Aligning learning activities with objectives and how three properties may aid course designers

by Klaus Petritsch PhD, email: Klaus@thinklearnknow.com. 21.August 2013 – unpublished. Download is free from www.thinklearnknow.com. Free to distribute without modification.

Abstract

In this paper I describe the distinction between three properties to characterize learning activities. I also use a new way to categorize learning objectives. These modifications aim to simplify the instructional designer's task. My hope is to help create holistic, engaging and effective learning experiences by simplifying the choice of the right learning activities for any given learning objective. I demonstrate the use of the method here as the key part of the design of a 16 hour course entitled "Knowledge Control".

The three properties of learning activities are: "**interactivity**", "**active participation**" and "**ease of alignment**". Each of these I assigned values (low, medium, high) or value ranges (e.g. low to medium). I define a highly interactive learning activity as one that requires a high rate of switching between reflecting & observing, doing & responding and feeling & triggering emotions.

I also define an "**alignment factor**" to represent how much time (as a fraction) the learner spends dealing with knowledge and skills related to the actual learning objective. The alignment factor depends almost entirely on the skills of the instructional designer and is likely the most important factor of all. However, the others, in particular "interactivity" and to a lesser extent "active participation" are also significant and reveal the suitability of the learning activity.

Since an objective method of obtaining the above properties may currently proof impractical or even impossible, I tried to estimate values based on personal experience, feedback by students and teachers and the literature. While the accuracy of these values is low requiring more research they may still be first approximations for the curious instructional designer

Using this method I could also identify which learning activities are the current bottlenecks for delivering higher quantities of new content and two approaches to a solution.

Introduction

The most interesting result of this paper may be the use of the three different properties of learning activities and a new variation to categorize learning objectives. This paper, however, is a result (development project) of my studies for the Vocational Teacher Education program at the University of Applied Sciences (JAMK) Jyväskylä, Finland.

This work is also influenced by the (online) Instructional Design program of the University of Stout/Wisconsin, USA – which I participated in during the same time. As a result, the purpose of this paper is to compile, apply and document some of my studies for both myself and perhaps my peers or examiners.

About ADDIE

ADDIE is an acronym for the most generic process that many instructional designers use. It represents a rough guideline for building effective training and performance support tools in five phases.

- ❖ **A**nalysis (audience description, course objectives)
- ❖ **De**sign (aligning objectives with learning activities and content)
- ❖ **De**velopment (produce and test the actual learning material/props/slides/games/)
- ❖ **I**mplementation (actual presentation and facilitation of learning)
- ❖ **E**valuation (feedback, analyse performance metrics)

In practice, instructional designers use or combine more specialized adaptations of ADDIE including the following:

- Rapid prototyping model [Piskurich 2000]
- Dick and Carey model [Dick 2005]
- Morrison/Ross/Kemp model [Morrison 2011]
- The four step combo – A project management version [Cox 2009]

For the purpose of the TOK course I adapted the Morrison/Ross/Kemp model and used many of the ideas about categorizing learning objectives and learning activities as described in Horton's excellent book [Horton 2012].

Applied Learning Theory

Researchers have described dozens of more or less different learning theories [Leonard 2002, Link 1]. The large number and popular believe that these are competing theories can be confusing and intimidating.

Personally, I believe the various theories complement each other rather naturally. They may emphasize different aspects of learning but rarely (to my knowledge - never) rely on mutually exclusive claims. It is usually possible to associate each of the smaller theories predominantly with one of the following four "eras" (they represent a very rough historical sequence) forming the pillars of current understanding of learning:

- Behaviourism (I. Pavlov, J. Watson, B.F. Skinner)
- Cognitivism (A. Baddeley, R.E..Mayer)
- Humanism (A. Masslow, C.Rogers, M. Montessori, M.Knowles, J. Holt)
- Constructivism (L. Vygotsky, M. Montessori, J. Dewey, J. Piaget, J. Bruner, D. Kolb)

For example the problem based, self-motivated approach to learning emphasized by the constructivists does not mean externally motivated drill based learning (as proposed by behaviourists) is obsolete or not effective. Each theory simply increases our understanding how learning can occur for different people given certain circumstances. The various theories simply supply additional research based learning devices and models to the arsenal of the instructional designer. I have pointed out the differences and similarities of perhaps the two perhaps most "contradicting" theories (Behaviourism & Humanism) in the appendix. Here are some examples how I applied various theories for the design and implementation of the TOK course.

Cognitivism: design of slides and activities to minimize cognitive overload, systematic approach to introduce new content, trying to optimize repetition (through short reviews), use of acronyms to aid memorizing, maximize do/connect activities and minimize passivity.

Humanism/Constructivism: stimulate self-motivation by minimizing coercion and maximizing student's interest in the subject (I chose immediately relevant examples/issues), many opportunities to actively participate and influence subjects, period and type of learning, encouraged critical thinking by acknowledging critical thoughts or contributions of various kinds, asking for feedback, group discussion and group tasks.

Behaviourism: I used positive re-enforcement of desired behaviour. For example, if someone was brave enough to start or continue a discussion I encouraged the participation her and others. My favourite tool is to minimize my own influence and pass on as much liberty and independence to the learners. In discussions I tried this by not stopping nor interfering as long as much of the class appeared interested.

ADDIE Phase 1: Analysis

Background and Aim of the course

I was given the opportunity to teach 8 double hours as part of the International Baccalaureate (IB) Diploma Program in Jyväskylä, Finland. The following is part of the official IB Organization mission statement taken from the IBO TOK guide [IBO 2006]:

"The IB organization aims to develop inquiring, knowledgeable and caring young people who help to create a better and more peaceful world through intercultural understanding and respect."

The course "Knowledge Control" was part of the IB specific subject Theory of Knowledge (TOK). This is a cross disciplinary subject with the primary purpose to encourage and acquire rational and critical thinking skills as well as strengthening ethical, cultural and philosophical understanding and awareness [IBO 2006, MacKenzie 2013].

