Alma Mater Studiorum – Università di Bologna

DOTTORATO DI RICERCA IN

INGEGNERIA EDILE - ARCHITETTURA

Ciclo XXIV

The school environment as a teacher

The role of space and place in enhancing ecological literacy and social competence development in children and young people

L'ambiente scolastico come "terzo insegnante"

Il ruolo di spazi e luoghi nel favorire lo sviluppo della coscienza ecologica e della competenza sociale durante l'infanzia e l'adolescenza

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Questa tesi è stata realizzata al fine dell'ottenimento del Dottorato di Ricerca in Ingegneria Edile – Architettura, alla Facoltà di Ingegneria dell'Università di Bologna. La tesi è stata scritta in inglese per permetterne la diffusione anche in altri paesi. Al fine di facilitare la lettura, includo una sintesi in italiano dei concetti più importanti. In particolare, ho scelto di tradurre l'abstract, l'introduzione, una parte del capitolo sui criteri progettuali, e la conclusione.

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Indice

Abstract

Tema e domande alla base della ricerca

Possono gli spazi e i luoghi facilitare lo sviluppo personale e in particolare la coscienza ecologica e la competenza sociale? In caso di risposta positiva, in che modo gli spazi e i luoghi sono in grado di fare la differenza? Questa tesi mostra che la risposta alla prima domanda è positiva e in seguito cerca di spiegare il modo in cui gli spazi e i luoghi possono assumere un ruolo rilevante.

Il focus sulla competenza sociale e sulla coscienza ecologica significa porre l'attenzione su ciò che va oltre il semplice apprendimento delle materie scolastiche: queste due competenze sono importanti sia a livello individuale, perché influenzano positivamente tutti gli aspetti dello sviluppo personale, sia a livello collettivo, perché sono aspetti significativi nel costruire comunità eque e responsabili.

Al fine di dimostrare che lo spazio può avere un ruolo importante, la tesi presenta una serie di criteri progettuali, elaborati secondo un processo spiegato nella sezione riguardante i metodi di ricerca. Quindi, come conseguenza, segue un'altra domanda: come possono dei criteri progettuali generali essere applicati ad una serie di casi diversi, attraverso l'individuazione di linee guida, senza dare indicazioni troppo specifiche? Una possibile risposta è offrire una gamma di possibilità a temi specifici e a problemi progettuali, invece che un'unica soluzione – quindi criteri "aperti" che possano essere declinati in vari modi. I criteri progettuali, che ho cercato di individuare, includono aspetti legati sia al risultato, l'ambiente, com'è progettato e costruito, sia al processo progettuale.

L'ultima domanda alla quale la ricerca cerca di dare una risposta riguarda le possibili implicazioni pratiche dei criteri progettuali proposti: come possono tali criteri essere inclusi in politiche (ad esempio, per distribuire fondi) e in nuovi regolamenti? Inoltre, come questi criteri progettuali possono fare la differenza per migliorare la qualità dei complessi scolastici? Una possibile risposta può essere distribuire incentivi economici alle scuole che seguono questi criteri, quando esse progettano la ricostruzione o il rinnovamento dei propri edifici

(adesione volontaria ai criteri): per esempio, un punteggio potrebbe essere assegnato per il numero di criteri che sono stati rispettati. Inoltre, in relazione agli specifici regolamenti sull'edilizia scolastica, questi criteri potrebbero essere modificati in base a specifiche esigenze locali, e quindi sarebbero in grado di contribuire all'aggiornamento o alla re-definizione di standard (adesione obbligatoria ai criteri). In entrambi i casi, comunque, i criteri non dovrebbero essere troppo prescrittivi e mantenere un certo grado di flessibilità.

Metodi di ricerca

La ricerca inizia con l'analisi di letteratura scientifica di diverse discipline – sviluppo infantile e personale, psicologia infantile, scienze dell'educazione, psicologia ambientale, architettura e architettura del paesaggio – anche con l'obiettivo di individuare le possibili connessioni per impostare riflessioni interdisciplinari, come l'argomento richiedeva: alcuni collegamenti sono stati creati, integrando le idee provenienti dalle diverse aree di ricerca.

Tali conoscenze interdisciplinari sono state tradotte in una serie di criteri progettuali per spazi e luoghi che possano facilitare lo sviluppo della competenza sociale e della coscienza ecologica. L'analisi della letteratura scientifica è finalizzata a costruire solide basi per lo sviluppo dei criteri progettuali. La definizione di tali criteri necessita anche dello studio di una serie di progetti e realizzazioni: casi di studio possono dare un contributo positivo perché esempi e buone pratiche possono aiutare nella "traduzione" di conoscenza teorica in idee progettuali illustrate. A tale scopo, i diversi casi di studio sono stati valutati in base ai vari temi apparsi nella letteratura.

