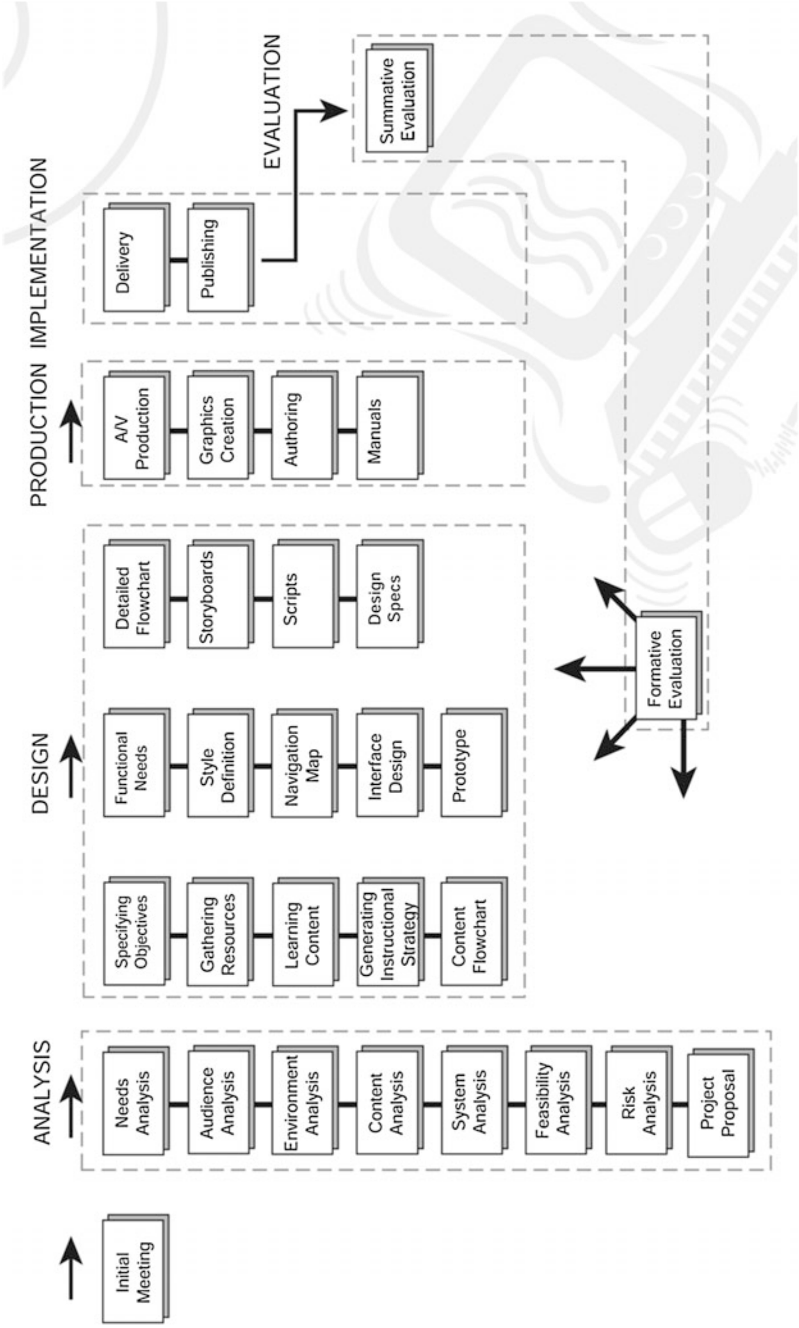

Fig. 4.1 An example of the CBI development process

- A personalized learning resource (Imran et al. 2016);
- An interactive digital resource illustrating one or a few interrelated concepts (Cochrane 2005); and
- An interactive visual representation (Churchill 2005).

These definitions appear to be articulated based on the three main learning theories: behaviorism, cognitivism and constructivism. For the behaviorist perspective (e.g., Haamel and Jones, in E-learning Competency Center 2003) all that is needed for learning is to appropriately present stimulus (material) and initiate responses. Responses are tracked by machine and remediation automatically provided until mastery is achieved. For cognitivism (e.g., Merrill 2000), learning objects must be directed at learners building mental representations and algorithms for their use. Learning is effective when material presented is isomorphic with an internal representation to be developed by a learner through '*incremental elaboration*' aided by instruction (see Merrill 2000). From a constructivist perspective (e.g., Churchill 2005), a learning object is a resource used to mediate a learning activity leading to learning outcomes, and learners' knowledge is constructed, transformed and applied through active engagement.

There is growing recognition that these ideas are incomplete and of limited use in context of any modernization of education. The academic community calls for reconsideration of what a learning object may be (e.g., Jonassen and Churchill 2004; Lukasiak et al. 2005; McGreal 2004). Friesen (2003) suggests that a learning object "need to be libelled, described, investigated and understood in ways that make the simplicity, compatibility and advantages claimed for them readily apparent to teachers, trainers and other practitioners". However, until now, this has not happened, and claimed advantages of a learning object such as *scalability*, *generatively* or *adaptability* (Gibbons 2000) are not well understood and appealing to educators. This might be because an average educator is more interested in improvements in teaching and learning through effective technology integration, rather than being replaced by a 'teaching machine' and resources capable of assembling lessons tailored for individual instruction. Merrill (2000) warns that with the current approaches "we are letting the idea of some mechanical principles drive what we are trying to do in psychology".