As a (temporary) teacher of TOK I had a perhaps unusual high degree of freedom to choose topics and teaching methodology. One reason is certainly that learners do not have the pressure of proofing their knowledge by answering specific questions in an exam. I also only taught and designed a relatively small part of the full TOK course (20%).

I had about two weeks preparation time until my first class. However, since I was scheduled to teach Monday's and Wednesdays a double class each while the regular teacher taught 1 hour (essentially independent of my teaching) on Friday. This way I did not have to completely finish the design and test phases but could continue to work on them through the following weeks. This schedule also provided great opportunities for me to learn from mistakes, discover unexpected challenges and continually improve based on feedback (formative evaluation) while the course was implemented.

Instructional designers define the aim of a course as an expression of a <u>long term</u> purpose, usually over the course of one or more years.
The aim of the course "Knowledge Control" is to enable students to analyse critically knowledge claims, their underlying assumptions and their implications.

Audience description

The target audience includes 16-18 year old male and female students. All speak English and most in addition Finnish or at least another language. The school curriculum covers many different countries and encourages cross cultural, holistic education and critical thinking skills. Students are likely to have been exposed to multicultural and more than average inquisitive and perhaps open minded home environments.

IB diploma students experience 100 hours of TOK spread over two years. There is no formal exam in this subject but students are required to write an essay (1200-1600 words) and give a short (10min/presenter) presentation alone or in a small group. The presentation may take many forms, such as lectures, skits, simulations, games dramatized readings, interviews or debates. Students will be asked to self-assess their presentation according to four criteria. The teacher's assessment however, will be used to calculate the final grade [IBO 2006].

Course goal and learning objectives

Instructional designers define a goal as the outcome of a series of successfully completed objectives, possibly measured over a series of days. I defined the goal of this course as follows:
Upon completion of course, learners will be able to consciously and comfortably apply methods to identify bias in knowledge claims, their underlying assumptions and their implications.
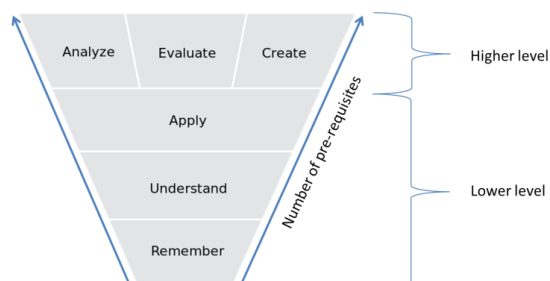

Fig.1: Chart visualising Bloom's 6 different skill levels in the cognitive domain.
The lower level skills are required to achieve any of the higher level skills.

Learning objectives are at the heart of any systematic instructional design. Learning objectives are highly specific typically measurable results in less than a day. A handful of useful methodologies to formulate learning objectives have been published including "Behavioural", "SMART" and "Mager" type objectives. For an overview see [Morrison 2011].

When creating the learning objectives, I found it very helpful to think of "Know, Do, Believe, Feel" types. This way I could be more specific, systematic and be confident that the learners will experience a more holistic learning process through both the desired change in the cognitive <u>and</u> the affective domain [Bloom 1956, Krathwohl 2002].

A similar method to categorize learning objectives was described by Horton [Horton 2012]. However, following common practice in instructional design, I adapted only part of his method and used my own definition as follows:

1. **Know**: what the learner should remember/understand
2. **Do**: what the learner should be able to do (apply, analyse, create, evaluate)
3. **Believe**: what the head of the learner should suspect
4. **Feel**: what the "gut" of the learner should suspect

The Know and Do objective types I have defined such as to fit Bloom's taxonomy for the cognitive domain – see Fig1.

In case the learning objectives are not about cognitive skills - "Do" would then include different levels of mechanical skills. Bloom broke these down into various levels within the psychomotor domain as described elsewhere [Bloom 1956, Krathwohl 2002]. In my course we aim to develop pure cognitive and attitudinal change.

I have also redefined Horton's "Believe" and "Feel" to account for the competing "gut versus head" in human decision making [Ha 2012]. Both, "Believe" and "Feel", aim at attitudinal changes in what Bloom called the affective domain.

I broke the course goal down into a logical hierarchy of required lower level objectives and categorized them into "Know, Do, Feel and Believe" – Fig.2. I sent this chart to the TOK teacher for confirmation.

