Anchored Instruction: Developed by the Cognition and Technology Group at Vanderbilt [CTGV] (1993), based on the concept of creating a semantically rich “anchor” that illustrates important problem-solving situations. These anchors create a “macrocontext” that provides a common ground for experts in various areas, as well as teachers and students from diverse backgrounds, to communicate and build collective understanding (CTGV, 1993). Macrocontexts can be used to integrate concepts across curriculum in which meaningful authentic problems can be posed. The anchors can serve as contexts for collective inquiry in classrooms and research on learning.

Assessment: Term used for evaluating student achievement of learning outcomes in some way. For example, this may involve indicators of performance of a task or skill; behaviours, attitudes or assessment of knowledge (understanding, application).

- **Norm-Referenced Assessment:** An assessment method that designed to measure and compare individual students’ to those of their peer group (that is, norm group). It measures relative performance rather than absolute achievement.

- **Criterion-Referenced Assessment:** An assessment method that measures student knowledge and understanding in relation to specific standards. It measures students’ performance in relation to standards, not in relation to other students; all students may earn the highest grade if all meet the established criteria.
• **Reliability and Validity**: A valid assessment is one that measures “what it is supposed to measure” (Biggs & Moore 1993, p. 409). In designing assessment we often rely on expert judgment of validity, that is, whether the success at the assessed task implies achievement of the learning outcome. Validity is a large and fascinating topic in its own right, trying to establish validity in an objective way is by no means trivial. Biggs (1999, p. 152) argues that valid assessment “must be of the total performance, not just aspects of it.” Reliability concerns how consistent the results of some assessment can be made buy different assessors, on different occasions. It is vital that summative assessments are both reliable and valid. This generally requires large amounts of time and often moderation by other assessors. Formative assessments on the other hand should be valid, but need not be reliable, the feedback is more important than the accuracy of the grade.

**Asynchronous Tools for Communication**: Those which do not rely on participants being available at the same time in order to communicate. Examples include e-mail and electronic forums (often called conferences or bulletin boards).

**Attitudes**: Complex mental states of human beings that affect their choices of personal action toward people, things and events. Learners have an attitude when they make consistent choices in repeated situations.

**Authenticity**: Used to indicate that the problem occurs in a sufficiently real-world context so that it is “true-to-life.” This real-world nature can be motivational for the student. However, authenticity is a relative term that varies with student experience: what is authentic to a 15-year-old and relevant to their experience is likely to be very different to that of a post graduate student.

**Behavioural Learning**: Described as a change in the observable behaviour of a learner, made as a function of events in the environment. The primary focus of the behavioural perspective is on behaviour and the influence of the external environment in shaping the individual’s behaviour (Newby et al., 1996). Learning in behaviourism is equated with changes in either the form or frequency of observable performance. The learner, in behavioural learning, is characterised as being reactive to conditions in the environment as opposed to taking an active role in discovering the environment.
**Blended Learning:** A relatively new term, used to denote the combination or integration of e-learning with traditional face-to-face learning. Littlejohn (2004) argues that there is not a precise definition and the term blended learning is often used to include integration of electronic forms of learning administration as well as electronic content delivery.

**Blogging:** see Web log

**Bloom’s Taxonomy:** Benjamin Bloom (1956) developed a taxonomy for categorizing level of abstraction of questions that commonly occur in educational settings of intellectual behaviour in learning. This taxonomy contains three overlapping domains: the cognitive, psychomotor, and affective. Cognitive is for mental skills (Knowledge), affective is for growth in feelings or emotional areas (Attitude), while psychomotor is for manual or physical skills (Skills). Within the cognitive domain, he identified six levels: knowledge, comprehension, application, analysis, synthesis, and evaluation. These domains and levels are very useful to help the development of critical thinking skills of students.

**Bruner Discovery Learning:** Bruner (1965) believes that learning is an active, social process; in which students construct new ideas or concepts based on their current knowledge. To Bruner, learning is a continual process that occurs in three stages. The first is Enactive in which children need to experience the concrete, such as manipulating objects in their hands, or touching a cat, in order to understand. Iconic is the second stage when children are able to represent materials graphically or mentally. They can do basic additions in their heads. Finally, Symbolic, children are able to use logic, higher order thinking skills and symbolic systems such as using formula. Bruner believes that knowledge is best acquired through discovery (Bruner, 1961). Interaction between students and instructors is necessary for discovery learning. Tutors should try to encourage students to discover principles by themselves. The tutor and student should engage in active dialog. Bruner also believes that the curriculum should be organized in a spiral manner so that students continually build upon what they have already learned.