Current categorizations of learning objects do not appear to contribute to the solution of the problem. Wiley (2000) previously attempted to articulate a classification of learning objects. However, this classification has not been found in the literature to be of any use since it emerged. Wiley appears to classify learning objects according to parameters such as types and quantity of objects or elements contained and whether these can be extracted and reused in other learning objects (e.g., a single image, digital video, a web page, a machine-generated instructional module that monitors learner performance on practices and tests). However, even earlier classifications of educational resources, such as the one used by Alessi and Trollip (1995), might be more useful and relevant to teaching and learning. Alessi and Trollip suggest that computer-based educational resources can be classified into: (a) instructional modules or tutorials, (b) drill and practice, (c) simulations, and

(d) games. However, Alessi and Trollip's categories served the purpose for the classification of educational resources designed to instruct in a typically explicit instructivist way, or engage a learner in the practice of certain routine procedures, recall and recognition. Another classification of educational material that can be found is by MERLOT (Multimedia Educational Resource for Learning and Online Teaching) where learning objects are classified as: Animation, Assessment Tool, Assignment, Case Study, Collection, Development Tool, Drill and Practice, e-Portfolio, Learning Object Repository, Online Course, Open Journal—Article, Open Textbook, Presentation, Quiz/Test, Reference Material, Simulation, Social Networking Tool, Tutorial and Workshop and Training Material (see MERLOT, n. d.). This is a highly ambiguous categorization with overlapping categories, lacks any coherent theoretical underpinning and explicit links to curriculum content knowledge formats and, as such, is far from being effectively useful for designers and educators.

An alternative definition of a learning object and classification are needed to support diverse views and the needs of people involved in design (e.g., a designer who examines a subject matter, conceptualizes a potentially useful resource, and creates a blue print of it for production) and the reuse of learning objects (e.g., a teacher who plans to develop an activity for learning and locate learning objects to be used in that context). However, the up-to-date debate of what a learning object appears to be indeterminable. So, given that the issue of learning objects cannot easily be resolved, changes in thinking must follow. This would be possible when a definition is supported with a classification that includes a variety of categories, and where different categories are alighted with different perspectives and needs. In this book, the author proposes such a solution. However, at first, we must disregard all these naïve ideas of what a learning object is, and think in more general terms about digital resources specifically designed to support learning—digital resources for learning, and expand these in a way that will support the modernization of education. The 'digital resource for learning' term is adopted as the more appropriate representation of educational resources designed and delivered via technology-based environments.

However, in this book, we propose retaining the term 'learning object' as a specific form of presentation resource; that is, a digital resource for learning that explicitly presents specific curriculum content knowledge in a form most effective for direct instruction. Also, it is suggested that the most effective approach in this context is the learning object strategy proposed by Cisco (see Cisco Systems 2001). For Cisco, curriculum content can be broken down into small, reusable instructional/informational components, or information objects, that each address a single specific learning objective, and that could be tagged with metadata descriptors and deposited in digital libraries for primarily machine-driven and automated reuse. Therefore, the term 'reusable' is used in this strategy with both the learning object and the information object. According to this approach, a reusable learning object is a collection of 7 ± 2 pieces of reusable information objects. Each reusable information object contains information/presentation about a fact, concept, process, principles or procedure (Cisco provides guidelines for the design of each of these content forms); a practice component designed to improve retention and determine any remediation; and assessment components used to test if the specific learning outcome has been achieved and determine the component of any further learning. This 7 ± 2 number emerges from Miller's (1956) theory that proposes limits to human capacity for processing information, arguing that at one-time, human working memory might operate with 5–9 pieces of information. The components of a reusable information object are depicted in Fig. 4.2.

Although this approach acknowledges concepts, essentially, any concept learning is spontaneous rather than intentional, and the main purpose is to present information about the concept, rather than to engage learners in any deep conceptual changes through a learning activity. Building instructional modules or learning objects based on this strategy involves a system that packages these information objects automatically for learners to study independently. All that an instructor has to determine is a set of learning objectives to package in a learning object or a course initially (or in a set of learning objects), and then the system will retrieve related information objects, practice and assessment components, and package these in learning objects (or an instructional module). Alternatively, a pre-testing mechanism might determine where learners are at in terms of achievement of the curriculum specific learning outcomes, and the automatic packaging of learning objects will follow. Figure 4.3 illustrates the structure of a reusable learning object.