Note that most "Do" (Bloom's high level skills: apply, analyse, evaluate, create) objectives are located higher up and are therefore taught later in the course. I also identified a critical path of objectives [Horton 2012p34] that I deem most important to achieve. Objectives not on the critical path can be seen as supportive (not essential).
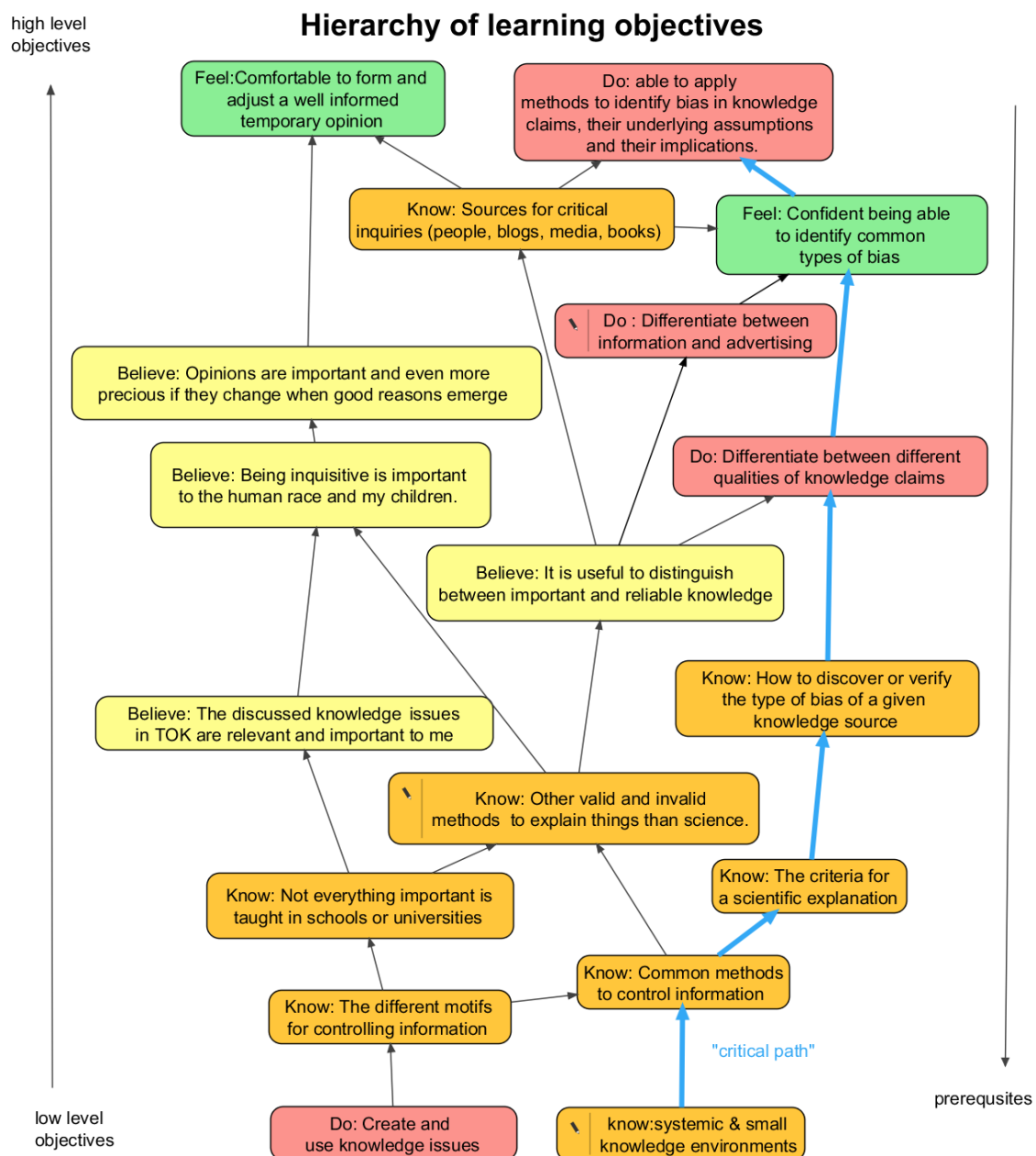

Hierarchy of learning objectives

high level objectives

Feel:Comfortable to form and adjust a well informed temporary opinion

Do: able to apply methods to identify bias in knowledge claims, their underlying assumptions and their implications.

Know: Sources for critical inquiries (people, blogs, media, books)

Feel: Confident being able to identify common types of bias

Do : Differentiate between information and advertising

Believe: Opinions are important and even more precious if they change when good reasons emerge

Do: Differentiate between different qualities of knowledge claims

Believe: Being inquisitive is important to the human race and my children.

Believe: It is useful to distinguish between important and reliable knowledge

Know: How to discover or verify the type of bias of a given knowledge source

Believe: The discussed knowledge issues in TOK are relevant and important to me

Know: Other valid and invalid methods to explain things than science.

Know: Not everything important is taught in schools or universities

Know: The criteria for a scientific explanation

Know: The different motifs for controlling information

Know: Common methods to control information

"critical path"

low level objectives

Do: Create and use knowledge issues

know:systemic & small knowledge environments

prerequsites

Fig.2: The objectives of the 16 hour TOK course "Knowledge control" is broken down into different intermediate goals (lower level objectives). Care was taken to include mostly low level cognitive skills at the bottom. The critical path includes the most important objectives.

ADDIE Phase 2: Design

The previous chapter was largely about creating a hierarchy of learning objectives and categorizing them to allow gradual learning in all relevant domains.

The design phase begins with using the hierarchy of learning objectives to create a logical sequence of chapters on PowerPoint slides. I also summarized the learning objectives at the beginning of each chapter for the learners.

The next step is to find suitable learning activities to accomplish the above learning objectives.

How can I find the best possible learning activities for a given learning objective?

Horton takes on this challenge by categorizing learning activities into three different types:

1. Do (actively exercising, exploring, discovering)

2. Absorb (reading, listening, watching),

3. Connect (connecting old with new knowledge e.g. questioning, research, original work, stories told by learners, pondering).

He also states [Horton2012p58] that it is common that learners spend 90% of their time absorbing, 9 %, doing and 1% connecting. A better goal he states, may be 40% Absorb, 50% Do and 10% Connect.

While this approach is very intuitive and natural it will work for some designers. I find myself unable to clearly separate many learning activities into Absorb, Do or Connect. I believe all three can easily occur in a single activity – for example in role plays, discussions or games.

I would prefer to use various degrees of "interactivity" instead.