Infine, la ricerca attraverso il progetto può essere usata per precisare i principii progettuali: sulla base della conoscenza costruita, il ruolo del progettista è di elaborare una serie di soluzioni progettuali che possano dare risposte alle diverse "domande" emerse dall'analisi della letteratura (Figura 1).
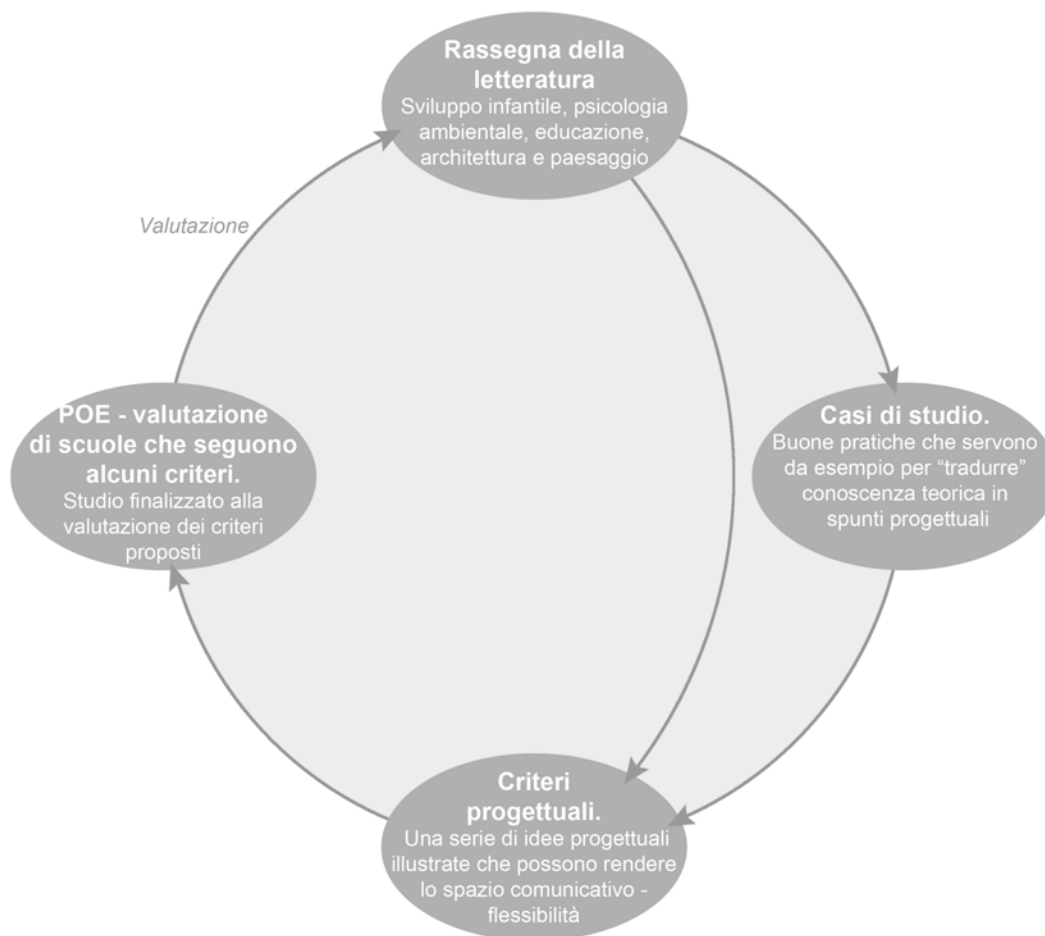
Figura 1. Il metodo di ricerca proposto

Nota: Una fase successiva dello studio, che non può essere completata per motivi economici e temporali, sarebbe la valutazione di tali criteri progettuali. L'analisi di edifici completati e utilizzati focalizzata allo sviluppo della coscienza ecologica e della competenza sociale, e realizzata su complessi scolastici standard e su complessi scolastici che in parte seguono questi criteri, sarebbe un modo di valutare l'efficacia dei principii progettuali proposti. Il completamento di questa fase successiva richiederebbe un team di ricercatori provenienti da diverse discipline (architetti, paesaggisti, educatori, psicologi) che lavorino a tempo pieno per alcuni mesi. In ogni caso, la tesi può essere considerata completa anche senza questa quarta fase perché, come si ritiene di aver dimostrato, i criteri progettuali sono stati elaborati sulla base di evidenza scientifica.

Sommario

1. Introduzione

1.1. Tema e domande alla base della ricerca

Dopo avere presentato una sintesi dell'attuale dibattito sull'edilizia scolastica al fine di dimostrare l'importanza dell'argomento, vengono introdotti i temi principali ed i quesiti che la ricerca si pone.

1.2. I metodi di ricerca

I diversi metodi di ricerca utilizzati sono illustrati e messi in relazione.

1.3. Il sommario

Le diverse parti della tesi sono introdotte, inclusi brevi abstract che spiegano i contenuti principali di ogni capitolo.

2. Rassegna della letteratura da diverse discipline

La letteratura non è solo analizzata ma viene organizzata in strutture teoriche che cercano di interpretare le conoscenze esistenti in nuovi modi, attraverso analisi comparative di concetti derivate da diverse discipline. Tali strutture sono sintetizzate di seguito. In questa sezione il ruolo di spazi e luoghi è analizzato da una prospettiva più vicina a quella di uno psicologo dell'ambiente che di un progettista.

2.1. Il modo in cui spazi e luoghi facilitano lo sviluppo personale

Cinque diversi aspetti dello sviluppo infantile sono stati individuati e analizzati: fisico, emotivo, cognitivo, sociale ed etico. Tale analisi ha fatto emergere tre temi che ricorrono in ogni aspetto: le varietà di scala, il contatto con la natura, e la modificabilità e interattività dello spazio.

2.2. Il focus sulla coscienza ecologica e sulla competenza sociale

Lo sviluppo della competenza sociale e della coscienza ecologica sono connessi perché entrambi implicano andare oltre gli interessi personali e aprirsi a una prospettiva più ampia (in particolare, alla natura e alle altre persone).

2.3. Lo sviluppo della coscienza ecologica e il ruolo di educazione, spazi e luoghi

Lo sviluppo della coscienza ecologica è analizzato secondo due componenti, emozionali e razionali, che sono espresse nell'empatia verso il mondo naturale e nella conoscenza dei fenomeni ambientali. Entrambe le componenti possono provocare un senso di apprensione per le attuali e future condizioni ambientali nei bambini e negli adolescenti. In seguito, questi ultimi possono intraprendere comportamenti ecologicamente compatibili (azione) se sviluppano una serie di competenze e se sono consci che la loro azione individuale può fare la differenza.

2.4. Lo sviluppo della competenza sociale e il ruolo di educazione, spazi e luoghi

Lo sviluppo della competenza sociale è un processo in cui gli individui cominciano a interagire con altre persone, imparano a relazionarsi con gli "altri", diventano parte di un gruppo e provano un senso di appartenenza, e infine, da adolescenti, diventano pronti a intraprendere iniziative autonome e condurre azioni positive per il loro gruppo o per altre persone.

2.5. Lezioni e competenze che spazi e luoghi possono contribuire a insegnare

Sulla base della letteratura analizzata, sono introdotte una serie d'idee sulla coscienza ecologica e sulla competenza sociale che spazi e luoghi possono contribuire a insegnare. Tali lezioni esprimono alcuni obiettivi educativi generali e possono essere considerati una sorta di programma progettuale generale per complessi scolastici.