Although essentially being a data-based driven and mechanistic approach, the Cisco reusable learning object strategy might be a promising and effective approach for the management of traditional direct instruction with the purpose of declarative

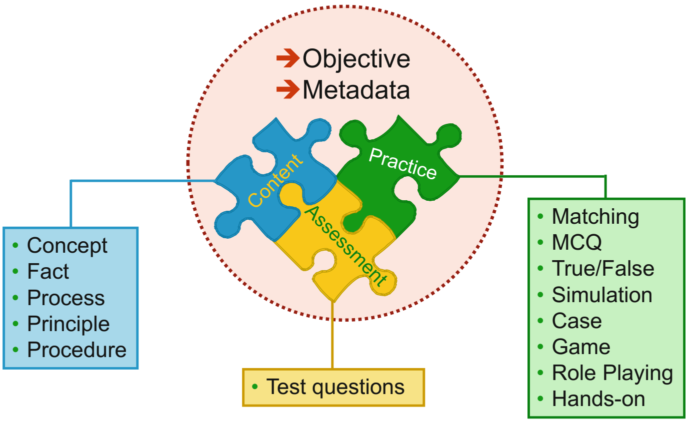

Fig. 4.2 Reusable information object according to Cisco System (2001)

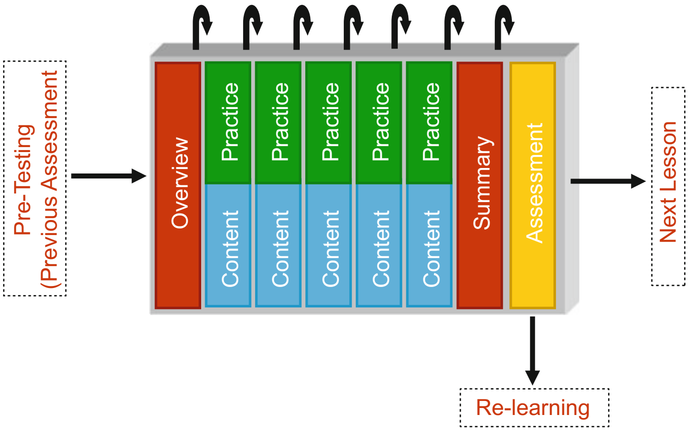

Fig. 4.3 Structure of a reusable learning object (Cisco Systems 2001)

knowledge content delivery. Although this is now more than a 15 years old strategy, those who subscribe to contemporary learning analytics claims, might find this highly relevant. Nevertheless, developing system architecture and content for this strategy will come at high expense and huge effort, but all that can be achieved are traditional learning outcomes addressing declarative knowledge. As we have noted so far in this book, the primary purpose of contemporary education in schools and universities should be the development of conceptual knowledge that is essential for disciplinary specific theoretical thinking, as well as new literacies emerging as important due to contemporary technological, social, cultural and economic developments. Perhaps, the Cisco strategy might at best fit in with learning in corporate environments.

Activity 4.3

Look carefully at Table 4.2. *Examine the typical elements included in the Computer-based Instruction (CBI) type of presentation resources. Now, consider the topic of "Introduction to Digital Resources for Learning (DLR)". Look at the presentation you developed in Activity 1.2 and think how this can be redesigned into a CBI type of presentation resource. Create a flowchart to show the content of a CMI to cover this topic. Expand on the following flow chart (add boxes as you wish). Also, use lines to connect the different boxes. Eventually, each of the boxes on your chart can become a single screen of the final CBI package. Flowcharting is an important stage in development; it assists the development team to articulate ideas and evaluate various instructional design issues.*

Also, think how you could reorganize your CBI into a reusable learning object type of resource.

4.4 Theoretical Perspectives of Uses of Visuals and Interactive Representations in Instruction

When designing presentation resources, various modalities (or modes) can be integrated in a display in a way that supports communication and learning of declarative knowledge content. For De Jong et al. (1998), the term 'modality' indicates a particular form of expression such as text, animations, diagrams, graphs, algebraic notions, formula, tables and videos. Although visuals and main points summarized in textual format often dominate presentation resources, other modalities, such as sounds, animation, transitions and special effects are used to emphasize important points, provide signals and capture attention. Nevertheless, visuals are the most important mode of representations (or representational modality). By visuals, we mean the whole set of possibilities such as diagrams, charts, logos, signs, illustrations, cartoons, photographs, and even tables. When visuals are used with other modalities, e.g., text, these need to supplement each other and work in a way that enhance transfer and knowledge content learning. When multiple representational modalities are combined in a single knowledge content presentational piece, we refer to that resource as multimodal text in general, or a representation, more specifically in the context of teaching and learning.

This book proposes that visuals (visual affordances) are the most powerful mode of representation for all forms of digital learning resources. They can communicate maximum information in a smallest screen space. The second most important affordance of contemporary technologies for the design and presentation of information is interactivity (interactivity affordance). Interactivity makes possible for a large amount of information to be integrated, structured, presented and linked in a screen display of a resource, while making it possible to represent and illustrate conceptual properties, relationships and parameters. New or existing information can emerge based on configurations obtained through learners' interactions with screen elements. Also, other external parameters and data emerging spontaneously from an environment, in addition to screen interaction elements, can be used to manipulate information, for example, global positioning location obtained through GPS connectivity, or time of day.

Most critical for instructional presentation resources is how to effectively design and present information in a way that assists learners to follow, remember and understand the lecture. Visuals assist students to recognize patterns (e.g., comparisons, contrasts and regularities), and use these as mnemonics and schemas for understanding and remembering knowledge content. Visuals are prominently used in the design of presentation resources that supplement a lecture, while interactivity is limited and used mostly for navigation between screens. However, even with tools such as PowerPoint, some effective interactivity can be built into the screens. Nevertheless, the application of interactivity significantly increases in the design of presentation resources for self-learning.

