Introduction

Once potential solutions have been identified and each learner is clear what they are to achieve it is time for the learner to reflect on stages 1-5. Once this has complete they then complete independent study to enable them to achieve their learning objectives.

Lesson 1: Reflecting on steps 1-5 and introducing self-study (Step 6)
Lesson 2: Identifying information sources and search strategies
Lesson 3: Searching for secondary data and evaluating it
Lesson 4: Gathering primary data

As a facilitator your job is to be aware of the work the learner needs to do during the self-study stage and be available to direct them as to where they can find material to help them to satisfy their learning objectives.

Lesson 1: Reflecting on steps 1-5 and introducing self-study

Firstly, the learner needs to reflect on:

1) In the opening stage (steps 1-5) have they acquired enough information to allow them to understand the problem and understand potential solutions.
2) If not, do they need to ask any additional questions of the PBL group in order to allow them to achieve their learning objectives?
3) What approaches should they use to achieve my learning objectives? Why will these be effective? What problems might arise and how can they deal with them (study plan)
4) Is there anything that may impact their ability to achieve the learning outcomes?
5) Does the learning objectives impact on tasks/work assigned to other PBL learners and other areas of the organisation? If so how can they integrate these?

It is important that as a facilitator you emphasise the importance of reflecting on these aspects prior to undertaking self-study.

Once the reflection is complete the learner needs to gather information related to each learning objective or the learning objectives assigned to them in the opening stage. The learner is required to collect, evaluate (the reliability) and apply material to a practical solution.

The approach that we will use is information literacy which is concerned with the ability to locate, understand and use information. This skill is a necessary competence in the workplace today (Gardner, 2000; Goad, 2002; Klusek & Bornstein, 2006).

Information literacy is identified the ability to "recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information" (ALA 2000).

Please see the below resources for videos explaining the role of information literacy in the workplace.

> **Supplementary Video Resource**
> http://libguides.uwf.edu/workforce

In the self-study step of PBL the learner is required to gather the information needed and apply it to achieve the specified learning objectives. There are several approaches to information literacy in the workplace. Both Goad, 2002 and Doyle, 2010 identified approaches specific to the work place, Goad used a 16 stage approach whereas Doyle uses 10 steps. Below are the steps which are common to both

1) Identifying the information need
2) Identifying the information sources
3) Developing a search strategy/question list
4) Gathering the information (information acquisition)
5) Evaluating the information
6) Applying the information

The rest of the lessons will be loosely based around these common steps. The first step which involves identifying the need for information need. The information the learner needs largely depends on the learning objectives outlined in step 5. See example below

> **Example**
> **For our cash flow problem.**
>
> "Learning objective 1: Examine best practices in forecasting"
>
> You might need information on:
> - The common approaches to forecasting.
> - Challenges in forecasting.
> - Success factors in forecasting.
> - What forecasting approaches do other companies use.

As a facilitator it is important that if the learner is unsure of how to identify their information needs you are available to assist them.

Lesson 2: Identifying information sources and search strategies

2.1 Identifying information sources
Prior to conducting their information search the learner will need to determine where the information resides. Or potential sources of information. Information may be

1) Internal to the organisation. It may be contained in metrics, reports, machines, on IT systems or the employees might have this information.
2) External to the organisation. It may be contained in benchmark reports, newspapers, research reports, market surveys, membership organisations or your competitors, suppliers

or customers may have this information

Also it may be in a number of forms

1) It may be textual in reports, presentations, forms etc
2) Online in social media, emails, IT systems, online reports etc
3) Human in the minds of staff, competitors, suppliers or customers

Furthermore, information may be

3) Primary data – which does not exist and which the learner will have to gather.
4) Secondary data – which has already been gathered for another purpose and which the learner can use

Example
For our cash flow problem.

"Learning objective 1: Examine best practices in forecasting"

Information sources for the below information needs might be
- The common approaches to forecasting. (Information sources will be secondary and may be external bodies such as: supply chain council, APICS, academic papers, courses)
- Challenges in forecasting. (Information sources will be secondary and may be external bodies such as: supply chain council, APICS, academic papers, courses. The student might want to gather primary data on other company's perspectives on their challenges in forecasting)
- Success factors in forecasting. (Information sources will be secondary and may be external bodies such as: supply chain council, APICS, academic papers, courses. The student might want to gather primary data on other company's perspectives on their successes in forecasting)
- What forecasting approaches do other companies use. (information sources will be mainly primary and will involve speaking to other companies you work with, your suppliers and customers, you could also search for information on your competitors)

2.2 Search strategies.

For secondary data much of the learner's information will probably be online. To search for information online it is important that the learner devises the correct search strategy. The words which they choose to look for information can significantly impact the results that they get.

