The Framework of Complex Adaptive Blended Learning Systems (CABLS)

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Outline

1. A review of blended learning models
2. Complex adaptive systems: a theory for re-conceptualizing blended learning
3. Our framework for BL system (CABLS)
4. Using the CABLS to analyze the gaps in BL research and practice
5. Establishing a Deeper Understanding BL
6. Conclusion

This presentation is based on the articles as below:
1. A review of BL models

**Blended Learning:**

完全传统课堂教学（Completely F2F）

混合教学（Blended）

完全在线学习（Completely Online）

1. A review of BL models

- Shea’s grounded model (2007) focuses on one aspect in blended learning, the instructional design of a blended curriculum;
- McSporran and King’s (2005) generic framework caters for one element of blended learning, the content delivery;
- A more comprehensive framework is found in the Octagonal Model proposed by Khan (2001). It contains eight elements: pedagogical, technological, interfacial, valuational, managerial, resource supportive, ethical and institutional;
- One model that recognizes the dynamic relationship between elements in online learning is the well-known Community of Inquiry (CoI) Framework developed by Garrison, Anderson, and Archer, (2000).
Analysis Framework – Systems Theory

Structure

Process

Process input:
- Customer Needs/Objectives/
  Requirements
- Mission
- Measures of Effectiveness
- Environment
- Constraints
- Technology Base
- Output Requirements from Prior
  Development Effort
- Program Decision Requirements
- Requirements Applied Through
  Specifications and Standards

Requirements Analysis
- Analyze Missions and Environments
- Identify Functional Requirements
- Define/Refine Performance and Design
  Constraint Requirements

Functional Analysis/Allocation
- Decompose to Lower-Level Functions
- Allocate Performance and Other Limiting Requirements
  to All Functional Levels
- Define/Refine Functional Interfaces (Internal/External)
- Define/Refine/Integrate Functional Architecture

Synthesis
- Transform Architecture (Functional to Physical)
- Define Alternative System Concepts, Configuration
  Items, and System Elements
- Select Preferred Product and Process Solutions
- Define/Refine Physical Interfaces (Internal/External)

Verification
- Requirements Loop
- System Analysis and Control
  (Balance)
  - Trade-Off Studies
  - Effectiveness Analysis
  - Risk Management
  - Configuration Management
  - Interface Management
  - Data Management
  - Performance Measurement
  - GMS
  - TPM
  - Technical Reviews

Related Terms:
- Customer
- Primary Functions
- Development
- Production/Construction
- Verification
- Deployment
- Operations
- Support
- Training
- Diagnostic
- Hardware
- Software
- Personnel
- Facilities
- Data
- Materials
- Services
- Techniques

Process Output
- Development Level Dependent
  - Decision Database
  - System/Configuration Item
    Architecture
  - Specifications and Baselines
2. Complex adaptive systems theory

Used to gain an understanding into the complexity of dynamic and nonlinear systems such as neural systems, ecologies, galaxies, and social systems (Bertalanffy, 1968; Waddington, 1977; Waldrop, 1992)

The five fundamental attributes:

- Complexity
- Self-organization
- Adaptability
- Dynamism
- Co-evolution
3. Our framework for BL System (CABLS)

- We propose a six-component framework named the Complex Adaptive Blended Learning System (CABLS).

Each of six components has its own subsystems and acts on others in a dynamic and non-linear fashion.

Each has its own characteristics and internal driving forces, depending on surrounding subsystems to maintain its vitality.
The learner co-evolves with other subsystems, constantly acquiring new identities.

This is a result of undergoing a dynamic, adaptive process of change as they interact with other subsystems in the multimodal learning environment.

BL studies have confirmed the transformation of learners from being passive to becoming active participants in learning, and improved learning outcomes and behaviours, and learners’ overall positive reception of blended learning.

The teacher in CABLS

- Teachers co-evolve with other subsystems, particularly with learners, to become a generation of teachers with new identities and multi-disciplined professional skills.

- There are many new labels which describe this generation of teachers, for example, “e-moderators” (Salmon, 2004), “facilitators”, “guide on the side” and “advisors”, among others.
3. Our framework for BL System (CABLS)

- The content in CABLS
  - The content that learners are engaged in blended learning has never been as rich and engaging as it is today as a result of constantly interacting with, and often determined by the teacher, the technology, the learning support and the institution.
  - This is clearly demonstrated in Singh’s (2003, p.52) categorization of blended learning, including blending offline and online learning, blending self-paced and live, collaborative learning, blending structured and unstructured learning, blending custom content with off-the-shelf content and blending learning, practice and performance support.
  - More studies have pointed toward the emergence of deeper learning as one of the changes caused by the new content in blended learning (Moor & Gilmartin, 2010).
3. Our framework for BL System (CABLS)

- The technology in CABLS

  - The complex nature of technology has been recognized by Ni and Branch (2008). They (p.30) identified multiple interactions within technology and between technology and the environment, and pointed out that such complexity has been insufficiently addressed in research, “thereby rendering the results of many research studies about educational technology lacking in generalizability or application”.