**Case-Based Lectures:** When students are presented with case vignettes, or more complete case histories before the lecture. The cases highlight material to be covered. The students have to analyse the case using their prior knowledge, before any new knowledge is provided. This effect causes some oriented structuring of information provided in lectures, as opposed to possible restructuring of information already provided, as may occur in the lecture-demonstration method above. This is not self-directed learning.
Case Method: Where students are given a complete case for study and research in preparation for subsequent class discussion. The subsequent interactive case discussion in class with the teacher combines both student-directed and teacher-directed learning. There is a stronger challenge to hypothesis generation, data analysis and decision making with more active structuring of information. The method is also more motivating. However, the case study is already organised and synthesised for the students, thus limiting the amount of reasoning that will occur.

Cognitive Apprenticeship: A model of instruction developed by Collins and colleagues (1989) that makes thinking visible to students in learning. These authors believe that Cognitive Apprenticeship can be adapted to the teaching and learning of cognitive skills.

Cognitive Domain: Defined as learning that involves instinctual skills such as knowledge, concepts, rules and principles.

Cognitive Engagement: Observable when the learners are giving sustained, engaged attention to a task requiring mental effort; and authentic, useful learning is produced by extended engagement in optimally complex cognitive activities (Corno & Mandinach, 1983). Cognitive engagement and motivation are inextricably linked together through mental representations, monitoring, and evaluation of responses and strategic thinking (Stoney & Oliver, 1999). The highest form of cognitive engagement is self-regulated learning, where learners plan and manage their own learning and have a high degree of personal control and autonomy.

Cognitive Flexibility Theory (CFT): An integrated theory of learning, mental representation and instruction. It provides a number of heuristics to design instruction that avoids over-simplifying instruction by providing real-world cases, using multiple representations of content in order to enhance transfer and requiring knowledge construction by the learners, not knowledge retrieval. A central tenet of the theory is that revisiting the same material at different times, for different purposes, and from different conceptual perspectives is essential for attaining the goals of advanced knowledge acquisition (Spiro et al., 1991)

Cognitive Learning: Equated with discrete changes between states of knowledge rather than with changes in the probability of response. In cognitive learning, the issues of how information is received, organised, stored and retrieved by the mind is important. Learning is concerned not so much with what learners do, but with what they know and how they came to acquire that
knowledge (Jonassen, 1991). The most dominant of the cognitive learning theories is based on an information-processing approach.

**Cognitive Strategies**: Learners have acquired cognitive strategies when they have developed ways to improve the effectiveness and efficiency of their own intellectual and learning processes; when they can learn independently; when they can propose and solve original problems. This is the highest form of learning.

**Computer Supported Collaborative Learning (CSCL)**: Refers to the practice of using computer technology to support communication between learners in order to help them construct meaning. It is therefore based on social constructivist theories of learning.

**Constructivist Learning**: Theory is based on the assumption that knowledge is constructed by learners as they attempt to make sense of their experiences. Learners actively construct knowledge, based on prior experiences, and they are not empty vessels waiting to be filled. In constructivism, constructive processes operate and learners form, elaborate and test candidate mental structures until a satisfactory one emerges (Perkins, 1991).

**Critical Thinking Skills**: Ability to use logic and reasoning in solving problems. In order to help students to acquire critical thinking skills, students should be provided with environments where thinking skills can be learned and then practised in realistic situations. A strategy for teaching critical thinking skills includes: identifying the problem, deciphering the purpose, uncovering the assumptions, recognising and using different paradigms, demonstrating different methods of reasoning, examining data, creating alternative solutions and evaluating one’s thinking to improve it (Chubinski, 1996).

**Discovery Learning**: An instructional method that uses an inductive approach to find answers by students through the use of trial and error in problem solving strategies.