For each information need it is important that the learner identifies the key terms and alternative words that might be used.

For example, for the information need "Common approaches to forecasting" identified in the above the search terms might be:

- Approaches to forecasting
- Other words for forecasting might be models, tools, techniques and frameworks.
- Alternative words for forecasting might be predicting sales.

If the learner is struggling to find information, it is important that you assess the search strategy they are using

In addition to the correct search terms the learner can use the search operators to make your search more accurate for example:

Operator	Meaning
Quotation marks ""	Search for the exact phrase "forecasting approaches"
Plus sign or quotation marks + or ""	In search engine common words such as which, that, the, I are not used in the search term. If you want to include these you can use the plus sign (+) or quotation marks ("") For example +The most common forecasting approaches "The most common forecasting approaches"
Minus sign -	To exclude words from a search you can use the minus(-) sign In the search for forecasting approaches a lot of weather forecasting techniques were displayed therefore we will remove this from our search Forecasting approaches – weather
OR	Allows you to search for two terms at the same time E.g. forecasting approaches OR Techniques Note this broadens your search

Table 1: search strategy operators
(See http://www.lib.berkeley.edu/TeachingLib/Guides/Internet/Boolean.pdf for more information)

Furthermore, many search engines offer search tools or advanced search terms to allow you narrow your search further. See the below example

Example
For Google search Engine to narrow your search.

1) Enter your search term and press search.
2) In the top toolbar there is a search tools option which allows you to narrow your search to your country, to a certain time period or only use exact terms.
3) In the top left hand corner there is a cog wheel, click on this and it gives you the option of doing an advanced search to enable you to narrow your search further.

Lesson 3: Searching for secondary data and evaluating it

It is estimated that the average employee spends 9.5 hours per week searching the internet with 3.5 hours being wasted from not finding what is required. To reduce this it is important to guide staff where to collect information, how to collect it and when to stop.   This lesson will examine:

- Where to search for secondary data? This looks at potential places information may reside
- How to evaluate the data you find? Over collection of information results in information overload, therefore it is important after the learner is finished collecting information they evaluate if what has been gathered satisfies their information need.

Once the learner has identified their search strategies it is time to find information. The first stage is looking for information on what work has already been done on the problem and satisfying your information needs as much as possible through using data that already exists or secondary data.

There a number of places learners can find this information and the place where the learner needs to go to access this information will largely depend on their information needs identified previously.

Category	Content/Purpose	Location	Tips
General Information	Web search for general information about a topic	www.google.com	Use the search strategies identified in lesson 2 to make your search more accurate
Academic site	Identifies academic research conducted in your specified area, it also searches for patents.	https://scholar.google.com/	
Library/Academic	Allows you to search for academic research conducted in your problem area	https://login.proxy.lib.ul.ie/login	If you are registered with a university for a programme or a course you will have access to their database of

			papers and resources (often thousands of them)
Educational resources	Higher education institutes now make some of their courses freely available online	www.moocs-list.com (whole courses) www.oercommons.org (course notes)	
Business databases	There are companies that provide business intelligence and advice for companies	Business balls – this is a free online training resource for business managers www.businessballs.com IBIS world – this site provides market advice and reports for businesses. You can view a snapshot of reports and have a free demo. There is a tailored subscription model for different companies for full reports once the demo period is up. http://www.ibisworld.com/ Gartner group – this provides research and market intelligence for information technology firms. It has free access for some publications. http://www.gartner.com/technology/home.jsp International data corporation – this provides market intelligence and business reports for technology firms. There is a free trial available. http://www.idc.com/ Research farm – this company are research analysts in the retail industry. You can download a free sample report and view abstracts for freehttp://www.researchfarm.co.uk/	Often charge for this service but you may be able to get a free trial or an overview of some of the reports which may help you solve the problem
Membership sites.	Often associations provide report and support to direct you to relevant sources of information	Marketing – Chartered institute of marketing www.**cim**.co.uk Finance – Association of chartered certified accountants www.**acca**global.com/ Supply chain – Association for professionals in supply chain http://www.apics.org/sites/apics-supply-chain-council Manufacturing – Association for manufacturing excellence - www.ame.org/ Sales – Association of professional sales - http://associationofprofessionalsales.com/ HR and training – Society for Human resources	

