CRITICAL ANALYSIS OF LEARNING MODELS

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Edgar Dale’s pyramid is often associated with percentages by training organizations to promote active pedagogies. However, this model has a marketing origin and no scientific basis. It is therefore appropriate to turn to other models such as those of Agyris, Schön and Kolb (1984), which emphasize the importance of learning by doing. At the same time, by studying these different models, we can identify the extent to which the use of games and, by extension, serious games are fully consistent with such learning models.

Keywords: Learning models, Serious Game, Evaluation
Is the Edgar Dale pyramid reliable?

Edgar Dale’s pyramid theory is present in numerous publications of articles or training websites dedicated to learning methods as shown in Figure 1.

Nevertheless, most of the uses of the model seem to be based on a lack of knowledge of the researcher’s work, as shown, for example, by the article by Vanessa Dufêtre Badja of the XOS company «Edgar Dale’s learning cone is not what we think it is...». (2019). She explains that in 1946, when Edgar Dale published his book «Audio-visual methods in teaching», which includes his pyramid model (Figure 2), he was already warning his readers about the misuse or misinterpretation that could be made of it.
For Edgar Dale, there is no hierarchy or ranking order of learning methods. As Didier Goudeseune explains on the blog «Par-temps-clair» (2018), Edgar Dale has developed the pyramid to apply it to the audiovisual field, with the aim of ordering the different experiences from the most abstract to the most concrete form. It is not a question of ranking the different experiences, but of showing the loss of the richness of sensory information, when we slide from the concrete to the abstract. On the other hand, as shown in Figure 2, in its 1946 version, Edgar Dale’s pyramid has no percentage.

This leads us to question the percentages associated with the various pyramids found on the Net, as in Figure 1, whose values vary from one representation to another. It should be noted that there is originally no scientific basis for establishing these percentages. It is a purely marketing approach that originated with the American training firm, the National training laboratories (NTL) Institute, to sell training in active pedagogy (see Figure 3).

Goudeseune explains that with the addition of such percentages, we are moving from a ranking based on abstraction to a ranking of educational experiences according to their hypothetical degree of learning. This is not the same thing.

*These percentages are not validated in educational sciences and cognitive psychology.*

Goudeseune, 2018
Thus, there is still no agreement on learning retention percentages, and for good reason: first of all, dedicated scientific experiments should be conducted to evaluate this. From this, we can deduce that Edgar Dale’s pyramids associated with percentages are not scientifically valid. Thus the use of such pyramids by training centers can produce a counter-effect by deteriorating their image with regard to the lack of scientific credibility.

Based on this observation, would there be other models related to the classification of learning that would be scientifically proven? If so, could Serious Games and other gamified approaches be taken into account in such models? It is this exploration that we now propose to conduct.
We can begin our exploration with the work of academic researcher Chris Argyris, a Harvard University professor specializing in social sciences. Since the 1970s, he has collaborated regularly with Professor Donald Schön, Professor of Education at MIT. Both professors are recognized for their work on «organizational learning». They have laid the foundations and fundamental principles of organizational learning. According to them, we are all subject to the «learning imperative». They define «organizational learning» as follows:

Organizational learning occurs whenever there are discrepancies between observed and expected results. These discrepancies are then analyzed and codified in organizational memory. This leads us to consider two levels in a dynamic learning process.

In other words, according to Si & Management, **single-loop learning** corresponds to the fact that the actor applies known solutions, resolves basic difficulties without really innovating. The individual therefore repeats the same actions and learns by error. Learning occurs whenever there are gaps between what is observed and what is expected. When the individual faces a situation where he or she encounters a problem that he or she can solve, then there is **single-loop learning**.

*We learn when we detect an error and correct it.*

Argyris C.