3. Dalla teoria alla pratica: casi di studio

Una serie di casi di studio sono analizzati in base alle idee che sono state introdotte nella rassegna della letteratura – e alle lezioni e competenze che ne sono il risultato. Questa sezione include una presentazione critica di alcuni complessi scolastici attraverso fotografie, disegni e brevi descrizioni del modo in cui i progetti rispondono alle lezioni introdotte in precedenza.

4. Criteri progettuali per facilitare lo sviluppo della coscienza ecologica e della competenza sociale

Queste idee progettuali cercano di dare risposta ai bisogni emersi dall'analisi della letteratura. Esse spiegano come gli spazi e i luoghi possono fare la differenza nello sviluppo della coscienza ecologica e della competenza sociale. Alcuni criteri progettuali hanno un ruolo per entrambe le competenze: questo significa che i due fenomeni sono in qualche modo collegati.

4.1. I criteri progettuali

I criteri progettuali (illustrati con disegni elaborati dall'autore) includono una serie di aspetti legati al risultato, gli spazi progettati e costruiti, e al processo progettuale. Tra i primi, la massimizzazione dei contatti con la natura (anche all'interno dell'edificio scolastico), l'idea di limitare le barriere tra studenti e adulti, l'articolazione degli spazi pubblici interni ed esterni per creare opportunità spaziali che supportino lo sviluppo di attività di apprendimento o di socializzazione, l'utilizzo di materiali da costruzione e di essenze vegetali locali, strategie progettuali che creino coesione spaziale, la gerarchia spaziale al fine di favorire il senso di appartenenza ai luoghi, una dimensione bilanciata degli spazi in relazione alla densità spaziale, l'utilizzo di tecnologie facilmente comprensibili da bambini e adolescenti, un equilibrio tra elementi naturali e artificiali, e un'atmosfera domestica e rilassata. Tra i secondi, la partecipazione degli studenti nel progetto e l'idea che lo spazio possa subire continue modifiche nelle attività giornaliere, al fine di responsabilizzare gli studenti e permettere un certo grado di personalizzazione.

4.2. Le relazioni tra i criteri progettuali e le lezioni e competenze

Spazi e luoghi progettati secondo i diversi criteri progettuali possono contribuire all'insegnamento delle diverse lezioni. Tali collegamenti sono espressi in un diagramma.

5. Sintesi e prospettive per lo sviluppo

5.1. Sintesi dei risultati

I principali risultati sono espressi attraverso le lezioni che spazi e luoghi possono contribuire a insegnare e nei criteri progettuali che rispondono a tali lezioni.

5.2. Il modo in cui questa ricerca può contribuire con spunti originali al dibattito sugli spazi per l'educazione e le sue implicazioni pratiche

Questa tesi cerca di creare collegamenti tra varie discipline connettendo idee tra diverse aree di ricerca. Il contributo specifico di un progettista è la traduzione di queste conoscenze in criteri progettuali e nella loro visualizzazione. Tali criteri potrebbero essere usati per valutare proposte progettuali per la distribuzione di finanziamenti oppure potrebbero contribuire ad aggiornare regolamenti sull'edilizia scolastica.

5.3. Future direzioni per la ricerca

Il passo successivo della ricerca sarebbe compiere valutazioni di edifici esistenti (POE – *Post occupancy evaluation*) che seguono alcuni dei criteri proposti.

1. Introduzione

"Ciò che i bambini apprendono non è un risultato automatico di quello che viene insegnato. Invece, è in gran parte dovuto a ciò che i bambini fanno da soli come conseguenza delle loro attività e delle loro risorse" – Loris Malaguzzi

L'architettura scolastica ha ricevuto un interesse sempre crescente negli ultimi quindici anni. Varie pubblicazioni hanno posto l'attenzione sul tema con prospettive differenti, alcune basate su forme di evidenza scientifica e altre basate sulle conoscenze "artigianali" dei progettisti (Ceppi & Zini, 1998; Day, 2007; Dudek, 2000; Hertzberger, 2008; Nair & Fielding, 2005; Olds, 2001). Inoltre, parecchie pubblicazioni scientifiche nei campi della psicologia ambientale, dell'educazione e dello sviluppo infantile sono state rivolte al tema dell'influenza degli spazi per l'apprendimento sui risultati scolastici degli studenti, sulla loro motivazione, sulla loro esperienza dei luoghi e sul loro comportamento (Adams, 1991; Cotton, 1996; Killeen et al., 2003; Malone & Tranter, 2003). Quindi, questo tema è stato esplorato in modi diversi da ricercatori provenienti da diverse discipline, e non solo da architetti e paesaggisti.

Recentemente, vari programmi governativi mirati al miglioramento dell'edilizia scolastica sono stati intrapresi e completati in diversi paesi. Alcuni di essi sono su scala nazionale, altri a livello locale. Il programma *"Building Schools for the Future"* (BSF), sviluppato nel Regno Unito, ha conseguito un interesse internazionale. Tale programma pone l'attenzione sul cambiamento educativo, sulla corrispondenza tra edifici e le necessità pedagogiche e sulla sostenibilità. In Australia, lo stato di Victoria ha cominciato la trasformazione delle sue scuole attraverso il *"Victorian Schools Plan"*: il piano include la ricostruzione o l'ammodernamento di oltre 9000 scuole. In alcune scuole, gli interventi sono costituiti da piccoli miglioramenti sviluppati attraverso la partecipazione degli studenti, allo scopo di incrementare il senso di appartenenza. Il successo di tale

programma ha stimolato la creazione di un piano nazionale, il *"Building and Education Revolution"* (BER). Anche in nazioni in via di sviluppo, come la Colombia, alcuni comuni hanno intrapreso programmi per il rinnovamento dell'edilizia scolastica. E' il caso di Bogotà, dove il piano *"Nuevo Colegios"* mira a portare un cambiamento sociale attraverso l'architettura in quartieri caratterizzati da crimine e mancanza di pianificazione. Altri programmi noti sono *"Parque Escolar"* in Portogallo, *"Schools of the Future"* a Gentofte, in Danimarca, e il programma del distretto scolastico di Los Angeles.