Specific techniques to effectively create visuals to communicate data and information are best described in the collection of works by Tufte (1990, 1997, 2001): “Visual Explanations”, “Envisioning Information” and “The Visual Display of Quantitative Information”. Tufte suggests a range of visuals (e.g., graphs, illustrations, icons, pictures) to represent anything from everyday concepts to complex scientific information and data. For Tufte, visuals should be built on a single principle: present complexity through visual clarity. Tufte acknowledged that the possibilities for visualization of data and information are expanded with new technologies that allow representations in three-dimensional and animated formats. However, Tufte does not examine the use of visuals for teaching and learning, and he remains focused on effectiveness of communication of data, information and ideas in fields such as publishing, journalism, statistics or marketing. Nevertheless, a list of recommendations that he suggests, are valuable and should be considered in the design of visual material for education as well. Recommendations and principles are featured in Table 4.3.

Contemporary technology offers a spectrum of possibilities for the design and delivery of visuals. Previous research on text informs that learners are likely to learn more when text is supported with visual information, rather than with text alone (see Alesandrini 1984; Clark and Mayer 2016; Dale 1946; Dean and Enomoth 1983; Levie and Lentz 1982; Levin and Berry 1980; Mayer 1989; Paivio 1986; Shallert 1980). Purposefully included in this list of older publications are to indicate that the capabilities of visuals to support learning have been documented much before today’s powerful multimedia-enabled computers, and a variety of mobile devices. Even as early as 1946, Edgar Dale (see Dale 1946) expanded on Confucius’s saying “I hear and I forget—I see and I remember—I do and I understand” and developed what became widely known as the ‘Cone of Experience’. Cone of Experience is a visual representation that summarizes Dale’s classification of types of learning from the most concrete to most abstract experiences. For Dale, learning, usually, is a combination of concrete and abstract experiences, and he suggests that visualization becomes more important for understanding as learning experience becomes more abstract. See Fig. 4.4 for a modification of the original Edgar Dale’s Cone of Experience.

Reflecting on Dale’s proposal, teaching and learning should lead students to be active and gain experiences, engage in doing things, and use and/or develop media rich resources in these processes. This diagram suggests that for learning, it is essential to engage knowledge use, not just in passive consumption of knowledge content at the upper part of the triangle in the center (please see Chap. 1 and revisit the 3D curriculum model).

Paivio (1986) suggests another important idea that learning is empowered by visuals, because their content is processed simultaneously in image and verbal systems of memory. Based upon this idea, Mayer (1989) conducted a study to explore the impact of a visual display of some system (e.g., electric circuit or radar) upon learners’ conceptual recall, verbatim retention and transfer of what they learned to solve new problems. A visual display for Mayer “… *highlights the major objects and actions in a system as well as the causal relations among them*” (p. 43).

Table 4.3 Edward Tufte's recommendations and principle for visual design—adapted and modified based on Venkatesh (2001)

Recommendation	Description	Example
Show cause and effect	When we try to comprehend something, we are looking for information to understand the underlying mechanisms. Reasoning is about examining causality. A visual should not only provide descriptive narration, but also explain the cause and effect	Tufte uses an example of John Snow's medical detective work examining the cause of Cholera epidemic in London in 1854 (see http://www.ph.ucla.edu/epi/snow.html). Comparing two sets of data about the number of deaths and their corresponding locations. Snow recast the one-dimensional temporal data sets into a two-dimensional spatial comparison that helped him pinpoint the contaminated pump well
Make comparisons	To be persuasive, which is the ultimate goal of communication, together with what is the cause, and what is the effect, the third important question that needs to be answered is, compared to what?	Citing the same example of the Cholera epidemic, Tufte describes how Snow's map with great clarity, presents several clues for comparison of the living and the dead, and clues about various locations etc.
Make displays multidimensional	Tufte argues for a feature of a design of information that utilizes multidimensionality in order to maximize the amount of information presentable	To demonstrate this principle, Tufte shows a 19th century map of Napoleon's 1812 march into Russia (see Chap. 2). The map shows multiple dimensions on a two-dimensional paper (e.g., the size of the army, direction the army is moving, temperature, and date). On a single sheet of paper with no text, Minards captures Napoleon's disastrous adventure to take Russia
Integrate words, numbers and images	Tufte stresses on the importance of telling a "coherent story". This means avoiding references for figures and examples, which are physically removed from the flow of the text. Information for comparison should be put side-by-side, that is, within the eye span, not stacked in time on subsequent pages	Again, Minard's map is the best example of how this is achieved

(continued)

Table 4.3 (continued)

Recommendation	Description	Example
Effectiveness of visual design depends upon the quality, relevance and integrity of the content	Good design is clear thinking made visible	Tufte features a book by Galileo published in 1613, which reports the discovery of sunspots and the rings of Saturn for the first time. The report of the discovery of sunspots has a simple drawing of the sun on each page to show daily observations. From these observations, he learned that the sun was rotating as the spots moved across the page and changed the apparent shape at the edges due to foreshortening
Sleight of hand	For Tufte, magic is expressed in five dimensions: 3-dimensional space, time, and what is revealed and concealed. Tufte calls magic the art of "disinformation design"	Tufte identifies several devices that magicians employ to misinform their viewers. They are: disguise, deny, conceal, obscure, manipulate, suppress context, prevent reflective analysis and distract. Hence effective information design involves doing exactly the opposite of what magicians do