**Distributed (Virtual) PBL**: Distributed PBL (dPBL) refers to the situation where the participants in the PBL team are dispersed geographically. Typically communication and collaboration between team members during the PBL cycle is conducted using electronic means. Hence the term “virtual PBL” has been used to describe the same conditions. Distributed PBL may occur where all
participants are dispersed, or there may be variations where sub-teams are located in the same location. Such situations can mirror the modern work practice of employing globally distributed teams.

**E-Learning (JISC):** “Defined as ‘learning facilitated and supported through the use of information and communications technology’, e-learning may involve the use of some, or all, of the following technologies:

- Desktop and laptop computers;
- Software, including assistive software;
- Interactive whiteboards;
- Digital cameras;
- Mobile and wireless tools, including mobile phones;
- Electronic communication tools, including e-mail, discussion boards, chat facilities and video conferencing;
- Virtual Learning Environments (VLEs); and
- Learning activity management systems.”

Much has been promised about the potential of technology to revolutionise learning, with benefits identified in six key dimensions:

- **Connectivity:** Access to information is available on a global scale.
- **Flexibility:** Learning can take place any time, any place.
- **Interactivity:** Assessment of learning can be immediate and autonomous.
- **Collaboration:** Use of discussion tools can support collaborative learning beyond the classroom.
- **Extended opportunities:** E-content can reinforce and extend classroom-based learning.
- **Motivation:** Multimedia resources can make learning “fun” (JISCa, n.d).

**Facilitator’s Guide:** A document that replaces the traditional lesson plans and scheme of work. It is particularly necessary if there are a number of tutors running the course to help achieve a level of consistency. Typical contents include: A schedule for the PBL case, identifying milestones, activities, deliverables; Sample questions to ask at each meeting; Assessment criteria; Details of what you expect students to achieve at each stage. E.g.: After the first session the key learning issues/appropriate resources.
FIRO-B®: (An abbreviation for Fundamental Interpersonal Relations Orientation-Behavior). The FIRO-B is a proprietary psychometric tool for helping people understand themselves and how to work with others. There is a 54-item personality questionnaire to measure dimensions of interpersonal relationships: inclusion, control and affection.

Formative Assessment: “Formative assessment is designed to provide learners with feedback on progress and inform development, but does not contribute to the overall assessment” (QAA, 2000, p. 4).

Group Dynamics: Implies that individual behaviours may differ depending on individuals’ current or prospective connections to a group. It is also Phenomena that occur in groups based upon their interactions and interrelations.

Guided Design: Name for a scaffolding technique where students are prompted through the decision making process by a set of printed instructions, their answers are checked by the tutor and sample feedback answers are provided at appropriate times. Students are asked to reflect on any differences. This approach constrains the student, reduces their ownership and also requires a large amount of preparation by the tutor. It can be a very good way to introduce aspects of PBL, and the degree of guidance can be relaxed in later cases.

Holistic Assessment: Recognizes overall performance on the task, rather than analyzing and giving marks for each component part. In the latter it could be possible to achieve a pass by knowing very thoroughly several components of the solution, but being incapable of evaluating it in context and synthesizing a viable solution. This holistic approach corresponds to a qualitative view rather than a quantitative view; judging how well the knowledge and skills are integrated, rather than how much the student knows.

Information and Communication Technologies (ICT): “The building blocks of the Networked World.” ICTs include telecommunications technologies, such as telephony, cable, satellite and radio, as well as digital technologies, such as computers, information networks and software.” (Harvard Center for International Development, n.d.) http://cyber.law.harvard.edu/home/

Information Processing: Views the learner as a processor of information in the same way as a computer. Learning occurs when information is input from the environment, processed and stored in memory and output in the form of some learned capability. Learning is therefore perceived as information processing.
Instruction: Concerned with teaching. It makes use of deliberate arrangements of learning conditions to achieve an intended goal. Newby and others (1996) defined instruction as the selection and arrangement of information, activities, approaches and media to help students meet predetermined learning goals.

Intellectual Skills: Individuals use intellectual skills when they show competence, or interact with the environment using symbols or language. They demonstrate that they know how to do something of an intellectual nature.

Intelligent Tutoring System (ITS): “ITSs are computer-based learning systems which attempt to adapt to the needs of learners” (self, 1998). This involves the application of artificial intelligence techniques to model aspects of the learning process, such as domain knowledge, learner's knowledge and teaching knowledge.