  - The **unceasing advances in technology** often “kick” blended learning to rejuvenate it, while at the same time, keeping it balanced on “the edge of chaos”, stable enough to maintain its internal structure but sensitive enough to the changing needs of the learner and the new challenges and potential brought about by new technologies.
3. Our framework for BL System (CABLS)

- The technology in CABLS

  - Empirical studies have shown that new technologies usually undergo a **dynamic, adaptive process** of emergence, adoption and establishment or obsolescence. The self-organizing nature of the systems eventually retains those technologies which best facilitate blended learning.
3. Our framework for BL System (CABLS)

- Learning support in CABLS
  - The CABLS framework distinguishes itself from existing blended learning models by **pushing learning support from the background to the foreground**.
  - The rationale for this push lies in **the facilitation of a learner’s control over their own learning**, a central tenet in the learner-centred approach.
3. Our framework for BL System (CABLS)

- Learning support in CABLS
  - In this study, learning support is considered to contain two kinds of support:
    - **academic support** focusing on helping learners to develop effective learning strategies, such as time management and collaborative skills;
    - **technical support** aiming to help students improve their knowledge of the technological tools and the fluency with which they use the tools to complete specific learning tasks.
  - Both kinds of support are provided for specific purposes at the **course or task level**.
  - The development of **learning support mechanisms** should be informed by the needs of the learner, effectuated by the expertise of the teacher, necessitated by the constant advances in technology, and ensured by institutional support.
3. Our framework for BL System (CABLS)

- The institution in CABLS

  - The inclusion of the institution as a subsystem in the framework elevates blended learning from the course level to the institutional level.
  
  - In order to sustain blended learning, support mechanisms should be provided at an institutional level, and can include strategies, policies, support and service (Graham et al., 2013).
  
  - These mechanisms are interrelated within, and informed by, the learner, the teacher, the technology, the content and the learning support.
  
  - In turn, the institution becomes a major driving force behind the development of the subsystems around it.
In summary, the emphasis on the inter-dependence and dynamic interaction between the subsystems clearly marks the difference between the CABLS framework and the existing blended learning models.
4. Using CABLS to analyze the gaps in research and practice

- **Data collection**
  - **87 journal** articles on empirical studies (excluding review articles) were found through a title search in SCI, SSCI, CPCI-S citation indexes via Web of Science.
  - Key words used in the search were “blended learning”, “blending learning”, “b-learning”, “blended instruction”, “blended course”, “blended program”, “blended environment”, “blended class”, “blended e-learning”, “flipped classroom”, “flipped classrooms”, “flipped class”, “reversed teaching”, “reversed instruction”, “flipped teaching”, “flipped learning”.
The great majority (95%) of the reviewed articles focus on the **learner**, followed by the **content** (79%) and the **technology** (54%).

![Bar chart showing the percentage of each entity identified in the 87 articles]

**Figure 2. Number and percentage of each entity identified in the 87 articles**
4. Using CABLS to analyze the gaps in research and practice

- **Findings from the review of literature**

  - **learner-content** is the most investigated relationship (69%, 60), and the **learner-technology** (46%; 40) relationship came second.

Figure 3. Number and percentage of relationships between entities
Findings from the review of literature

The institution in blended learning

- Our literature review confirmed the inadequate number of studies into the institution as a subsystem in blended learning, which supports the comment from Porter et al., (2014, p. 185) that “While a number of scholars have conducted course-level investigations of BL’s effectiveness, very few have provided guidance for BL adoption at the institutional level”.