	Cognitive domain	Physical domain	Social & emotional domain	interactivity	active participation	ease of alignment
role play	h	h	m-h	h	m-h	l-m-h
new content (charts)	l-m-h	l	l-m	l-m	l-m	h
review slides	l-m-h	l	l	l-m	l-m	h
new content (videos)	l-m-h	l	l-m-h	l-m	m-h	h
personalization	m-h	l	m-h	m	h	h
optional videos at home	m-h	l-m	l-m-h	m	l	h
new content (listening)	l-m-h	l	l-m	l-m	l-m-h	h
feedback cards	h	m	l-m-h	m	m-h	h
find-the-answer games	h	l-m	l-m-h	m	m-h	m-h
short videos to stimulate discussion	m-h	l	m-h	m	m-h	m-h
use of acronyms	m-h	l-m	l	m	m-h	m
Inspiration/prep video	l-m-h	l	l-m-h	m	m-h	m-h
handouts of essentials	m-h	l-m	l-m	m	m-h	h
discussion (after class)	h	m	m-h	m-h	l	m-h
discussion (small group)	h	m	m-h	m-h	l-m-h	h
discussion (class/free debate)	h	m	m-h	m-h	l-m-h	m-h
quiz competition	m-h	m	m-h	m-h	m-h	h
ranking in groups	h	m	m-h	m-h	m-h	m-h

Table 1: Estimated activity rates in the three domains. The interactivity factor was taken as the average of these three. Shown are also estimated values for active participation and ease of alignment. h..high, m..medium, l..low. Multiple values (e.g. l-m) indicate that much depends on the specific theme, content and learner selection. In practice such ranges can remind the instructional designer to ensure a high level in this area/property.

How do you define interactivity?

Here is my definition: Interactivity is high if the learning activity requires frequent switching between reflecting & observing, doing & responding and feeling & triggering emotions. In order to experience learning at its fullest potential I would expect high interactivity in three different areas:

1. Cognitive (data processing)

2. Physical (movement)

3. Emotional & social (feeling and behaviour)

These "areas" correspond roughly to Bloom's cognitive, psychomotor and affective domains but probably not completely. While it is difficult to measure or even quantitatively guess cognitive switching rates, it appears more practical to estimate three different degrees of activities (low, medium, high) in the three different domains (cognitive, physical, emotional & social).

Hence, I determined the "interactivity factor" as the cumulative result of estimated activities of these three domains.

For example, role play has the values high (h), high (h), medium to high (m-h) for the three mentioned areas. I approximate the resulting cumulative interactivity as high (h).

 I suspect that a high interactivity property tends to stimulate prior knowledge sufficiently to connect new knowledge. In case prior knowledge is lacking or inconsistent the learner may feel the need to ask or at least think of a question. So a highly interactive learning activity may reveal itself through frequent questioning (or pondering) by learners.

What do you mean by "active participation" and "ease of alignment"?

In practice, a highly interactive learning game may be worth little if nobody wants to play it. To take this into account I define something I call the "active participation rate" or shorter: "active participation". "Active participation" considers the likelihood of learners actively and voluntarily participating in a given activity.

Finally I found it useful to characterize potential learning activities by a property I call "ease of alignment". This property should give some idea how easy a given learning activity can be adapted to a wide range of learning objectives.

 Table 1 shows all six parameters for every learning activity I used in this course. A table including promising learning activities which I did not apply in this course can be found in the appendix.

Now we can factor in these parameters to get an idea of the overall quality of a given learning activity for a given learning objective:

quality of given learning activity = alignment factor * interactivity * active participation

The alignment factor indicates how much of the learners activity time is used on material directly related to a specific learning objective. Usually I can get a meaningful alignment factor only <u>after</u> I have finalized most details of a learning activity as it is very sensitive to those details.   I found it useful to estimate my chances – or the degree of challenge – by knowing the "Ease of alignment" value.

Looking up "ease of alignment" in the table can help reduce misalignment problems. For example, until recently, games and simulations (typically computer based) were often criticised by some as not effective learning tools while others find opposite results [Link 2, Kapp 2012, Young 2012].

However, it often seemed that – while the games were always interactive and engaging – their designers simply failed to align them well with the respective learning objectives [Link 2]. Nowadays it is not rare to confuse good entertainment with good learning. Keeping an eye on the alignment factor (or at least "ease of alignment") can mitigate this common and important issue.