Questo mostra che il tema è stato oggetto d'interesse in termini di pubblicazioni, di politiche e di realizzazioni. Quello che emerge da questa breve analisi è che il progetto conta. In ogni modo, questo non significa che la presente tesi aderisca alle teorie del determinismo ambientale. In altre parole, io non credo che l'ambiente fisico possa determinare in maniera prevedibile i comportamenti delle persone. Broady (1972) ha coniato il termine "determinismo architettonico" e ha criticato la natura non democratica di tale approccio, che è stato largamente applicato per il progetto architettonico e urbano dal Movimento Moderno, soprattutto da Le Corbusier – "la casa è una macchina da abitare". Più di recente, il *New Urbanism* è caduto nello stesso errore, considerando lo spazio ben progettato una panacea per creare un senso di comunità. In contrasto al determinismo ambientale, la posizione di questa tesi è che il progetto conti e che esso possa creare opportunità, ma che esso dovrebbe lasciare libertà d'uso, interpretazione e personalizzazione per gli utenti, in un approccio aperto e democratico nel quale le persone abbiano l'ultima parola.

1.1. Articolazione della tesi

La presente tesi è articolata in tre parti principali, oltre ad alcune riflessioni "conclusive".

Nella prima parte (Capitolo 2), analizzo le letterature relative a diverse discipline per esplorare relazioni tra diverse materie. Questo mi permette anche di creare una solida base di conoscenza scientifica sulla quale basare le considerazioni

progettuali che seguono. Il focus principale in questa sezione è sullo sviluppo della coscienza ecologica e della competenza sociale, e sul ruolo che spazi e luoghi possono avere in proposito. Il *fil rouge* di questo capitolo è il concetto che spazi e luoghi possono avere un ruolo importante. Per ognuna delle due competenze, la tesi presenta una struttura teorica che ne spiega lo sviluppo. Il capitolo termina con una serie di lezioni e capacità sulla competenza ecologica e sociale che spazi e luoghi possono contribuire a insegnare.

La seconda parte (Capitolo 3) presenta un'analisi critica di una serie di complessi scolastici esemplari situati in Europa e in America settentrionale. Tali scuole sono state selezionate sulla base dei temi che sono emersi nella rassegna della letteratura e sintetizzati in forma di lezioni e competenze. La selezione non intende costituire un panorama esaustivo della corrente produzione di complessi scolastici nel mondo, ma si tratta di una selezione mirata a comprendere meglio temi progettuali emersi dall'analisi della letteratura. Ogni scuola è stata valutata sulla base di come "risponde" ai bisogni emersi nelle varie lezioni.

La terza parte (Capitolo 4) è il contributo più originale della tesi. Tale sezione presenta una serie di criteri progettuali che danno risposte alle lezioni e capacità presentate nel Capitolo 2. Come detto in precedenza, tali criteri sono basati sia sulla rassegna della letteratura sia sull'analisi critica dei casi di studio. La natura delle linee guida è abbastanza generale e ampia al fine di lasciare un certo grado di libertà ideativa ai progettisti che le volessero applicare. Alcuni criteri sono indirizzati allo sviluppo della coscienza ecologica, altri a quello della competenza sociale, e altri ancora includono entrambi i temi. Alla fine del capitolo, i criteri progettuali sono messi in relazione alle lezioni e competenze per evidenziare le correlazioni.

La parte finale (Capitolo 5) sintetizza i principali risultati della ricerca, esplora le implicazioni di tali risultati e suggerisce future direzioni d'indagine.

4. Criteri progettuali per facilitare lo sviluppo della coscienza ecologica e della competenza sociale

Le idee progettuali che vengono presentate forniscono possibili risposte alle lezioni emerse dall'analisi della letteratura. In altre parole, esse mostrano il contributo di spazi e luoghi nello sviluppo della coscienza ecologica e della competenza sociale. Alcuni criteri progettuali hanno un ruolo per entrambe le competenze: questo significa che i due fenomeni sono strettamente collegati.

4.1. Lezioni e competenze che spazi e luoghi possono contribuire a insegnare

Al fine di facilitare la comprensione dei criteri progettuali, è opportuno introdurre una serie d'idee sulla coscienza ecologica e sulla competenza sociale che spazi e luoghi possono contribuire a insegnare. Tali concetti sono stati elaborati sulla base della letteratura analizzata nel Capitolo 2. Le lezioni esprimono alcuni obiettivi educativi generali e possono essere considerate una sorta di programma progettuale per complessi scolastici.

Le lezioni sono organizzate in due categorie principali, una comprendente idee riguardanti la coscienza ecologica, l'altra focalizzata sulla competenza sociale (Figura 2). Le lezioni di quest'ultima categoria sono ordinate secondo una sequenza temporale, derivante dalle diverse fasi dello sviluppo sociale di un individuo. Infatti, è necessario riconoscere e sapersi relazionare con se stessi prima di imparare a interagire con altre persone.

Competenza ecologica

a. Rispettare e amare l'ambiente

b. Conservare l'energia e altre risorse

c. Il senso di responsabilità e prendersi cura dei luoghi e degli esseri viventi

d. Pensiero sistematico e connessioni tra azioni e conseguenze

e. La natura è ovunque, anche in città

f. Focus sui fenomeni locali

g. Educazione alimentare e per stili di vita sani

j. Relazionarsi con i pericoli della natura

k. Densità e mobilità sostenibile

h. Fonti di energia

Competenza sociale

i. Riconoscere e relazionarsi con i propri sentimenti

l. Capire i punti di vista di altre persone - pensare in prospettiva

m. Sviluppare le capacità per interagire positivamente con altri

n. Capire il funzionamento di una comunità (con le sue regole) e imparare a fare parte di tale gruppo

o. Accettare e apprezzare la diversità degli esseri umani

p. Sentire un senso di appartenenza a comunità e luoghi

q. Sviluppare le capacità per essere pensatori autonomi e critici

r. Sviluppare responsabilità sociale e porsi nuovi obiettivi

s. Pensare a livello globale, agire a livello locale

Figura 2. Le lezioni e competenze che spazi e luoghi possono insegnare.