Kolb Experiential Learning: (1984) Suggests that learning is the process whereby knowledge is created through the transformation of experience. His theory provides a way of structuring and sequencing the curriculum and indicates how a session or whole course may be taught to improve student learning. Kolb’s experiential learning structures a session or a whole course using a learning cycle. The different stages of learning are associated with the different learning styles. The core of Kolb’s four stage model is a simple description of the learning cycle that shows how experience is translated through reflection into concepts, which in turn are used as guides for active experimentation and choice of new experiences. The four stages are: concrete experience (CE), reflective observation (RO), abstract conceptualization (AC) and active experimentation (AE). Because learners have to go through the cycles several times, it is best thought of as a spiral of cycles. The different stages are associated with distinct learning styles. Kolb believes that student develops a preference for learning in a particular way.

Learner-Based Cases: Where the teacher presents the students with information in lectures and then a case or two, usually vignettes, to demonstrate the relevance of the information. Learner-based cases are typically used by teachers in their teaching and often referred to as PBL. However, this method does not directly foster any of the objectives required of PBL. Students are typically asked to understand the case presented in terms of information in the lectures and some of the information may be restructured by students. Although some hypothesis generation, data analysis and limited decision making may be required, there is no inquiry or case-building skills involved.
Learning: Defined as a persisting change in human performance or performance potential. There should be a change in performance brought about as a result of the learner’s interaction with the environment Driscoll (1994). It is measured by the amount of change that occurs in an individual’s level of performance or behaviour. This change occurs over time and results from specific experiences such as practice (Newby et al., 1996).

Learning Companion System (LCS): (Chou et al., 2002) An LCS is a development of an Intelligent Tutoring System (ITS) but whereas an ITS is built around a pedagogical model of instruction, educational software agents within an LCS can have a variety of roles, for example: a competitor, collaborator, troublemaker or critic.

Learning Environment: The physical surroundings in which learning takes place.

Learning Issue: A topic that requires further study outside of the tutorial meeting. Learning Issues are critical for successful development of self-directed learning. A good learning issue is presented in the form of an answerable question; is focused, requiring specific information; pursues information that is relevant to the problem; goes beyond superficial knowledge to probe conceptual issues and is often set in a context that provides direction (UDEL).

Learning Outcomes: These define the knowledge, skills, and abilities that students will attain as a result of their successful completion of a particular set of learning experiences. Thus they are learner centred, rather than teacher-centred and define what a student will know, and what a student will be able to do at the end of the course. Quite often we use the terms Learning Objectives and Learning outcomes interchangeably. However, strictly we can differentiate between them in terms of specificity Objectives are usually detailed behaviourist statements which specify exactly the action that is to be assessed. Outcomes tend to be more general descriptors.

Learning Team Coach: The term we have used to refer to a student PBL team facilitator. The term coach is also used by Woods(1994). We believe it carries more positive associations than the term facilitator, the metaphor of a sports team coach, implying active involvement, being dedicated to improving performance of the team, calling to account individuals who do not perform, helping the team keep focus, celebrating success, but standing on the sidelines while the team performs (solves the problem) without doing it for them.
LTM: Long term memory

**Metacognitive Skills:** Are “thinking about thinking.” They are required when we are confronted with a difficult, unexpected or puzzling problem or situation. It is the conscious monitoring and direction of problem solving or reasoning activities (Barrows, 1988).

**Motor Skills:** Learners have developed motor skills when they perform a physical task utilising equipment or materials according to a routine procedure. Driving a car, throwing a ball or typing a letter are all examples of motor skills.

**OPV:** Other person’s viewpoint

**Patchwork Text:** (Winter et al., 1999) “This is a way of getting students to present their work in written form. Students build up text in course work over a number of weeks. Each component of work is shared with other students and they are expected to use different styles, such as a commentary on a lecture, a personal account, and a book review. This kind of assessment fits well with PBL because of its emphasis on critique and self-questioning.” (Savin-Baden & McDonald, 2004 p. 12)

**Peer Assessment:** Refers to the situation where students make judgments about each others’ work or performance. There are a number of different ways this can be used: Students can identify their own criteria to assess each other, though a more common approach is for students to assess each other with criteria devised by faculty. The former method fits with the PBL approach of empowering students. Faculty often feel more comfortable with criteria they have devised, though this does have a disadvantage that students may not interpret them in the way that faculty had intended. Any form of peer assessment requires preparation of the students. It is also important to consider how results are fed back and the weighting involved. Nevertheless, it can be a valid approach to assessing student contribution to a team.