It is also important to remember that one learning activity may only cover <u>part</u> of the skills and knowledge necessary to achieve the objective. To guarantee comprehensive coverage, it may be useful to break learning objectives further down into parts that can be served <u>entirely</u> by a chosen activity or combination.
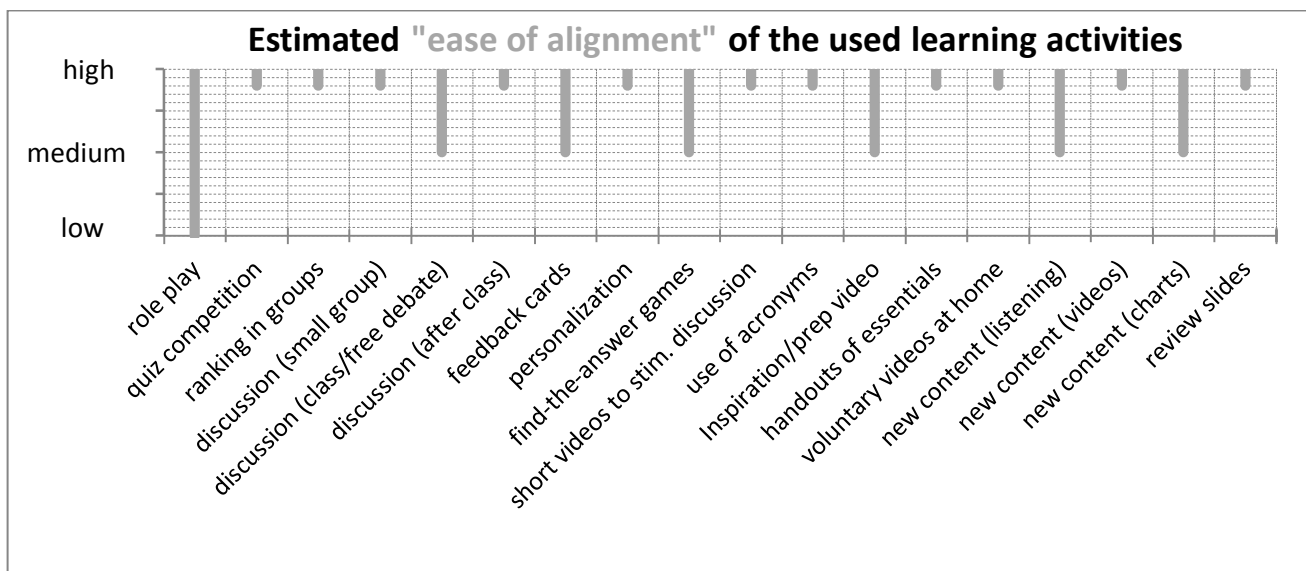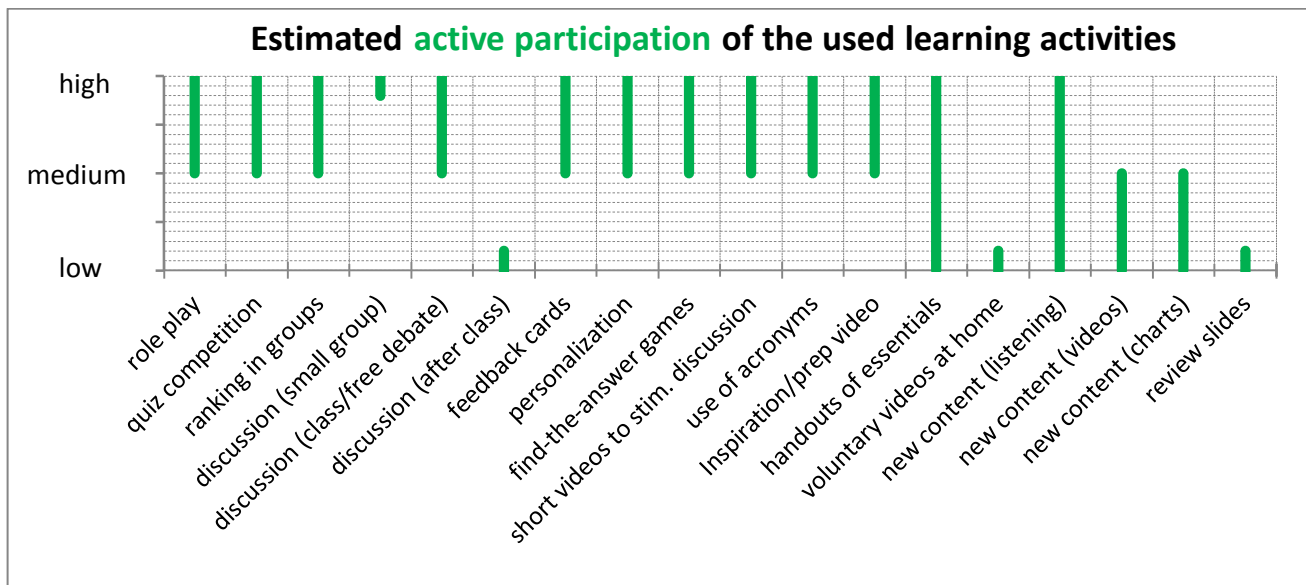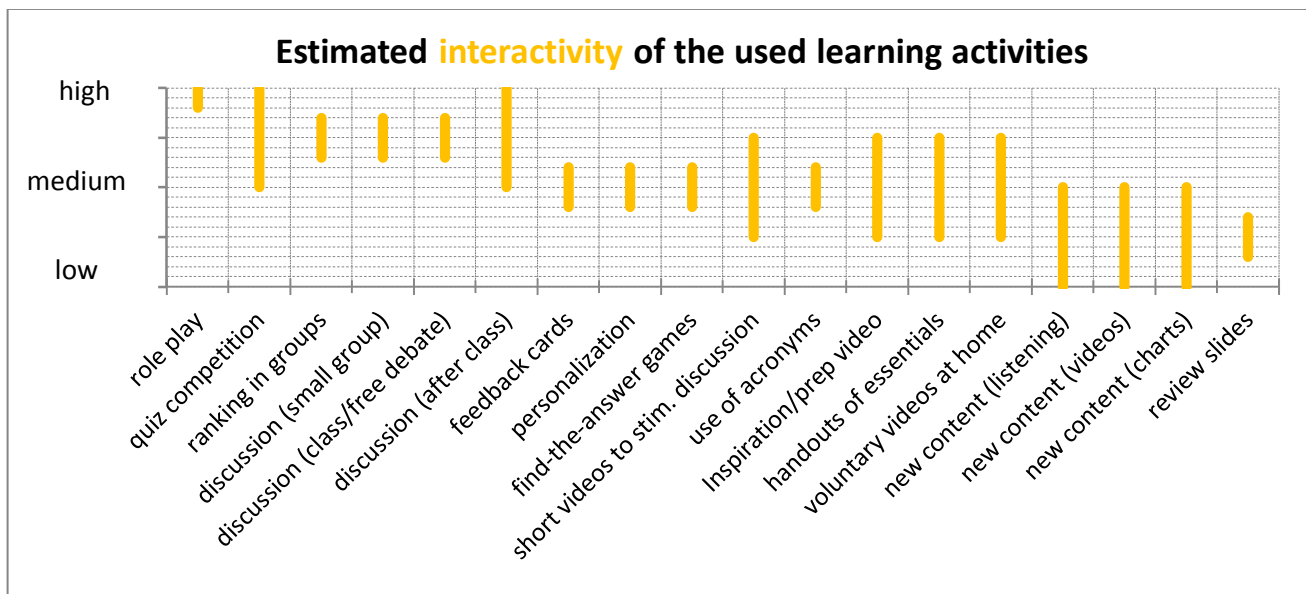
Fig.3: Estimated property values from Table 1. The learning activities are sorted according to "interactivity". As one would suspect "interactivity" correlates somewhat with "active participation".