4.2. Criteri progettuali

01. Massimizzare la presenza della natura
1.1. Portare la natura negli spazi interni - serre e atri
1.2. Massimizzare l'accessibilità a spazi esterni a ogni livello dell'edificio
1.3. Forme di giardinaggio diffuse in tutto il campus scolastico
1.4. Utilizzare attivamente i tetti degli edifici
1.5. Progettare edifici come entità separate nel campus scolastico
1.6. Eliminare o ridurre la presenza di automobili nell'area scolastica

02. Spazi non finiti e modificabili: appropriazione e personalizzazione
2.1. Includere elementi fissi che costituiscano l'"hardware" dello spazio
2.2. Lo spazio dovrebbe essere abbastanza flessibile per essere modificato facilmente
2.3. Opportunità di personalizzazione
2.4. Mostrare il lavoro degli studenti - esposizioni temporanee

03. La dimensione locale degli elementi progettati
3.1. Includere vegetazione locale
3.2. Il progetto deve tenere in considerazione i caratteri locali dell'ambiente costruito
3.3. Includere un elemento di identificazione locale

04. Le persone e la natura: coesistenza e interdipendenza
4.1. Sottolineare la differenza tra elementi naturali e artefatti e mostrarne la coesistenza
4.3. Continuità tra spazi interni ed esterni
4.3. La natura dovrebbe essere portata alla "casa base" degli studenti nell'edificio scolastico
4.4. La natura dovrebbe riprendere possesso del campus scolastico dopo l'intervento umano

05. Tecnologie e opere d'arte facili da capire e da usare
5.1. La tecnologia dovrebbe comunicare idee sul funzionamento dell'edificio
5.2. Tecnologie hi-tech e low-tech dovrebbero essere facili da capire per gli studenti
5.3. Focus su specifici temi della sostenibilità in parti distinte dell'edificio scolastico
5.4. Opere d'arte possono arricchire la bellezza di alcuni luoghi naturali
5.5. Includere materiati riciclati utiizzati in maniera insolita
5.6. Mostrare elementi didattici per imparare la matematica, la logica e le lingue

06. Articolare lo spazio pubblico e creare aree per attività
6.1. Attivare lo spazio pubblico
6.2. Creare aree per specifiche attività all'interno
6.3. Creare aree per specifiche attività all'esterno
6.4. Attrattori sociali
6.5. Relazioni bilanciate tra aree per attività sia all'interno che all'esterno
6.6. Varietà di spazi esterni per supportare un apprendimento multidisciplinare
6.7. Lo spazio dovrebbe facilitare un curriculum integrato per lo sviluppo della coscienza ecologica
6.8. Ogni scuola dovrebbe avere degli orti o una serra

07. Coesione spaziale, gerarchia, e varietà di scala
7.1. Includere elementi spaziali che facilitino la coesione spaziale
7.2. Articolare gli spazi secondo logiche gerarchiche, dedicando ai vari gruppi luoghi specifici
7.3. Includere strade e piazze nel sistema di spazi pubblici
7.4. Scuole di piccole dimensioni e piccole comunità di apprendimento
7.5. Una densità spaziale equlibrata

08. Favorire un'atmosfera scolastica positiva
8.1. Rompere le barriere tra studenti e adulti
8.2. Un aspetto domestico, un'atmosfera rilassata, e stimoli sensoriali
8.3. Includiere sedute informali e confortevoli

09. La partecipazione degli studenti nel progetto
9.1. Includere gli studenti in significative attività di partecipazione
9.2. Focalizzare l'attenzione su piccole parti della scuola
9.3. Includere la diversità culturale nel progetto

10. La scuola e il quartiere: localizzazione e connessioni
10.1. Localizzazione: vicino a casa e vicino alla natura
10.2. Una "scuola diffusa" composta di diversi luoghi all'interno del quartiere
10.3. Condividere spazi con il quartiere
10.4. Confini aperti - la strada come playground

Figura 3. I criteri progettuali elaborati.

I criteri progettuali, presentati anche attraverso illustrazioni elaborate dall'autore, includono una serie di aspetti legati al risultato, gli spazi progettati e costruiti, e al processo progettuale (Figura 3). La scelta di includere elementi dell'iter progettuale nei criteri proposti deriva dalla consapevolezza che sia molto difficile prevedere linee guida che si possano applicare allo stesso modo in contesti diversi, e che quindi sia necessario rispondere alle diverse istanze locali introducendo elementi di flessibilità (partecipazione e creazione di spazi modificabili che facilitano la personalizzazione).

4.3. Le relazioni tra i criteri progettuali e le lezioni e competenze

Come detto, i criteri progettuali costituiscono una "risposta" ai temi emersi nell'analisi della letteratura e sintetizzati nelle lezioni su ecologia e competenza sociale. Per questo motivo, è opportuno mostrare quali criteri progettuali possono contribuire a insegnare le diverse lezioni. La Figura 4 spiega le connessioni tra linee guida e competenze – per ogni connessione è stata data una breve spiegazione.

Le lezioni a-h riguardano la coscienza ecologica, mentre le lezioni i-s sono riferite alla competenza sociale. I criteri 1-5 sono principalmente riferiti a valori ecologici, mentre i criteri 6-10 rispondono maggiormente a temi legati alla competenza sociale. Come risultato, la Figura 4 mostra una più alta densità di relazioni in due aree, localizzate diagonalmente (maggiore corrispondenza tra a-h e 1-5 e tra i-s e 6-10). In ogni caso, ci sono diverse interconnessioni tra competenza sociale e coscienza ecologica.

Il grafico mostra anche che la maggior parte dei criteri è stata mirata alla creazione di luoghi che richiedono il diretto coinvolgimento degli studenti, al fine di favorire lo sviluppo di un senso di partecipazione. Questo mostra che la partecipazione è tema rilevante sia per la competenza ecologica sia per quella sociale.