4. Using CABLS to analyze the gaps in research and practice
4. Using CABLS to analyze the gaps in research and practice

- Findings from the review of literature

The institution in blended learning

BL implementation stages summarized from the BL adoption framework

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1</td>
<td><strong>Awareness/exploration.</strong> Institutional awareness of and limited support for</td>
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<td></td>
<td>individual faculty exploring ways in which they may employ BL techniques in</td>
</tr>
<tr>
<td></td>
<td>their classes</td>
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<tr>
<td>Stage 2</td>
<td><strong>Adoption/early implementation.</strong> Institutional adoption of BL strategy and</td>
</tr>
<tr>
<td></td>
<td>experimentation with new policies and practices to support its implementation</td>
</tr>
<tr>
<td>Stage 3</td>
<td><strong>Mature implementation/growth.</strong> Well-established BL strategies, structure</td>
</tr>
<tr>
<td></td>
<td>and support that are integral to university operations</td>
</tr>
</tbody>
</table>


4. Using CABLS to analyze the gaps in research and practice

- Findings from the review of literature

**The institution in blended learning**

BL implementation categories summarized from the BL adoption framework

<table>
<thead>
<tr>
<th>Theme</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strategy</strong></td>
<td>Addresses issues relating to the overall design of BL, such as definition of BL, forms of advocacy, degree of implementation, purposes of BL, and policies surrounding it.</td>
</tr>
<tr>
<td><strong>Structure</strong></td>
<td>Addresses issues relating to the technological, pedagogical, and administrative framework facilitating the BL environment, including governance, models, scheduling structures, and evaluation.</td>
</tr>
<tr>
<td><strong>Support</strong></td>
<td>Addresses issues relating to the manner in which an institution facilitates the implementation and maintenance of its BL design, incorporating technical support, pedagogical support and faculty incentives.</td>
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</tbody>
</table>


4. Using CABLS to analyze the gaps in research and practice

Findings from the review of literature

The institution in blended learning

- Another notable study discussing institutional implementation of blended learning was reported by Taylor and Newton (2013). In comparison to other studies into blended learning, this is the most comprehensive research and it covers curriculum design, students’ experiences, staff experiences, educational technologies and institutional factors.

- Although it does not specify the use of a systems approach, it does recognize the importance of the alignment of university systems and processes with the expectations of the learner and the faculty.

- It concludes that “Strategic institutional change will only happen if there is a shared vision and energy that touches all parts of an organisation” (p.59).
4. Using CABLS to analyze the gaps in research and practice

- Findings from the review of literature

**The institution in blended learning**

- A similar contention is reflected in the call by Garrison and Vaughan (2013, p.28) for “committed collaborative leadership that engages all levels of the institution”.

- The **learner-institution** relationship examines how institutions should take into account learners’ needs and expectations when implementing blended learning, and how learners should be supported at an institutional level.

- The need for **alignment of “institutional, faculty, and student goals”** is a case in point, as advocated by Moskal et al., (2013, p.15).
5. Establishing a Deeper Understanding BL

- Complex
- Adaptive
- Dynamic
- Self-organizing
- Co-evolving
6. Conclusion

① The CABLS framework is able to promote a systematic and holistic view of blended learning, providing us with a more complete picture of such learning; to allows us to view all the subsystems in relation to each other as an integral whole, so that the big picture will not be lost from view;
6. Conclusion

② The proposed framework illustrates the ways in which the subsystems within blended learning interact with, and impact upon, each other to grow as a healthy system.

This may have practical implications for blended learning practice as it will compel researchers to investigate the feedback loop of the systems (Cleveland, 1994), and the interaction between the subsystems, in order to avoid one-way interpretation of causality.
6. Conclusion

③ The systems approach enabled us to reveal untapped potential and crucial issues to be further investigated in future research, such as the provision of learning support, the promotion of institutional involvement, and the non-linear relationships of the subsystems in blended learning.
6. Conclusion

With an understanding of why and how temporal stability is constantly disturbed, and new balance is reached from the interaction and collaboration of the subsystems in blended learning, we could have a better grasp of its developmental stages, and could be better able to see where it will lead us.
We proposed a three-transition model for BL implementation.

More Findings from Our Latest Research

More Findings from Our Latest Research

Q1: What kinds of transitions does a vocational school experience for BL implementation?

- BL implementation transitions experienced in the school, FCEHS

<table>
<thead>
<tr>
<th>Transition</th>
<th>Transition 1</th>
<th>Transition 2</th>
<th>Transition 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Progress from one stage to another</td>
<td>From little awareness to Awareness/Exploration</td>
<td>From Awareness/Exploration to Adoption/Early implementation</td>
<td>From Adoption/Early Implementation to Mature Implementation/Growth</td>
</tr>
<tr>
<td>Timeline</td>
<td>May 2012 - February 2013</td>
<td>March 2013 - August 2014</td>
<td>September 2014 –</td>
</tr>
</tbody>
</table>

Q2: What are the determining factors which impact each transition of BL implementation?