Aligning the learning activities with learning objectives

Horton has published tables suggesting which learning activities are likely to facilitate certain types of learning objectives (Do, Feel, Believe, Know and some others).

One problem with his approach is that my hierarchy of learning objectives could be roughly used to sequence and guarantee "holistic coverage" of my course – which was very helpful – but rarely could I find a <u>single</u> activity serving a single objective.

One solution may be to spend more time on creating only objectives that can be fully addressed with single activities or perhaps known combinations of such. There was also another problem: I could not find some of my learning activities in Horton's tables or it was not clear to which category he would count them.

So, in practice, I created a sequence of the chapters based on the hierarchy of learning objectives. At the beginning of each chapter I reformulated two or three learning objectives for the students to know. I then collected learning activities that I deem potentially useful to match the objectives. Finally I chose the activities based on activity, active participation and how well I thought I could align it.

Of course, I also considered other factors like the time an activity required in class as well as my preparation time (which would compete with time I can dedicate to create better content). I also needed to provide enough new knowledge to achieve the goals and keep most learners interested but not overwhelmed. Motivated faster or slower than average learners I can help to some extend by being available before and after class.

When do we need to stimulate prior knowledge?

A common simplification is the assumption that every learner in the course has essentially the same set of old (and therefore also new) knowledge. To some extend this is often achieved by clustering similar learners together: same age, same sex, same minimum scores in an entry exam, same culture.

In such a coherent environment traditional learning activities like "new content (listening)" i.e. the teacher lectures may work reasonably well. However, the true power of interactive teaching methods unfolds if learners have a varying background. Role play or discussions can be particularly interesting and interactive when different views meet. The stimulation of prior knowledge (as well as the connection of the new knowledge!) with these activities is essentially on autopilot and learning facilitators could lean back and observe or answer questions that learners are likely to encounter under these conditions.

In other words, stimulation of prior knowledge can be done most effectively by employing highly intereactive learning activities. In that case students can do most of the work themselves while facilitators (or additional activites) may (preferably) be needed to answer only these specific questions.

However, if interactive teaching is limited [Alessi 2001p92] refers to works by Anderson, Park and Gagné suggesting the following methods to stimulate prior knowledge:

- brief synopsis of related material studied previously
- creating a rich natural (familiar) context (authentic learning environment)
- voluntary pre-testing

Alessi also suggests effective connection of new with prior knowledge (which implies stimulation of some prior knowledge too) through the use of:

- presenting common examples of the new information
- using extended analogy e.g. relate computer parts to the parts of a human body

Resisting the desire to deliver a lot of new knowledge - fast

One disadvantage of many high-activity learning activities is that new knowledge can only be introduced in relatively small quantities - or so it seems. I think the truth is more that the "fast" traditional methods are not just boring but most importantly much less effective and therefore more frustrating than we like to think. What is the point if the teacher can throw vast amounts of data at the learners if they can only retain 10% or less in the long term? It is very tempting to think we are learning – when often we are not [Druckman 1994].

During the course design & implementation I often fell into the same trap. Instead of modifying the learning objectives to require less new content I tried to push as much new knowledge as possible (albeit I tried my best to keep it

interactive – not always successfully).

Occasionally though, I found ways to feed the learners new information almost as a side product of their activities. For example, I asked two groups to act out two different scenarios described in the handout they received. I intentionally gave them too few handouts so they would need to share them to stimulate conversations. Being self- motivated and responsible they went through the new material (reading) surprisingly fast.

One group, spontaneously rehearsed outside the classroom (the other in the classroom) with 100% participation. Then both did their acts with a subsequent discussion. I received overwhelming feedback that they liked it and I am also quite confident they will remember the main points of their plays – and perhaps also the ones they watched - for many years.

Another way to facilitate new knowledge may have been to give the learners more freedom and responsibility. The objectives of this course are such that students could – in theory - discover and create/work on their own content with relatively few restrictions using the library, computers etc.

Here are the learning activities I used to deliver much of the new content:

- new content (videos)
- new content (charts)
- new content (talking)
- use of acronyms
- handouts of essential knowledge
- review slides
- voluntary assignments

Unfortunately these activities represent the bottom on the interactivity scale (Fig3). Note that the active participation rate of new content (listening) I have estimated to range from low to high. Research indicates that, if the biggest mistakes are avoided, lecturing can be reasonably effective. I suspect because active participation will then likely be high. I tried to follow the recommendations by Bjork and deWinstanley [deWinstanley 2002] which include:

- Spaced repetition within and across lectures (spacing)
- Presenting content from more than one standpoint (encoding variability)
- Providing handouts with headings and subheadings (not more!) encourages note taking (structure)
- Metaphors, humour and strategic placing of enthusiasm
- Less than 20 min is best, at least 5min breaks In between longer lectures

ADDIE Phase 3: Development

When creating a computer based course this phase is all about creating the planned graphics, content and functionality – much beyond a simplified prototype.

For the face to face TOK course the development phase was about creating PowerPoint slides, curating and organizing the full content and preparing the links to YouTube videos or preparing the cards for arranging/ranking group work and games.

I also created handouts for my students as well as notes with the timeline of learning activities including reminders of important points I am planning to emphasize. As I created this course essentially from scratch I spend between 4 and 8 hours designing and developing before each class. The hierarchy of learning objective turned out to be a very useful guide and helped tremendously to stay focused on the aim of the course. I have developed two computer based learning objects before where I also found it extremely helpful to have the learning objectives organized so early.