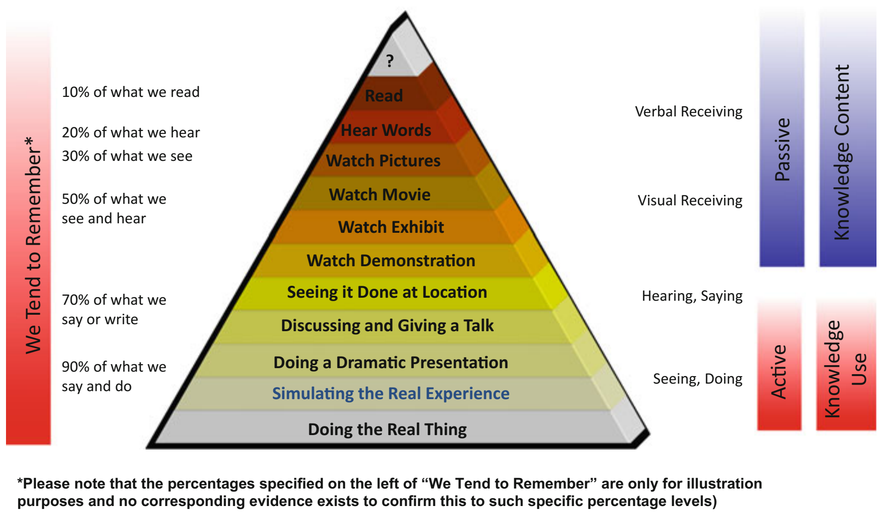

Fig. 4.4 Edgar Dale's Cone of Experience (modified by the author and others, such as Richard Felder who developed so called 'Cone of Learning')

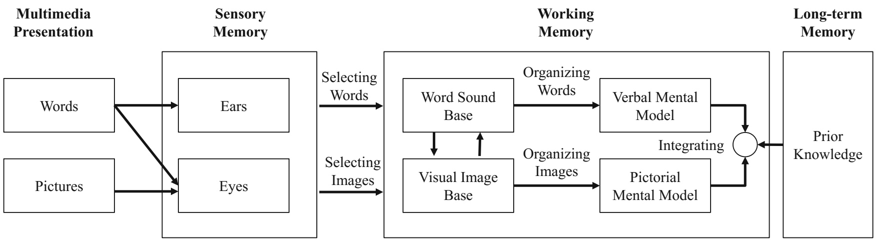

Fig. 4.5 Processing of visuals and verbal/words model (Mayer 2003)

For Mayer, a visual display, which he calls a '*conceptual model*', facilitates the development of learners' '*mental model*' of a system being learnt. By comparing two groups of learners, one that learnt with a conceptual model and another who learnt with conventional text information, Mayer understood that the visual model led to improved conceptual recall while at the same time, it resulted in reduced verbatim retention. As an explanation for this manifest, Mayer suggests that "… *the model helps students reorganize the material to fit with their conceptual model and when students actively reorganize the material they tend to lose the original presentation format*" (p. 59). Mayer acknowledged that there might be a problem if learners were expected to sit for a traditional test that expects the recall of information presented by books and teachers. However, the key understanding from Mayer's study is that learning with visual models improves the ability of learners to transfer what they learnt to solve new problems. Mayer further suggests that a possible reason for this transfer might be that students have constructed mind models that they could mentally manipulate when solving a new problem. Furthermore, Mayer (2003) expanded on these ideas and developed a model of how visual and verbal/textual information are processed during learning with multimedia material (see Fig. 4.5).

According to this model, words and pictures are processed through different sensory channels/memory. Certain elements of that information are then selected for processing thought working memory, resulting in an integrated mental model of the content being presented. This mental model then is contrasted and integrated with prior knowledge and, if a set of required conditions are met, stored in long-term memory. Based on such ideas, Mayer and his followers conducted a set of studies and developed the so-called, 'Theory of Multimedia Learning', providing a set of empirically developed guiding principles for the design of resources for learning for delivery via computer screens. These principles are:

- *Multimedia principle*—a resource for learning should integrate visual and verbal information, not verbal alone.
- *Split-attention principle*—words and pictures should be physically and temporally integrated in a screen.
- *Redundancy principle*—the same information should not be presented in more than one format within a screen.

- *Modality principle*—words should be spoken rather than written (in conversational rather than formal style, using a standard-accented human voice).
- *Segmenting principle*—multimedia messages should be presented in student-paced segments.
- *Pre-training principle*—names and characteristics of main concepts should be familiar to students.
- *Coherence*—extraneous material should be excluded.
- *Signalling*—cues should be used to highlight the organization of the essential material.