<table>
<thead>
<tr>
<th>Category</th>
<th>Key activities in transaction 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strategy</strong></td>
<td>Leadership of the school was the driving force.</td>
</tr>
<tr>
<td></td>
<td>• Administrators put forward an initiative for building a digital campus.</td>
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<tr>
<td></td>
<td>• Administrators invited national leading advisors in BL and vocational education to evaluate and comment on the digital campus initiative.</td>
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<tr>
<td></td>
<td>• The school formulated the BL Plan under the guidance of external BL advisors.</td>
</tr>
<tr>
<td><strong>Structure</strong></td>
<td>An IT director was appointed by administrators to liaise with external BL advisors.</td>
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<td></td>
<td>• A two staged schedule was discussed for course redevelopment between January and February 2013.</td>
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<td></td>
<td>• The school bid for and was funded by the Ministry of Education’s initiative for piloting e-learning nationally.</td>
</tr>
<tr>
<td><strong>Support</strong></td>
<td>The school started its first stage of infrastructure upgrade as a preparation for its digital campus initiative.</td>
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<tr>
<td></td>
<td>• The school started to seek advice from external BL advisors for BL implementation supporting model.</td>
</tr>
</tbody>
</table>
## Key activities in transaction 2

<table>
<thead>
<tr>
<th>Category</th>
<th>The attitude, pedagogical insight and digital literacy of teachers became the determinant in BL adoption into their daily teaching.</th>
</tr>
</thead>
</table>
| Strategy          | - The school promoted BL concepts, benefits and potentials to faculty through six seminars and workshops conducted by national BL advisors.  
                   - The school conducted workshops to promote the school’s vision to the faculty.  
                   - The school selected willing teachers to participate in drawing up the BL Master Plan under the guidance of BL advisors.  
                   - The school set the criteria for selecting courses and teachers for BL implementation.  
                   - The school issued policies for developing and implementing BL courses. |
| Structure         | - A steering committee was established for drawing up the BL Master Plan.  
                   - A BL team was formed consisting external BL advisors, the School IT director and course teachers.  
                   - 25 courses were successfully re-developed and conducted by teachers in BL mode in the summer 2014.  
                   - Evaluation methods were proposed in the BL handbook.  
                   - The first 10 courses were evaluated by the BL team and the students. |
| Support           | - A BL Handbook for teachers was developed by external BL advisors.  
                   - A one-week professional development workshop was conducted to develop faculty’s BL knowledge and pedagogy.  
                   - Incentives were offered to those who participated in writing up the BL Master Plan.  
                   - The first stage of infrastructure upgrade was completed with improved e-learning platform, new computer rooms with internet access. |
## More Findings from Our Latest Research

<table>
<thead>
<tr>
<th>Category</th>
<th>Key activities in transaction 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strategy</strong></td>
<td>The successful blended learners and the improved learning outcomes drove BL forward.</td>
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<td>interviews, onsite demonstrations and conference presentations.</td>
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<td></td>
<td>• The school aimed to sustain, improve and expand BL implementation.</td>
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<tr>
<td></td>
<td>• The school has further revised its BL policies, procedures and support mechanisms.</td>
</tr>
<tr>
<td><strong>Structure</strong></td>
<td>• The BL courses were evaluated by the teachers and students.</td>
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<tr>
<td></td>
<td>• All BL courses were refined in accordance with the evaluation results.</td>
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<tr>
<td></td>
<td>• Evaluation at the course level has become normalized with one in mid semester and one at the end of the semester.</td>
</tr>
<tr>
<td></td>
<td>• Governance at different administrative levels has been refined and standardized.</td>
</tr>
<tr>
<td></td>
<td>• BL course redevelopment and implementation have been normalized in every semester.</td>
</tr>
<tr>
<td></td>
<td>• The School’s IT centre offers ongoing support and seeks external advice occasionally.</td>
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<tr>
<td></td>
<td>• Course redevelopment for BL has become ongoing.</td>
</tr>
<tr>
<td><strong>Support</strong></td>
<td>• The second stage of infrastructure upgrade was completed.</td>
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<td></td>
<td>• The BL Handbook has been refined and enriched.</td>
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<tr>
<td></td>
<td>• BL professional development and experience sharing has become ongoing.</td>
</tr>
<tr>
<td></td>
<td>• The incentive schemes for BL implementation have been refined and standardized.</td>
</tr>
</tbody>
</table>
Suggestions for vocational schools in China:
1. To need to recognize in which stage they are;
2. To focus first on the determining factors in the specific transition;
3. To supply supports relevant to other factors, such technology, content design, learning support.
Q/C?

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