Here is a list of the items I needed to develop/prepare:

➢ PowerPoint slides
➢ Links to suitable YouTube videos
➢ Handouts for the students (kept to a minimum, perhaps on page per class)

- ➢ Personal notes to track time and learning activities and important points
- ➢ Props like cards for students to organize
- ➢ A copy of the latest PowerPoint file on a USB stick
- ➢ Testing of computer (access through password, compatible files), projector usage and audio
- ➢ A list of names of the students

ADDIE Phase 4 & 5: Implementation & Evaluation

The implementation phase included the following action items:

- ➢ Presentation of the learning material and facilitation of the planned learning activities
- ➢ Taking notes to record feedback, observations and ideas for improvement
- ➢ I used my notes to keep a log file with my personal impressions of each class

Since this was a completely new course I used every opportunity to obtain feedback. For example at the end of the first class I asked the students to write down what they liked or disliked.

Feedback after 1st lesson

Here are the four most critical and helpful comments I received followed by a short response from me:

- • "I learned that I really don't want to be "effective in my life" or a person who needs proof for everything."

This comment indicates that the student has done some active reflecting on the content during the first class. During the class we discussed briefly if the scientific method is the only way to understand and deal with issues. I tried to prepare them for a later discussion about the pro/cons of a variety of methods.

- • "I learned how to do my TOK presentation"

It seems my way of presenting material (simple PowerPoint slides with short multimedia material) combined with audience participation has appealed to at least one person.

- • "I learned that I have to come up with questions so that I can accomplish my goals."

At the beginning of the class I asked everyone to write down in a few words what they are aiming for in life. Some volunteered to share their ideas:

- - I want to improve the health system.
- - I want to contribute something significant to society
- - I want to be careless, open minded and happy. [He clarified that by careless he means not to be willing to take some risks/responsibility to experience life more intensely.]
- - I want to understand the world around me, especially human behaviour.

- • "I like that you let us take part in the discussion but you didn't force us."

It seems another person valued voluntary active participation during class.

- • "Informative lesson, just did not learn anything new."

I believe this could mean that a good amount of information has been conveyed during class but the student already knew most/all of it. It was the first class and activating (and for me to reveal) prior knowledge was one objective.

Feedback during the course and after the last lesson

At the end of the last class I asked again for formal written feedback. The most critical and helpful responses were:

- - "It was fun and interesting because you made the group participate."
- - "Interesting lessons, a bit boring sometimes going through the same things e.g. knowledge paradigms."

- "Good lesson in general. There were many different activities."
- "Lessons structured well. Sparking/ initiating conversation great."
- "I liked group works ☺ but smaller groups than dividing the class in two?"
- "Nice teacher, you lifted up the atmosphere in our TOK lessons!"
- "The question and answer things were nice."

Almost every response of the 16 I received included a positive comment related to <u>group</u> activities and <u>active</u> participation. I did not leave out any negative or other constructive comments in the above lists.

During the first four lessons I spent about 5-10 minutes summarizing what we did so far. I quickly flicked through the most important slides. When I noticed a lower participation level I asked if anyone finds that unnecessary and I received a few reluctant but genuine sounding "yes".

From then on I skipped these formal reviews and started with a motivational/preparation video to get right into the next chapter afterwards which seemed to work much better. I did include some references to previous material dispersed throughout the whole double hours, when I felt it was helpful.

Starting with an interesting short video exactly at the beginning of the class also greatly reduced the number of late comers (perhaps by 60%). Also the number of students coming to class increased.

I also received feedback from two peers (teaching students), my pedagogic teacher and the regular TOK teacher:

- They all liked the high level of active participation of the students
- The overall structure and organization was good
- I could spend less time sitting behind the computer during the presentation periods
- It may be better to reorganise the traditional setting (tables pointing at the teacher) of the class-room to better facilitate group work and interaction
- Much of the time I did not act as a source of knowledge but let learners discover the issues by giving them time to reflect as well as some challenging thinking tasks. This seemed to work well judging from the high participation rates.
- The endings of the lessons could have been more defined and less abrupt. [we sometimes simply ran out of time]

Personalization & pedagogy of vulnerability

Cogntive research in multimedia instruction suggests various forms of personalisation beneficial [Mayer 2002]:

- Using a less formal style e.g. using the first person rather than the third in verbal or written texts
- Using verbal cues (e.g. emphasizing important parts by changing pitch or speed)
- Using written cues (e.g. emphasizing important parts by using bold or italics

As one of the objectives for this course was "becoming comfortable with forming and changing opinions", I felt it would be appropriate to demonstrate this with my own behaviour throughout the course. So I was not avoiding saying what I think, but I always made it clear that this is my personal opinion – rather than suggesting this is what is correct or scientifically proven.

I also encouraged other students to do the same and supported them whenever they did.
From personal feedback I got as well as written, it seems students have recognized this as a rather positive, memorable and perhaps a little more interesting way to experience learning.

I suspect my role modelling of expressing and respecting opinions of all sorts helped trigger the relative high number of constructive debates we had in class. It also contributed to an atmosphere were opinions are encouraged but not forced or awkward.
On a few occasions I also gave away some <u>personal</u> information. Here are some examples:

- "You don't need to be Einstein to come up with some good ideas. If Klaus can do it – you can do it too!" (I have been granted several patents or some scientific breakthroughs by simply following the principles we were discussing.)
- "For example, Klaus is influenced by knowledge environments such as the Chess Club, married man, science and the Finnish culture."

As stated above, the advantages of some personalization have been recognized by cognitivists for some time. However, giving away some personal information to facilitate a better learning environment has been described (to my knowledge) only more recently. E.J. Brantmeier has described such a process pedagogy of vulnerability with promising results [Brantmeier 2013].

Based on the feedback I received I feel the personalized approach has worked well. However, like with the different learning theories, it is likely that it does work best when the conditions are favourable (learning objectives, learning activities, target audience, teacher's personality etc.).

Summary

In this paper I have analysed and partly documented the design and implementation of my course "Knowledge Control" at the IB school in Jyväskylä. I have described how I essentially followed one common instructional design model (ADDIE) and the lessons learned.