However, there might be limitations with this interpretation of the processing of pictures and words, especially when we consider contemporary representational technologies, interactive and integrated displays and multimodal text. For example, it is not clear how visuals and other modalities are cognitively separated from a single representation for processing into different sensory channels. Furthermore, learning is a complex phenomenon which most often includes an activity, rather than a mechanical process of inputting information and building mental representations from words and pictures and based on prior knowledge. In his later work, Mayer attempted to deal with this complexity by arguing that learning is a sense making and knowledge construction, however, this reaming to be at the surface rather than at any significantly deep theoretical level. Nevertheless, certain ideas and subsequent studies conducted by Mayer and colleagues subscribing to his theory of multimedia learning, provide useful ideas for the design of instructional material such as presentation resources.

Important
Knowledge is never a representation of the real world but a collection of conceptual structures adopted from an experience.

Van Someren (1998) proposes a similar idea in his edited book 'Learning with Multiple Representations' when suggesting that technology allows the integration of multiple representational formats into a single learning resource. This book explores a range of studies on different aspects of representations in learning. In one chapter of the book, van Someren et al. (1998) suggest, consistently with Mayer (2003) and Paivio (1986) that '*human cognitive architecture*' consists of different centres responsible for different modes of representations. For example, there are different centers for images and text processing. For these authors, what they call multiple representations, supports learning by allowing learners to cognitively link different representational modalities (e.g., visuals and auditory). Learners who learn in this way would be able to mentally change modes of internal representations, and this would facilitate independent problem solving and other reasoning tasks. A different chapter by Boshuizen and Hermina (1998) suggests that this is possible because different representational modalities are more efficient for dealing with different parts of a problem solving or reasoning task. In another chapter, De Jong et al. (1998) suggest that multiple representational modalities support different learning preferences and allow learners to select a suitable representation to be integrated in their personal knowledge construction process. However, De Jong et al. (1998) warns that the use of representations should be carefully planned in consideration of: (a) type of test to be used to test learners, (b) type of domain knowledge (more appropriate for “how it works” domains), (c) type of learners (more appropriate for novice learners), and (d) the type of support needed for learners to encode representations. Although the book provides useful discussion about the affordances of technology to bring together various media elements into multiple representational resources for learning, it fails short of addressing the importance of interactivity for enabling learners to manipulate these resources through their personal knowledge construction process and a learning activity. Interactivity was very briefly mentioned by Boshuizen and Hermina in their definition of a representation as “… *a format for recording, storing and presenting information together with a set of operators for modifying the information*” (p. 138). However, defining an aspect of a representation in terms of technical functionality might not be very helpful. This should be defined in terms of learners’ interactions with screen elements and the manipulation of properties of displayed modalities. However, more serious concerns with this book is a concept of learning environment as an integrated multimodal representation. Any representation should only be considered as a tool for the mediation of learning activates, but neither activity nor any tool (including digital resource for learning) alone can constitute an environment. Technology can be a part or an extension, but not a replacement to an environment in which we find ourselves to exist. In addition, van Someren’s book is similar to Mayer (1989) in discussing representation as a tool that improves an old approach to teaching and learning, thus, bringing to question how representations lead to improvements in learners’ traditional test results. With new technology, the activity itself has to change (Salomon et al. 1991). With changes in activity, evaluation should focus on processes and artefacts created by learners through an activity where they construct and use knowledge (and develop new literacies). Thus, all this brings us to the problematic nature of a concept of a representation.

For us in this book, representation is a media design with the purpose to mediate the processes of knowledge construction and use. It is a visual (and interactive) tool that mediates our thinking and decisions. It represents disciplinary knowledge content required to complete an intellectual task (theoretical thinking) and, as such, it is not information to be remembered for later reproduction. Rather, some functional properties of a representation and its affordances become internalized through its intellectual use, and later becomes a form of a physiological tool and a resource in our cognition. Ideas, concepts, information and data displayed are represented, not in their raw formats, as they might exist in the world, but in more effective, organized and simplified ways though the integration of various representational modalities such as pictures, drawings, test, audio, video, animation special effects, and colors. When multiple modalities are used to represent a piece of content, often a term ‘a representation’ is suitable to refer to such a design. The problem with a representation is when this concept is used for an internal form of knowledge existing in one's mind. To make a presentation resource more educationally effective, its content should include representations of key knowledge content. However, learning, again, is not just copying these representations into learners' minds, but a reconstruction of an experience.

Important
A multiple representation, a pedagogical model or a digital resource for learning must be considered as a tool with a purpose to mediate a learning activity rather than as a vehicle used to display material to be copied to a learner's mind. In this case, the focus of our analysis in the design of learning experiences shifts to an activity and away from mapping of external into internal or vice versa.