**Portfolios:** Have been used in assessment for many years, usually consisting of a collection of samples of work over a period of time. Recently, Nicky Guard reports (guard, n.d.) that “portfolios are finding a wider application as a form of educational assessment, especially in the USA. Even though they may vary in format, educational portfolios distinguish themselves from other portfolios by including reflective elements. They are therefore not merely a collection of best
practice or artefacts but are also intended to document the learning process and involve students in actively reflecting on their learning.”

**Prior Knowledge:** Often characterised metaphorically as schemata—organised networks of prior knowledge. According to Bartlett (1932), *schemas* or *schemata* are the basis of all knowledge. Schemata provide means by which learners can compare and contrast to-be-learned information with existing knowledge, to assimilate new information meaningfully within existing knowledge and to continually restructure knowledge accordingly (Hannafin & Hooper 1993).

**Problem-Based Learning (PBL):** According to Barrows (1988) is “… the learning that results from the process of working towards the understanding of, or resolution of a problem.” Barrows describes the main educational goals as: to develop students’ thinking or reasoning skills (problem solving, metacognition, critical thinking) and to help students become independent, self-directed learners (learning to learn, learning management).

**Problem-Solving Learning:** The situation where students are provided with a problem (usually of a restricted nature) that they solve with knowledge that has been provided previously.

**Problem-Solving Skills:** In the context of PBL, these are identified by Woods Woods (1994,1996) and comprise: Awareness of problem solving processes; analysis of problems for issues; demonstrating a systematic approach; creativity; use of knowledge appropriately; generating & testing hypotheses; confidence in own ability.

**Problem Statement:** This is the initial statement that students are given. It is formulated as a problem or query or puzzle that the team has to investigate. The aim is for students to learn, not necessarily to solve the problem; however in many cases solving the problem achieves the same end. A problem statement is not merely an exercise; ideally it should be authentic and messy, providing a number of avenues for investigation.

**Programmed Learning:** An “educational technique characterized by self-paced, self-administered instruction presented in logical sequence and with much repetition of concepts. Programmed learning received its major impetus from the work done in the mid-1950s by the American behavioural psychologist B.F. Skinner” (Encyclopaedia Britannica on-line).
**Project-Based Learning:** Typically uses a production model. It consists of:
1. Identify the purpose for the creation of the end product and their audience,
2. Research the topic,
3. Design the product, and
4. Create a plan for project management. (Esch, 2000)

**Reflection:** A term that is widely used today in education to describe an active process of self-analysis of performance where the learner attempts to make some sort of sense of their experiences. Dewey (1933, p. 9) defined reflection as: “An active persistent and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusion to which it tends.” Boud et al. (1985, p. 19) explain reflection as “a generic term for those intellectual and effective activities in which individuals engage to explore their experiences in order to lead to a new understanding and appreciation.” Schön (1987) is well known for his suggestion that there are different levels of reflection: these are reflection-in-action (a characteristic of experts) and reflection-on-action (after the event).

**Reflection:** Means the pulling together of a broad range of previous thinking or knowledge in order to make greater sense of it for another purpose that may transcend the previous bounds of personal knowledge or thought (Moon, 2002). It normally involves complicated mental processing of issues for which there is no obvious solution (Dewey, 1933). This suggests that reflection implies a form of mental processing with a purpose and/or an anticipated outcome that is applied to relatively complicated or unstructured ideas for which there is not an obvious solution. Reflection therefore has close association with, or involvement in, learning and the representation of learning. There may be an overlap between the use of the words “reflection” and “thinking.” These words can refer to the same activity as in the notion of the “reflection practitioner” (Schön 1983). An example of this is that of taking an overview or “sitting back” from a situation to review.

**Reflective Journal:** A reflective journal enables the documentation of experiences, thoughts, questions, ideas and conclusions during the learning experience. By recording such information on a regular basis we reduce the chance of omission and we encourage a regular cycle of action planning. A journal can also provide a detailed evidence base when analysing and reflecting on a course as a whole.
Resource-Based Learning (RBL): Resource-based learning is an approach to learning where students are exposed to a wide variety of resources. PBL can be regarded as a specialised form of RBL, with a particular defined process, and particular requirements for the characteristics of the problem-statement.