		management www.**shrm**.org or Continuing and professional development - https://www.cipd.co.uk/cpd Engineering – Irish institute for Engineers - https://www.engineersireland.ie/ Management – Irish management institute – http://www.imi.ie/ Distribution – Chartered institute of Logistics and transport - www.ciltinternational.org Purchasing – Charted institute of procurement and supply - www.**cips**.org Insurance – Chartered insurance institute - www.**cii**.co.uk. The international insurance professionals organisation allows you to download guides and best practices in the insurance industry - http://www.internationalinsuranceprofessionals.org/ Retail – The retail industry leader's association http://www.rila.org	
Government organisations and policy makers	These sites often contain information about the market of a particular industry and efforts that are being introduced to promote and sustain growth	OECD - Organisation for Economic Co-operation and Development (OECD) - www.**oecd**.org	
Books		Worldcat is a website that allows you to search for access books in other libraries throughout the world. https://www.worldcat.org/ Google books allows you to search content similar to a library catalogue. Depending on the agreement with the publisher google books will let you read an entire book or selected pages. https://books.google.com/ In some cases, people put books or chapter of books online to access these put your topic name and book pdf in google e.g. supply chain management book pdf	Google Books is also paired up with WorldCat. So straight from Google Books you can click "Find in a library" and you will be presented with a list of libraries

			that have the book. You can also use this to find out if your own library has it. A really good strategy for using Google Books for research is to use it to search for books, create a list that might be relevant, use the full-text features to read as much as you can, then check out the ones that are most relevant so that you can have them to flip through as needed when you are working on your paper
Internal company data		this may be information in company reports, operating procedures, training manuals, process maps metric data in databases or in IT systems. As the data is internal it should be easier to access.	

Table 2: Suggested places to find information

2) **Evaluating the information.**

There is a lot of information on the web, however it is a place where anybody is free to upload content and some information might not always be correct. It is therefore necessary for the learner to evaluate information to ensure it is correct so they can make the correct decisions to solve the problem. Generally, information is evaluated under the following criteria:

1. Authority: credibility of the source, who created the information, are they respected, are experts actually experts, is it from a government, university or membership site
2. Currency: When written was the information written, what events were occurring during this time and could they have impacted the information in any way, for websites when was it visited, created and updated.
3. Relevance: how close to your question/ subject, is it at the right level
4. Bias: why was it written was it written to inform, sell or persuade?
5. Language style: is it reasonable or exaggerated
6. Completeness: how much of the research question has been answered, terms e.g. further research, limitations
7. Accuracy: does the author look at counter arguments, do they look at other sources of information and reference these? Is the background information accurate? What evidence does the author use to support their argument or is it their opinion?

Questions you might encourage the learner to ask that evaluate the information might be:

- What is the source of the article, is it reputable?
- In what ways does this book or article contribute to our understanding of the problem under study, and in what ways is it useful for practice?
- What are the strengths and limitations?
- Could the problem have been approached more effectively from another perspective?
- Has the author evaluated the literature relevant to the problem/issue?
- Does the author include literature taking positions she or he does not agree with?
- How significant was the study: Who were the authors research subjects? How many research participants did they have?
- When was the article written? What major events were occurring at this time that might influence the research study?

Once the learner is being happy you have collected enough secondary information to satisfy their information needs they need to determine their information gaps.
1) What information am I missing to enable me to achieve my learning objectives

Lesson 4: Gathering primary data

In a study conducted by Alison Head on information literacy in the workplace the lack of primary research skills of graduates was highlighted as a major issue. It was found that graduates rarely used techniques such as speaking to colleagues and examining internal data sources. (Head, 2012[i])

When a learner cannot obtain secondary information to satisfy a learning objective they will need to create their own data i.e. gather primary data.

[ii]Primary sources encompass a broad range of materials. These include emails, letters or correspondence, speeches or interviews, surveys or polls, metrics, photographs(of a production line or a work area) or images, newspaper accounts, records of organizations or agencies (including governmental and international bodies), relics or artifacts (products), and audio or video recordings.