Fraser (1999) distinguishes between a mental model, which 'exists' in the mind of a learner and a 'pedagogical model' (a representation) designed to facilitate a learner's construction of that mental model. He suggests that interactivity and visualization enable the creation of powerful pedagogical models, something that no previous technology was able to effectively combine for the purpose of learning. An important issue in Fraser's view is the division between a mental model as something in the mind and a pedagogical model as something in the world, and the two are not identical things. This division is, in fact, important, and literature confuses the matter by using the term representation to interchangeably refer to things of the mind and things of the world. This portrays a picture that there may be representations in the world, which can be copied or transported to, rather than deconstructed in the world through a learning experience. Von Glasersfeld (1997) suggests that representations exist only in the world but not in the mind. He writes that "*… the term representation is used for mental images that are supposed to reflect, or correspond to things that lie beyond our experiential interface*" and that this "*… use of representation is misguided, because it entails the belief that certain ideas we abstract from our experience correspond to a reality that lies beyond experience.*" For von Glasersfeld, knowledge is never a representation of the real world, but a collection of conceptual structures adopted from an experience. It is the learner who deconstructs segments parts of his or her experience into "*raw elementary particles*" and combines these into conceptual structures. This experience must be more than just learners' contact with instructional materials and it should include an "active struggle" with such materials (e.g., use of digital resources for learning) in order to subtract useful understanding, which informs thinking and decisions within a learning activity. A multiple representation, a pedagogical model or a digital resource for learning must be considered as a tool with the purpose to mediate a learning activity rather than as a strategy used to display material to be copied to a learner's mind. In this case, the focus of our analysis in the design of learning experiences shifts to an activity and away from mapping of external into internal or vice versa. A cognitive residue resulting from a tool-use experience can be considered as an 'interiorized' psychological tool. Interiorization of an external tool is not mapping or copying of an external representation into an internal cognitive residue. Interiorization possibly occurs through the deconstruction of an external tool and tool-using experience, and reconstruction of its elements into an intellectually useable residue. This process is likely to be mediated with other auxiliary means, which replace original elements of an external tool, prior knowledge and one's own cognitive capacity at a particular stage of conceptual development.

As noted in this book, in addition to visuals, a distinct feature of contemporary technologies and their affordances for representation is interactivity. White, as early as in 1984, writes that interactive visual capabilities of computer technology provide opportunities for representations to be developed as powerful tools for learning. Some years later, Fraser (1999) advises that the level to which a learner gains the same pedagogical benefit from a printout of a digital resource as from the digital resource viewed via a screen, is the extent to which nothing of pedagogical value was done by using technology. What difference does technology make? For Fraser, interactive visual capabilities of contemporary technology provide unique opportunities for the communication of mental models to learners through pedagogical models (representations). Fraser writes that:

> In the past, we relied on words, diagrams, equations, and gesticulations to build those models piece by piece in the minds of the students. We now have a new tool – not one that replaces the older ones, but one that greatly extends them: interactive computer visualization. Today, a teacher can build a pedagogical model, and both student and teacher can interact with it to explore the behaviour of the system in a way inconceivable in earlier times. The amazing thing is that such interactive models can be readily delivered through the Web not only into the classroom, where the teacher can use them to help communicate concepts, but also into the computer laboratory, the dormitory room, and the home, where the student can interact with them to explore ideas.

However, rather than thinking of interactivity as an affordance of technology that affords the design of a representation, as rightly suggested by White (1984) and Fraser (1999), the literature often discusses interactivity in terms of content navigation through structured instructional sequences with feedback and directions. It often appears in the literature that interactivity is traditionally discussed in the context of a learner's acquisition of subject matter from digital resources carefully designed to present appropriately paced content and corresponding cycles of question-interaction-feedback-remediation sequences. Digital resources are often considered to be the direct causes of learning in the same fashion that teachers are traditionally considered. Thus, these kinds of educational material are often perceived as a replacement for teachers and classroom teaching. Unlike learning from a teacher, such resources allow learners to revise and go through material as many times as they need. Interactions can be tracked and recorded into a database, which allows a teacher to obtain certain quantitative indicators regarding a learner's involvements with the resource (e.g., sections attended, duration of time spent in each section, and results from quizzes). Therefore, interactivity is expected to support learners to learn subject matter embedded in digital resources. For example, Jonassen (1988) writes that the quality of the interaction is generally a function of the nature of the learner's response and computer feedback, and that "if the response is consistent with the learner's information processing needs, then it is meaningful" (p. 101). This is also supported by Spector (1995) in Sims (1997) who suggests that although creating effective interface is important "… *the critical factor (of learning effectiveness) is more likely the learner's mental engagement or involvement with the subject material*". Sims (1997) writes that interactivity in educational material must support learning. Sims developed a classification of different levels of interactivity and proposed three dimensions by which interactivity may be perceived: engagement, control and interactive concept. The engagement dimension refers to interactivity for navigation or for instructional purpose. The control dimension refers to the level to which the resource or a learner makes navigational and/or learning decisions. The third dimension, interactive concept, indicates the type of interaction expected under the varying conditions defined by the content presented.

For us in this book, interactivity affords the design of digital resources that can be used as mediating tools in learning activities. It is a feature of a tool, not a cause of learning. Technology-based interactivity is what separates contemporary digital resources for learning from all previous forms of educational material such as print-based material, analogue video, audio, non-digital toys, and even manipulable material (e.g., pop-up books and Algebra Blocks). Although the digitization of traditional resources is made possible by contemporary technologies (e.g., scanning) and improved access, the simple conversion of these resources should not be understood as a creation of historically new kinds of educationally useful resources (e.g., by scanning a textbook and creating an electronic e-book). The fundamental question for any new tool in human praxis is how the tool is a product of historical development of previous generations of tools and socio-cultural developments of humans (Vygotsky 1978; Engeström 1987). As a new kind of tool in teaching and learning, digital resources for learning must build on our previous and emerging understandings of media, psychology and pedagogy, and extend upon affordances brought about by new and emerging technologies. Interactivity adds the critical dimension to the design of the forms of educational resources—the digital resources for learning.