Scaffolding: A term originally used by Bruner to describe tutorial interaction between an adult and a child. It is a metaphor of a temporary support for learning that is gradually removed. In this book it is used to refer to all forms of learning support, whether or not they be cognitively-based, logistical or emotional. It broadly refers to the range of services provided to assist students’ progress towards independent learning.

Seen Examination: A seen examination is one in which the questions are provided to students in advance of the examination. They are sometimes referred to as “pre-seen” examinations. Advantages of seen examinations are that they reduce the stress on students and remove the element of luck in “revising for the right question.” From a perspective of Problem-based Learning, they can be problem-statements that are individually assessed, which complements team assessment in PBL. Seen examinations also enable more complex questions to be set, since students have more time to explore and answer them. They also have the opportunity to clarify any aspects of the question that they are unsure of: you cannot answer a question you do not understand.

Self Assessment: The process by which students assess their own work. This may be using criteria they have developed, or by interpreting criteria developed by the tutor. It is well aligned with PBL, and is particularly easy to use for formative assessment. However, it is essential that students are prepared well for self-assessment; especially if they do not generate the criteria themselves.

STM: Short-term memory

Student-Centred Learning: When students take control of their own learning. Students should be actively involved in determining what their own learning needs are and how these needs are best met.

Summative Assessment: “Summative assessment provides a measure of achievement or failure made in respect of a learner’s performance in relation to the intended learning outcomes of the programme of study” (QAA, 2000, p. 4). Thus, work that is submitted during the module, and which is graded, counting towards the final mark is still classified as summative assessment.
**Synchronous Communication Tools**: Those that require participants to be communicating at the same time, though they may be separated geographically. Telephones, Web-cams, video-conferencing and instant messaging are examples.

**Trigger**: see problem-statement

**Tripartite Assessment**: (Savin-Baden, 2003) This is a method of assessment that balances individual and team marks as follows. There are three components: Firstly the team submits a report for which they receive a mark in the normal PBL manner. Secondly each individual submits the piece of work they researched. Finally the individual writes an account of the group process that is linked to the theory of group work.

**Triple Jump**: (Painvin et al., 1979) This is an assessment that has been specifically developed for PBL, but it is very time consuming. As the name suggests, the “Triple jump” exercise has three phases: hop, step and jump. In the hop phase the tutor questions the student. The step phase allows the student time to research the questions that have emerged from the first phase. In the final jump phase the student is provided with a written report of their findings.

**Tutor or Teacher**: These terms are used interchangeably to denote any person who is conducting the teaching or the tutorial process. In traditional classrooms, the tutor is usually the professor who is delivering the lectures. In the tutorial session, the tutor could be the professor or teacher or instructor facilitating the students in their studies.

**Undergraduate**: Refers to university students studying for their first degree. In the British educational system there is no direct equivalent to “high school graduates.”

**Virtual Learning Environment (VLE)**: A useful working definition is provided by JISC: “A Virtual Learning Environment is a collection of integrated tools enabling the management of on-line learning, providing a delivery mechanism, student tracking, assessment and access to resources.” These integrated tools may be one product (e.g. BlackBoard, WebCT) or an integrated set of individual, perhaps open-source, tools” (JISC n.d.). A VLE may link to administrative systems, both in-house and external. Such an integrated system is sometimes called a Managed Learning Environment (MLE).
**Viva**: An oral examination (shortened from Viva Voce).

**Weblog**: “A public Web site where users post informal journals of their thoughts, comments, and philosophies, updated frequently and normally reflecting the views of the blog’s creator.” (glossary of on-line education terms)

**Wiki** (pronounced “wicky” or “weekly”) or **WikiWiki**: As defined by the Wikipedia is a Web site (or other hypertext document collection) that gives users the ability to add content, as on an Internet forum, but also allows that content to be edited by other users.

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**References**


advanced knowledge acquisition in ill-structured domains. *Educational Technology, 31*, 24-33


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**Endnote**

1 http://en.wikipedia.org/wiki/Main_Page