lezioni / criteri progettuali	a. Rispettare e amare l'ambiente	b. Conservare energia e altre risorse	c. Responsabilità e prendersi cura dei luoghi e degli esseri viventi	d. Pensiero sistematico e connessioni tra azioni e conseguenze	e. La natura è ovunque, anche in città	f. Focus su fenomeni locali	g. Educazione alimentare e per stili di vita sani	j. Relazionarsi con i pericoli della natura	k. Densità e mobilità sostenibile	h. Fonti di energia	i. Riconoscere e relazionarsi con i propri sentimenti	l. Capire i punti di vista di altre persone: pensare in prospettiva	m. Sviluppare le capacità per interagire positivamente con gli altri	n. Imparare a essere parte di una comunità	o. Accettare e apprezzare la diversità degli esseri umani	p. Sentire un senso di appartenenza a comunità e luoghi	q. Essere pensatori autonomi e critici	r. Sviluppare responsabilità sociale e porsi nuovi obiettivi	s. Pensare a livello globale, agire a livello locale
1. Massimizzare la presenza della natura	Il contatto con la natura è fondamentale per la coscienza ecologica				La natura è presente in una serie di elementi, come l'acqua			Contatto con elementi naturali, inclusi quelli che fanno paura	I tetti verdi sono esempi di un uso intelligente delle risorse										
2. Spazi non finiti e modificabili: personalizzazione			Gli spazi modificabili necessitano di cura: questo richiede l'impegno degli studenti	Modificare gli spazi richiede prendere decisioni e valutarne le conseguenze				Permettere usi diversi per lo spazio è un modo di usarli intelligentemente, risparmiando spazio				Modificare lo spazio richiede di prendere decisioni e quindi valutare i diversi punti di vista	Lo spazio può essere modificato ma ci sono regole: confrontare i propri bisogni con altri			Modificare lo spazio in relazione alla propria identità incrementa l'attaccamento o ad esso	Spazi modificabili danno una possibilità agli studenti di mettere in discussione il progetto	Modificare lo spazio richiede de prendere decisioni e valutarle (auto valutazione)	
3. La dimensione locale degli elementi progettati		Usare materiali locali è un esempio di sostenibilità	Agire a livello locale per la natura: permette agli studenti di fare la differenza													Il focus sulle identità locali rinforza i legami con la comunità			Il focus su elementi locali favorisce la conoscenza dei propri luoghi
4. Le persone e la natura: coesistenza e interdipendenza	...gli studenti imparano che gli umani dipendono dalla natura, è più facile che la rispettino			Mostrare le connessioni tra umani e natura favorisce il pensiero sistematico	Le connessioni tra umani e natura spiegano che la natura è necessaria in città	La flora locale è importante per la fauna locale: ecosistemi locali da osservare		La natura che si riappropria del sito significa che la natura è senza tempo					La natura è uno spazio informale dove socializzare			Connessioni interno-esterno favoriscono il contatto visivo, quindi il senso di unità			Essere coscienti dei fenomeni locali e globali favorisce l'azione a livello locale
5. Tecnologie e opere d'arte facili da capire e utilizzare	Forme d'arte comprendenti la natura stimolano e amore per l'ambiente	Elementi che producono energia rinnovabile mostrano esempi di sostenibilità		Sapere come funzionano gli edifici e gli spazi esterni favorisce il pensiero sistematico						Pannelli fotovoltaici e pale eoliche mostrano agli studenti come viene prodotta l'energia						L'arte è un modo per favorire la connessione emozionale ad un luogo			
6. Articolare lo spazio pubblico e creare aree per attività	Giardini e orti richiedendo cura, rinforzano i legami tra studenti e natura		Gli orti inclusivi rendono gli esseri viventi che necessitano di cura: responsabilità	Mostrare l'intero ciclo del cibo facilita il pensiero sistematico	Giardini e orti introducono la natura nelle scuole urbane		Giardini e orti: produzione di cibo locale e sano	Giardini e orti possono includere piccoli animali					Le attività nello spazio pubblico facilitano interazioni, attratto sociali		Lo spazio pubblico è dove le persone incontrano gli "altri", cioè la diversità	Divertimento nello spazio pubblico favorisce l'attaccamento ai luoghi			
7. Coesione spaziale, gerarchia e varietà di scala											La presenza di una casa base facilita lo sviluppo di un senso di sé		Densità spaziale, dimensioni e prossimità influenzano la socializzazione	Lapertura richiede delle regole, come essere silenziosi	Lapertura significa uguaglianza: stesse opportunità	La coesione spaziale e la gerarchia favoriscono un senso di appartenenza	Piccole comunità di apprendimento favoriscono il senso di appartenenza	Gli studenti devono prendersi cura e della loro spazi e della loro "famiglia"	
8. Favorire un'atmosfera positiva											Un clima domestico: le persone possono essere loro stesse	Progettare insieme: relazionarsi con altri punti di vista	Progettare significa interagire con altre persone	Il progetto partecipato ha delle regole, come una comunità	Partecipazione significa includere tutti nel progetto	Apertura: clima positivo e socievole per facilitare la coesione	Progettare per il cambiamento significa modificare lo status quo	Apertura: studenti responsabili del loro comportamento	
9. Partecipazione degli studenti al progetto			Spazi naturali progettati da studenti: senso di appartenenza	Progettare richiede il pensiero sistematico		Progettare nella propria comunità: implicare fenomeni locali					Le persone devono pensare a quello che vogliono che progettare					Il progetto partecipato favorisce l'attaccamento o ai luoghi	Il progetto partecipato è un esercizio di responsabilità civica		Progettare la propria scuola significa agire a livello locale
10. Scuola e quartiere: localizzazione e connessioni					Posizione vicino a parchi urbani: presenza di boschi e prati	Connettersi con la propria comunità e porre attenzione alla sfera locale	Scuole vicino permettono a andarci in bici e a piedi		Scuole vicino a casa permettono a studenti di andarci in bici e a piedi			Condividere spazio: incontrare i vicini e conoscere i loro punti di vista				Connessioni locali migliorano la coesione del quartiere		Partecipare a livello locale facilita l'attaccamento o ai luoghi	Partecipare in attività della comunità con spazi condivisi

Figura 4. Le connessioni tra criteri progettuali e lezioni e competenze.

5. Sintesi e prospettive di sviluppo

5.1. Sintesi dei risultati della ricerca

Questa tesi ha dimostrato che spazi e luoghi sono potenzialmente portatori di conoscenze e valori e che possono trasmettere agli studenti idee sulla natura e fornire opportunità per condividere esperienze con altre persone. Inoltre, spazi e luoghi possono contribuire allo sviluppo di comportamenti ecologicamente e socialmente responsabili. In relazione alla coscienza ecologica, il tema degli spazi esterni è stato oggetto di numerosi studi ma si riscontra una parziale mancanza di ricerche sull'organizzazione e i caratteri degli spazi interni. Per questo motivo, tale argomento è stato analizzato da una prospettiva meta-progettuale, anche attraverso lo studio di complessi scolastici esemplari, e alcune nuove idee sono emerse.