In the context of more contemporary pedagogical approaches, learning is understood to result from conscious psychological processes, where these occur within an engagement in an activity (e.g., Davydov 1999; Engeström 1987; Jonassen and Rohrer-Murphy 1999; Hedegaard and Lompscher 1999). In these, a digital resource for learning is a tool that mediates an activity. However, no resource or a person is a direct cause of learning because knowledge does not directly transfer from a teacher, social context or a resource to a passive learner. In this thinking, it might not be appropriate to discuss interactivity as a cause of learning, but rather, only as an effective strategy for representing and organizing data, information, conceptual content and ideas into a digital resource for learning. The concept of "feedback" traditionally associated with interactivity also needs to be reconsidered in the context of more contemporary approaches. The major feedback that learners receive comes from their engagement in a learning activity (not from a digital resource for learning or other tools alone). A further issue with interactivity is that it is often discussed as a strategy that makes for easy navigation. Real-life situations require individuals to struggle with complexity and no educational activity should over-simplify that situation. Interactivity should be explored as a strategy that preserves this complexity.

In this book, we want to reiterate that visuals used in the design of presentation resources (and other forms of digital resources for learning) should strictly be the ones supporting representation of knowledge content. A significant problem arises when design includes irrelevant content, such as fun characters and decorations. Some teachers and designers hold the view that learning should be fun and, therefore, their design includes irrelevant fun-like characters and content-irrelevant multimedia with the intention to extrinsically motivate learners and make the learning process more entertaining. This is problematic in numerous ways, such as described below:

- Learning, most often, is not a fun activity, and a minority of individuals like to learn, unless it is purpose directed and related to personal goals. The strategy of making learning fun might work for some young learners (e.g., in lower primary school and kindergartens), as well as learners with special needs (e.g., autism), however, the very moment when disciplinary concepts become critical in a curriculum, it becomes much less important to worry about extrinsic motivation. Learning should be led by an interesting activity, but trying to make it fun, will not take us very far in teaching, at least not across all levels of schooling and university studies. Intrinsic motivation is critical for engagement, and engagement is strongly related to the achievement of learning outcomes. The designers of digital resources should think about aspects of activities where digital resources for learning will be used. This is what this module refers to as "design for learning uses". Engagement and intrinsic motivation occurs with these activities, where digital resources are tools that mediate these. Also, this is valid for the design of presentation resources which intends to either support teaching or be used as self-learning material.
- Unnecessary content (e.g., cartoon-like characters meant to be making learning fun) overloads cognitive capacity, that is, it creates unnecessary cognitive load, which is committed to analyzing irrelevant rather than relevant information. The cognitive load should not be focused on having fun rather than addressing the requirements of an activity where learning occurs.
- Motivation for learning is not caused by resources; rather it is a learning activity that facilitates students' motivation and engagement. When students are engaged in learning activities that they are interested in and that are related to their intrinsic motives, they are more likely to learn even from not so well-designed content. Engagement in learning is something that traditional teaching and presentation resources significantly fail to achieve.

- Creating content-related fun elements, animations and special sounds, while not contributing much to learning, unnecessarily complicates and makes considerably more expensive the process of design and the development of digital learning resources.

Important
Intrinsic motivation is critical for engagement, and engagement is strongly related to the achievement of learning outcomes.

In summary, visuals are powerful representational means for the communication of declarative knowledge content. In the case of instructional presentation resources, visuals significantly enhance teachers' ability to communicate declarative knowledge content in simplified ways; maximize the amount of content presented within specific time frame and a display; and empower learners with a framework for understanding the content. Interactive affordances add further possibilities to the design of representations to be utilized with in-presentation resources. When designing instructional presentation resources, visuals should always lead the design and text, and other modalities that should be used to supplement these and summarize and emphasize key aspects of information being delivered. This kind of resource aims to enhance and support teachers in delivering their lectures and, as such, alone, the resources should not be used as self-learning material. Alternative forms of presentation resources for self-learning of declarative knowledge content can be effectively designed by utilizing contemporary representational technologies. However, even though both of these kinds of presentation resources are designed with the intention to support traditional approaches to teaching and learning, they can find uses in the context of more contemporary, learning-centered, activity-based approaches. Presentation resources, if used in a learning activity, become information displays, delivering certain information to learners to use when completing their activities. In later parts of this book, we examine the concept of learning activity in greater details.

Activity 4.4
Previously in Chap. 2*, you designed an information display resource, which presented organized information about the atmosphere. Now, let's assume you want to teach a class about the atmosphere, and you need a presentation resource to help you in the process.*

Use Prezi.com to design an instructional presentation on the topic of 'Atmosphere' to support your teaching. Alternatively, you can design an instructional presentation resource to support a teacher to teach the topic of the 'Shape of a rain drop'.

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