However, when the individual encounters a problem that he or she cannot solve, then there can be **double-loop learning** (see Figure 4). It can occur in certain situations when the acquired learning standards no longer solve the problem in the new context. Thus, the individual seeks to eliminate cascading errors and defensive routines. **Organizational learning** then takes place. For example, an individual faced with an incident that he or she has never encountered before (fire, construction site accident, etc.), will have to call upon the second learning loop to solve the problem. According to Argyris and Schön, **double-loop learning** is the only one that produces long-term effects on the organization and often develops in crisis situations.

With regard to Edgar Dale’s pyramid, the model of Argyris and Schön teaches us that it is by correcting errors that we learn. Thus, the «Doing» seems to be a major axis of learning, but only if you make a mistake and find the solution to correct it.

If we now wish to establish a link with the Serious Game, we should remember that according to Donald Winnicott, «playing is doing» (1975/1971). Thus, as the play activity is precisely doing, we can establish here a **first coherence link between learning and playing**. Let us continue our exploration to see if we can refine this link.
For David Kolb in his book «Experiential Learning» (1984), building on the work of John Dewey, Kurt Lewin and Jean Piaget (p.21), learning would be structured by a cycle of four phases: Concrete Experience, Reflective Observation, Abstract Conceptualisation and Active Experimentation. This approach reinforces the idea that learning is intimately linked to doing as we deduced from the Argyris and Schön model. However, Kolb’s model details the learning loop more precisely:

- **CONCRETE EXPERIENCE:**
  According to Kolb, the learning cycle starts with a concrete action to be carried out. It is led by a person, a team or an organized system (e.g. a company). Kolb’s model implies that one cannot learn just by watching or reading, but by doing.

- **REFLECTIVE OBSERVATION:**
  At this stage, according to Kolb, it is necessary to think about the actions to be carried out by taking a step back, by questioning oneself and, if necessary, by communicating, using an adapted vocabulary, with the actors involved in the experiment to be carried out.

- **ABSTRACT CONCEPTUALISATION:**
  During this step, the aim is to give meaning to the actions already carried out and the results obtained. It is also about linking events and associating knowledge, theories, observations, experiences and the opinion of others.

- **ACTIVE EXPERIMENTATION:**
  For this last step, it is a question of thinking on the implementation of learning through planning the actions to be carried out. According to Kolb, a concrete and relevant contextualisation is necessary to give meaning to these actions. If the learning seems useless, it is highly likely that it will be forgotten afterwards.
Reading these different stages of the learning cycle, it seems that **error is not the only way to start a new iteration**. If we no longer find the principle of the simple and double loop proposed by Argyris and Schön, Kolb’s work puts into perspective that the **learning cycle integrates phases alternating the concrete and the abstract on the one hand and action and reflection on the other**. Thus, contrary to some interpretations of Edgar Dale’s pyramid, Kolb’s model does not involve a hierarchy of learning modalities, but rather a **skillful combination of them during the learning cycle**.
To illustrate this idea, we can refer to the website of the University of Leicester, which proposes, with regard to Kolb’s work, teaching activities associated with each of these four cycles, as shown in Figure 6. It is interesting to note that for the Concrete Experience phase, there are «readings» and «text reading» as well as the use of «simulations» and «games».

To further elaborate, Figure 6 therefore puts forward the idea that different types of teaching activities can be associated within the same phase of the learning cycle. It should be noted, however, that the phases of Reflective Observation and Abstract Conceptualisation focus on teaching activities involving reading, reflection, and verbal communication, whereas the phases of Concrete Experience and Active Experimentation rather propose action teaching activities: simulation, fieldwork, laboratory activities, etc.
Different Learner profiles

This difference in the proposed teaching activities leads us to identify preferences among learners. Indeed, Kolb observes that his own students have preferences when it comes to positioning themselves on one of the four stages of their learning cycle. As Daniel Chartier (2003) points out, the two axes Concrete/Abstract and Active/Reflective allow Kolb to identify four types of learners according to their preferences:

- **THE DIVERGENT (Concrete-Reflective)**
  Characterized by his capacity of imagination and emotional intelligence;

- **THE CONVERGENT (Abstract-Active)**
  Who enjoys applying ideas;

- **THE ACCOMMODATOR (Concrete-Active)**
  Who prefers facts to theory and action to mediation;

- **THE ASSIMILATOR (Abstract-Reflective)**
  Interested in concepts and theories.