In summary, the use of the ADDIE model was both helpful and (judged by the feedback) largely successful. The analysis phase was very straight forward and resulted in useful learner profile and the hierarchy of learning objectives. The learning objectives were created considering a gradual build-up of cognitive skills following Bloom's taxonomy. I distinguished between Know and Do objectives –which correspond to Bloom's cognitive domain. I also used some Feel (gut) and Believe (head) objectives taking into account transformation in the affective domain.

The design phase was more demanding as the alignment of the learning activities with the specific learning objectives in the hierarchy was not always possible or easy to complete. As a job aid I used the somewhat (more aimed at learning activities) adapted learning objectives at the beginning of each chapter to select a suitable set of corresponding learning activities. I also modified previously published ideas by Horton and suggested the use of some "new" parameters (interactivity, active participation rate, ease of alignment) to help find suitable effective learning activities. The level of interactivity was constructed out of estimated activities in three areas: cognitive, physical, social/emotional.

The implementation and evaluation phase revealed several outcomes:

- I used a good number of learning activities that were appreciated by the learners as active, more participatory and interesting
- An informal evaluation during the last lessons indicated that at least half the class has achieved or made significant progress towards the course goals. However, a more formal evaluation would be desirable but was not performed.
- My observation of active participation rates during the course helped put together the now also per feedback confirmed values in table 1. In particular the low rates for optional assignments (video) and review slides were confirmed. Feedback also suggested I reached the lower active participation range of new content (listening) several times. Presenting new information remains an area with considerable room for improvement

Overall, the application of all four major components of learning theory (behaviourism, cognitivism, humanism, and constructivism) appeared to work well together.

A reduction of new content – e.g. by creating a more focused course objective may have been useful to reduce the less active/low participation activities needed to deliver the bulk of new information. On the other hand, the highly active activities like role play, various forms of discussions and games proved effective in developing new skills.

Based on this course design experience I could also put together a list of promising learning activities with estimated property values to be tried in future. See appendix.

Future work

 In future, I would like to see more accurate and objective ways to determine the proposed properties of learning objectives, in particular "interactivity" and "active participation".

It may also be useful to refine the definitions of these properties further.

Acknowledgement

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[Link 1] For an overview of learning theories see: http://www.instructionaldesign.org/theories/index.html

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Appendix 1: Two "contradicting" learning theories

Behaviorism	Humanism
Main Theme • some contributors: B. F. Skinner, I. Pavlov, E.L. Thorndike • focuses on changing behaviour through manipulating the environment • uses optimized ways of reinforcement ("rewards") or negative consequences following a response	**Main Theme** • some contributors: C. Rogers (experiential learning), J. Holt (child education), M. Knowles (Andragogy) • natural intrinsic desire to learn is assumed • learners have control over the learning process
How it Affects Learning • repetition is important • rewards and/or punishments, e.g. points or verbal feedback should be immediate albeit ideally in unpredictable intervals • linking known behaviour to the desired new behaviour accomplished through direct external association • complex skills are developed through approximation: the first behaviouristic goal may be very "rough", but subsequent steps will approximate the final desired behaviour.	**How it Affects Learning** • subject matter needs to be highly relevant to the learners interest • external threats should be a minimum • self-initiated learning is most lasting • quizzing and grading is to be minimized • doing the real thing – mostly alone if possible - is most effective • learners should be able to control how the learn e.g. self-paced, asynchronous or not, highly personalized
Similarities Both theories are • evidence based and work well in practice • applied a lot – although the term humanistic theory of learning seems to be dying out. Humanistic theory is split into Experiential, Andragogy, (liberal) child education by Holt and others. • sometimes treated as being out-dated or undesirable (humanistic theory is often seen unpractical and behaviourism ethically questionable).	**Differences** Behaviourism is: • teacher centered (student has little freedom) vs. student centered (student has a lot of choices, is less controlled and has more responsibilities) • motivated by external vs. internal rewards • using basic instincts already present in non-humans vs. using human specific meta-abilities like self-reflection, long term strategic thinking or moral reasoning

While behaviourism and humanism have rather different values at their core they are flexible enough to construct a rather complementing learning environment where learning is facilitated using quite different approaches together.

This is possible for most theories - not just these two - because while emphasizing different values they do not negate others in principle. For example it is possible to have both: a student centred approach for most of the time and a teacher centred phase (e.g. a story told by a teacher or a task given and explained) at other times. It is also possible and perhaps even beneficial to have both external and internal stimulation/motivation. I like to use elements of both, simply because both suggest highly effective methods of learning.

While many aspects of behaviourism work well with all age groups, John Holt's work as well as Piaget's theory of cognitive development are particularly useful when designing the instruction intended for smaller children. Knowles and Rogers' work is targeted toward instructional design for adults.

However, I also believe adults can also learn effectively with methods usually associated with children (e.g. "Gamification" [Kapp 2012]). The humanistic approach also includes and is certainly very compatible with the internal stimulus proposed by constructivists including the social aspects of modern collaborative/collectivist theory.

Appendix 2: Estimated properties of promising learning activities not used in this course

	Cognitive domain	Physical domain	Social & emotional domain	interactivity factor	active participation	ease of alignment
learning diary	h	m-h	l-m-h	m-h	l-m	m-h
sculpture (reflect)	h	m-h	m-h	m-h	m-h	l-m
online forum	m-h	m	m-h	m-h	m-h	h
partially completed problems	h	m	m-h	m-h	l-m-h	m-h
choosing picture cards (reflect)	h	m	m-h	m-h	h	l-m-h
breaks for peer discussions	h	m	h	h	l-m	m
team assignments (home)	h	m	m-h	m-h	l	h
computer games	h	m-h	m-h	h	h	l-m
work experience	h	m-h	m-h	h	m-h	h
storytelling by learners	h	m	h	h	l-m-h	l-m-h
learning café	l-m-h	m	m-h	m	l-m	l-m