I risultati principali, che costituiscono un contributo originale alla letteratura del settore, sono stati espressi attraverso le lezioni che spazi e luoghi possono contribuire a insegnare e nei criteri progettuali che rispondono a tali lezioni.

Nelle lezioni, ho sintetizzato le principali abilità e conoscenze sull'ecologia e sulla socialità che gli studenti dovrebbero sviluppare. Inoltre, ho inserito tali abilità e conoscenze in due strutture teoriche di riferimento. In quella sulla competenza ecologica, la conoscenza della natura e l'empatia per l'ambiente sono considerati i due percorsi principali che possono portare a sviluppare un senso di apprensione per la natura. In seguito, comportamenti ecologicamente compatibili possono essere una conseguenza di tale apprensione se agli studenti vengono insegnati gli strumenti opportuni e se essi sono coscienti che le proprie azioni possono fare la differenza, almeno a livello locale. Nella struttura teorica sulla competenza sociale è descritta l'evoluzione delle relazioni dei bambini e degli adolescenti con "gli altri". Dopo aver appreso a relazionarsi positivamente con le proprie sensazioni, i bambini possono sviluppare le competenze per interagire con i propri pari e con gli adulti e dunque uscire dal proprio mondo introverso. Se tali interazioni sono positive, i bambini e gli adolescenti possono

imparare a essere parte di un gruppo e a provare un senso di appartenenza a una comunità. Infine, col passare del tempo, gli adolescenti possono trovare un equilibrio tra l'appartenenza a un gruppo e l'indipendenza e cominciare a intraprendere azioni per il loro gruppo o per altre persone, come forma di impegno civico.

I criteri esprimono idee progettuali che, se applicate alla concezione di complessi scolastici, possono contribuire allo sviluppo positivo delle competenze ecologiche e sociali. Tali criteri sono basati sia sulla rassegna della letteratura presentata nel Capitolo 2, sia sull'analisi critica di complessi scolastici esemplari illustrata nel Capitolo 3. I principii progettuali sono basati, per quanto possibile, su evidenza scientifica e, quindi, si è cercato di limitare l'introduzione di opinioni soggettive. Alcuni criteri sono indirizzati a rispondere a questioni relative alla coscienza ecologica – per esempio, il numero 1, "Massimizzare la presenza della natura", o il numero 4, "Le persone e la natura: coesistenza e interdipendenza". Altri sono focalizzati sulla competenza sociale, come il numero 6, "Articolazione dello spazio pubblico e zone di attività" e il numero 7, "Coesione spaziale, gerarchia e scala". Inoltre, alcuni criteri rispondono a questioni sollevate da entrambi i temi principali, e questo mostra come questi ultimi siano fortemente connessi: il numero 2, "Spazi non finiti e modificabili: appropriazione e personalizzazione" e il numero 10, "La scuola e il quartiere: posizione e connessioni". Come detto, la Figura 4 esprime il modo in cui spazi e luoghi concepiti secondo i criteri progettuali proposti possono contribuire a insegnare le lezioni e le abilità sulle competenze ecologiche e sociali.

5.2. Come questa ricerca può portare avanzamenti alla disciplina e le sue implicazioni pratiche

Questa tesi ha cercato di stabilire connessioni tra discipline diverse attraverso il confronto critico d'idee elaborate in diverse aree di ricerca. Il contributo specifico di un progettista è costituito dalla "traduzione" di tale conoscenza in criteri progettuali e nella visualizzazione degli stessi. Le soluzioni progettuali

proposte sono deliberatamente generali e flessibili in modo che esse possano essere applicate, se convenientemente modificate, a contesti e situazioni diverse.

Ogni ricerca deve trattare temi rilevanti sia sul piano teorico sia a livello pratico. I criteri progettuali proposti possono essere utilizzati in vari modi.

In primo luogo, essi possono essere usati per valutare proposte progettuali. Ad esempio, i criteri possono servire come base per attribuire punteggi a diverse proposte nell'ambito di concorsi di architettura per il progetto di complessi scolastici. Inoltre, comuni e circoli didattici possono utilizzare tali linee guida per valutare diversi progetti di complessi scolastici e distribuire fondi o incentivi alle varie scuole.

Inoltre, comuni e province possono valutare i complessi scolastici esistenti di propria pertinenza attraverso i criteri progettuali proposti, al fine di determinare quali richiedono una ristrutturazione, quali devono essere demoliti e ricostruiti, e quali invece sono in condizioni soddisfacenti.

Infine, i criteri potrebbero contribuire ad aggiornare le norme tecniche relative all'edilizia scolastica. In Italia, per esempio, tali norme sono parecchio datate (D.M. 18/12/1975) e necessitano ovviamente di una revisione che tenga conto delle mutate condizioni educative e sociali. L'integrazione di concetti relativi alla competenza sociale ed ecologica nelle norme tecniche darebbe ai comuni e alle province strumenti importanti per controllare la qualità dei propri complessi scolastici. Questo potrebbe contribuire a incrementare il potenziale istruttivo di spazi e luoghi.

5.3. Ulteriori direzioni di ricerca

Come notato nell'introduzione, il passo successivo di questa ricerca richiederebbe valutare se le scuole progettate seguendo alcuni dei criteri proposti contribuiscano, in effetti, allo sviluppo della coscienza ecologica e della competenza sociale negli studenti che le abitano.

A tal scopo, eseguirei una serie di studi su complessi scolastici in uso, focalizzando l'attenzione sulla coscienza ecologica e sulle competenze sociali degli studenti: confronterei complessi scolastici esemplari ad altri progettati secondo gli schemi ricorrenti. Tale studio includerebbe questionari che cerchino di misurare il livello delle competenze ecologiche e sociali degli studenti, interviste intese ad analizzare come gli spazi sono utilizzati e percepiti e una valutazione della qualità degli spazi stessi – che può essere effettuata usando i criteri progettuali proposti. Le scuole analizzate dovrebbero essere raggruppate in coppie simili dal punto di vista del contesto sociale, educativo, economico ed etnico. In ogni coppia, l'unico fattore che dovrebbe variare sarebbe la presenza di soluzioni progettuali in accordo con i criteri proposti. Tale strategia escluderebbe gli effetti di altri possibili fattori (come contesto sociale ed educativo) per l'effetto misurato – maggiore coscienza ecologica e competenza – e quindi isolerebbe l'effetto di spazi e luoghi. Tale studio potrebbe creare ulteriore evidenza scientifica sulla quale basare analisi più approfondite sul potenziale istruttivo degli edifici scolastici e dei loro spazi esterni.