This classification of learners according to Kolb, allows us to see that activities related to the use of simulators and serious games in particular could be aimed at audiences who prefer the Concrete Experience and Active Experience phases, i.e. the Divergent and Accommodative audiences.
Divergent et Accommodator, the only categories to benefit from serious games?

One can however question the choices made by the University of Leicester regarding the positioning of simulators and games just at the level of two phases of the Kolb cycle in Figure 6. Indeed, the ESAR system, developed by Denise Garon (1985) and improved since then by Rolande Filion, classifies games and toys according to the skills that can be worked on through play activities. However, if we identify functional and motor skills (facet C) that could be associated with concrete and active teaching activities, we identify other skills that can be worked on through play:

- **COGNITIVE (FACET B)**
  Applicable at least to the Abstract Conceptualisation phase (analogies, model building...)

- **LANGUAGE (FACET E)**
  Applicable at least to the Reflective Observation phase (brainstorming, rhetorical questions...)

- **SOCIAL (FACET D)**
  Applicable at least to the Reflective Observation phase (brainstorming, discussion, etc.)

- **AFFECTIVE (FACET F)**
  Applicable at least to the Reflective Observation phase (rhetorical questions...)

Therefore, it seems quite possible to imagine the use of games, and by extension serious games, as teaching activities for all four phases of the learning cycle of Kolb’s model. Thus, if « playing is doing » according to Donald Winnicott, by relying on the ESAR system, we can now affirm that all the phases of the Kolb learning cycle can be the subject of teaching activities involving games. Of course, the types of games offered must be consistent with the learners’ work skills.
What about percentages?

With the models of Agyris and Schön as well as the Kolb model we explored the learning cycles. But percentages are absent from them. However, are there learning models in the field of scientific research that could present some?

Since 1996, we can find the «70/20/10» model, which is the result of research conducted by scientists Morgan McCall, Robert W. Eichinger and Michael M. Lombardo of the Center for Creative Leadership. Their goal is to create a global learning model for all. The approach chosen by the researchers to establish the percentages is based on a declarative survey of 200 executives. In the end, they deduce that going to school, taking training courses, is only a small part of our learning. Thus, **70% of our learning would take place when we act by ourselves on a daily basis in real situations.** This would represent our greatest experiential formative approach. Then would come the learning related to **social interactions (feedback and coaching)** which would represent **20%**. Finally, the remaining **10%** would be related to **training in formal situations**. However, the researchers specify that we should not try to oppose traditional training, social interactions and learning through practice and experience. Even if these first two represent only 10% and 20% of the formative approaches, they are not negligible for all that.
While this model is interesting, we will remain cautious about the statistics related to the survey conducted by the three researchers. Indeed, we can firstly note a lack of representativeness. Interviewing only executives is an approach that necessarily constitutes a bias. Would we have obtained similar responses with other socio-professional categories? The danger here would be to try to generalize the data from this model to an entire population. Moreover, the sample of 200 subjects is probably too small to be meaningful. Statistically speaking, this model must therefore be confirmed.

Leaving aside these statistical limitations, what links can we make with serious game and the 70/20/10 model? The percentages put forward by McCall, Eichinger and Lombardo highlight that more than 90% of our learning would take place in informal situations. However, it turns out that playing can be a source of learning in informal situations, as illustrated, for example, by the work of Haydée Silva (2016). Silva identifies that playing as a source of learning can be part of a formal/informal continuum as shown in Figure 8.