Methods of gathering primary data:

For business professionals you might use approaches such as

Method	Explanation	More information
Survey	You might choose to survey partners, suppliers, customers or employees on company issues.	http://gradnyc.com/wp-content/uploads/2012/08/GNYC_Academy_Workshop-3_Conducting-Survey-Research.pdf
Interviewing	You might choose to speak to partners, suppliers, customers and employees about how to improve a particular work process	http://www.comp.dit.ie/dgordon/Podcasts/Interviews/chap15.pdf
Focus groups	Focus groups allow you to interview or gather the perspectives of multiple people at the same time	http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2550365/pdf/bmj00603-0031.pdf

Table 3: Methods of collecting primary data for business professionals

Some primary data collection techniques for engineers

Method	Explanation	More information
Experimentation	Allows engineers to collect data about the factors that impact on	https://onlinecourses.science.psu.edu/stat503/node/67; http://www.jhuapl.edu/techdigest/td/td2703/telford.pdf

Method	Explanation	Further information
	their product or process-	
Failure mode and effect analysis	Identifies the reasons for faults in a product/process	http://people.ucalgary.ca/~design/engg251/First%20Year%20Files/fmea.pdf
Variation mode and effect analysis	Allows engineers to identify the causes of variation in a process	https://www.chalmers.se/en/departments/math/centres/gmmc/research-programme/risk-reliability-quality/Documents/Johannesson.pdf
Control charts	provides a means of identifying if your process is subject to variation.	http://www.au.af.mil/au/awc/awcgate/navy/bpi_manual/mod10-control.pdf; https://www.stat.auckland.ac.nz/~wild/ChanceEnc/Ch13.pdf
Process capability	this determines the ability of a process to satisfy the customer tolerance requirements. For example, in a service environment how long is a customer prepared to wait before they go elsewhere	• https://www.youtube.com/watch?v=fo1CT0DZAsE

Table 4: Primary data collection methods for Engineers

Generic approaches such as

Method	Explanation	Further information
Performance measurement/metric data	By identifying how your company is performing in certain areas you will be able to see how you compare to	http://www.businessballs.com/dtiresources/performance_measurement_management.pdf

	your competitors or identify areas for improvement. It also helps you to determine if there is a correlation between an event that occurred and a change in your business performance	2
Break even analysis	this technique allows you to identify how much you need to sell in order to break even	https://www.youtube.com/watch?v=CsI2q3TWvaU
Process analysis	using flow charts and other techniques to graphically display a process to understand issues associated with it	http://www.businessballs.com/business-process-modelling.htm
Bottle neck analysis	this allows a company to understand what parts of their process are causing delays	http://itech.fgcu.edu/faculty/aruiztor/dw/bottlenecks.doc
Pareto charts	this technique uses a pareto analysis and principle (known as the 80:20 rule) to allow you to do 20% of work to attain 80% of the benefit.	http://kisi.deu.edu.tr/userweb/mehmetali.ilgin/Pareto_Analysis.ppt

Table 5: Generic methods for gathering primary data

> **Example**
> **For our cash flow problem.**
>
> "Learning objective 1: Examine best practices in forecasting"
>
> You might need to interview/survey your customers and suppliers on
> - The forecasting approaches they use
> - The challenges they experience in forecasting.
> - The critical success factors the recommend to ensure accurate forecasting.
>
> You might decide to analyse the forecasting process of one of your competitors and measure their forecasting accuracy using performance metrics such as the mean absolute percentage error (MAPE)

Once the learner has gathered the data the learner will construct this information into a format that answers the learning objective.

> **Example**
> **For our cash flow problem.**
>
> "Learning objective 1: Examine best practices in forecasting"
>
> The best approaches to forecasting are time series analysis techniques, namely exponential smoothing, time series analysis and seasonality.
>
> Most of our customers use seasonality forecasting in our industry there are common periods of an increase in demand and decrease in demand which occur during similar times of the year
>
> The main challenges experienced by our customers are calculating a seasonality formula
>
> The critical success factors are choosing two to three seasonality formula over a 6-month period and calculating the MAPE for each of these before deciding on one

Assignment

For two of the learning objectives outlined in Unit 7:

1) Identify what information you need to satisfy each learning objective
2) Identify the sources of those information
3) Find the relevant secondary information to satisfy the learning objectives
4) Identify information gaps
5) Outline how you are going to gather the information (primary data) to fill the information gaps. (what methods are you going to use surveys, metric data, bottleneck analysis)
6) Gather the relevant data
7) Outline how what you have gathered satisfies each learning objective.

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[i] http://projectinfolit.org/images/pdfs/pil_fall2012_workplacestudy_fullreport_revised.pdf
[ii] Note this information is from http://cloud.lib.wfu.edu/blog/research-like-a-librarian/primary-sources/