<table>
<thead>
<tr>
<th>Formal game situation, further away from play-leisure</th>
</tr>
</thead>
<tbody>
<tr>
<td>At least, transformation or educational ruse</td>
</tr>
<tr>
<td>Game of the Goose to systematize a grammar point.</td>
</tr>
<tr>
<td>Adaptation/legitimization</td>
</tr>
<tr>
<td>Riddles about an authentic tale read in class.</td>
</tr>
<tr>
<td>Changes in context</td>
</tr>
<tr>
<td>Taboo game with adapted rules and a selective corpus of cards</td>
</tr>
<tr>
<td>Brief aside followed by an educational intervention</td>
</tr>
<tr>
<td>Puzzle game to solve (for example Black stories)</td>
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<td></td>
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<tr>
<td>Allocation of a legitimate or central position</td>
</tr>
<tr>
<td>Game night in the media library.</td>
</tr>
<tr>
<td>Promotion of playing games outside the classroom</td>
</tr>
<tr>
<td>Recommendation of a selection of games that learners can practice outside the classroom.</td>
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<tr>
<td>Open Practice for Deliberate Learning</td>
</tr>
<tr>
<td>Participation in a mutual learning or networking community offering games.</td>
</tr>
<tr>
<td>Open Practice for purely recreational purposes</td>
</tr>
<tr>
<td>Autonomous use of a ludolinguistic application for native users.</td>
</tr>
</tbody>
</table>

| Informal game situation, closer to play-leisure      |

| Figure 8: The formal/informal continuum with playing by Haydée Silva (2016) |
However, in informal situations, as Julian Alvarez explains to us, we find ourselves in learning that is unsearched and subject to hazards. For example, while playing Scrabble, we may discover a new word.

However, this learning situation is involuntary. This opposes the idea of an approach in which one seeks to teach a specific knowledge, know-how or life skills. In this case, we are in a formal situation. That is, « conceived, recognized or experienced as educational » (Brougère, 2007). « This implies that the approach must make it possible to achieve a given result and that one will be able to evaluate its effectiveness ». (Alvarez, 2019, p.84).

Thus, if game can be used as a learning support, in both informal and formal situations, we perceive that context plays a key role. In informal situations, playing can allow us to learn something unintentionally. In formal situations, playing is instrumentalized to target specific learning.
In order to supplement the erroneous pyramids based on Edgar Dale’s model while displaying scientifically unsound percentages, we conducted an exploration to identify learning models from Scientific Research. Our exploration focused on the models of Argyris and Schön on the one hand and Kolb (1984) on the other. The latter is one of the most widely disseminated to date according to Chartier (2003). The study of these two models has allowed us to highlight that doing is an essential, even unavoidable approach in learning processes. We are therefore theoretically on a value of 100%. This confirms once again that the percentages shown on certain pyramids claiming to be the work of Edgar Dale are without scientific foundation. Moreover, Kolb’s model has revealed that all types of teaching activities find their place in the learning cycles: reading, communication, use of serious games or simulator...

At the same time, we looked for models related to learning that could present percentages. The idea being to produce a potential concatenation with, for example, the Kolb model. Unfortunately, the statistical data associated with the 70/20/10 model do not seem sufficiently representative and significant. Caution therefore remains the order of the day and we must get used to the idea that there is no scientific model that can fully replace an erroneous Edar Dale pyramid associating percentages. This remains the object of a quest to be completed.

But does such a quest really make sense in the light of Kolb’s model, which teaches us that the Abstract / Concrete axis proposed by Edgar Dale must eventually be completed by another Active / Reflexive axis? Moreover, the association of these two axes allows us to categorize learners according to such an orthonormal marker. We could thus identify «Divergent», «Convergent», «Accommodator» and «Assimilator» profiles according to their propensity to position themselves on the Active, Reflexive, Abstract and Concrete poles.

In parallel with our exploration of learning models, we were able to study how play and, by extension, serious play can be positioned in relation to different learning models. It seems that consistency is always required, even in learning phases where the University of Leicester has not chosen to position playing as a teaching modality. It remains to be seen, however, how in the context of teaching activities, it is possible to instrumentalize play...
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