Il completamento di questa fase successiva richiederebbe un team di ricercatori provenienti da diverse discipline (architetti, paesaggisti, educatori, psicologi) che lavorino a tempo pieno per alcuni mesi. In ogni caso, la tesi può essere considerata completa anche senza questa ulteriore fase perché, com'è su ritiene di avere dimostrato, i criteri progettuali sono stati elaborati sulla base di evidenza scientifica.

The school environment as a teacher

The role of space and place in enhancing ecological literacy and social competence development in children and young people

This dissertation has been realized in fulfillment of the requirements of the PhD degree in Ingegneria Edile - Architettura at the Facoltà di Ingegneria of the Università di Bologna.

Bologna, 15 March 2012

Abstract

Topic and main research questions

Can space and place foster child development, and in particular social competence and ecological literacy? If yes, how can space and place do that? This study shows that the answer to the first question is positive and then tries to explain the way space and place can make a difference.

The choice of social competence and ecological literacy implies the focus on what goes beyond simple academic achievement: those two "life skills" are important both for individuals – as they have a positive influence on all the aspects of personal development – and for groups of people – as they are significant aspects for building fair and responsible communities.

In order to show the way space can make a difference, a series of illustrated design criteria has been developed (through a process that is explained in the research methods section). Then, as a consequence, another research question follows: can some general design suggestions be applied to a variety of cases, giving an insight but without being too specific? A possible answer is offering a variety of possibilities to every design problem, rather than just one solution – i.e. various illustrations are presented for every criterion.

The cited design suggestions include a series of aspects both related to the outcome, the designed environment, and to the design process.

The final research question is about the possible practical implications of the proposed design criteria: how can such design suggestions be included in policies (for example, the distribution of funding) and building regulations? Also, how those design criteria can actually make a difference? A possible answer would be distributing economic incentives to the schools that follow such criteria when they design their new facilities or when they renovate the existing ones (voluntary adhesion to the criteria): for example, a score could be given for the number of criteria that has been met. Also, in relation to the school-specific building regulations, these criteria could be made more specific responding to local aspects and then they could contribute to updating and redefining the

standards (compulsory adhesion to the criteria). However, in both cases, the criteria should not be too prescriptive and leave a certain degree of flexibility.

Research methods

Literature from different disciplines – child development and child psychology, education, environmental psychology, architecture and landscape architecture – is reviewed. Some bridges among such disciplines are created and in some cases the ideas from the different areas of research merge: thus, this is an interdisciplinary study.

The interdisciplinary knowledge from these disciplines is translated into a range of design suggestions that can foster the development of social competence and ecological literacy. Using scientific knowledge from different disciplines is a way of introducing forms of evidence into the development of design criteria. However, the definition of design criteria also has to pass through the study of a series of school buildings and un-built projects: case studies can give a positive contribution to the criteria because examples and good practices can help "translating" the theoretical knowledge into design ideas and illustrations. To do that, the different case studies have to be assessed in relation to the various themes that emerged in the literature review.

Finally, research by design can be used to help define the illustrated design criteria: based on all the background knowledge that has been built, the role of the architect is to provide a series of different design solutions that can give answers to the different "questions" emerged in the previous work.

Table of contents

1. Introduction

"What children learn does not follow as automatic result from what is taught. Rather, it is in large part due to the children's own doing as a consequence of their activities and our resources". --Loris Malaguzzi

School architecture has received a growing interest in the last fifteen years. Several publications have addressed this theme from different perspectives, some relying on forms of scientific evidence and some based on the designers' craftsmanship knowledge (Ceppi & Zini, 1998; Day, 2007; Dudek, 2000; Hertzberger, 2008; Nair & Fielding, 2005; Olds, 2001). Also, several scholarly publications in the fields of environmental psychology, education and child development address the topic of the influence of educational facilities on students' achievement, motivation, experience of place, and behavior (Adams, 1991; Cotton, 1996; Killeen et al., 2003; Malone & Tranter, 2003). Hence, this theme has been explored in different ways by scholars from different disciplines, not only by architects and landscape architects.

In recent years, several programs aimed at improving school buildings have been undertaken or have been completed around the world. Some of them are nationwide, while others are local. The United Kingdom "Building Schools for the Future" (BSF) program has gained international interest. It focuses on educational transformation, on the correspondence between buildings and pedagogical needs, and on sustainability. In Australia, the State of Victoria has started transforming its schools through its Victorian Schools Plan with over 900 schools that will be rebuilt and modernized. In some schools, the interventions were small improvements in schools developed through students' participation at the aim of enhancing their place attachment. The success of this program has stimulated a nationwide program, the Building and Education Revolution (BER). Even in developing countries like Colombia, some municipalities have undertaken school renovation programs. It is the case of Bogota, where the

"Nuevo Colegios" plan aims at bringing social change through architecture in neighborhoods characterized by crime and a lack of urban planning. Other well-known programs are Portugal's "Parque Escolar," Gentofte's "Schools of the Future" in Denmark, and Los Angeles School District's school building program.

Hence, the topic has been object of interests in terms of publications, of policies and of implemented plans. What emerges from this is that design matters. This does not mean that this thesis embraces the environmental deterministic theories. In other words, I do not believe that the physical environment can determine in predictable ways people's behaviors. Broady (1972) coined the term "architectural determinism" and criticized the undemocratic nature of this approach, which was widely applied both for architectural and urban design by the Modernist architectural movement, namely by Le Corbusier - "the house is a machine for living." In more recent years, New Urbanism made the same error: its theorists and practitioners consider well-designed space as a panacea for creating community. In contrast to environmental determinism, my position is that design matters and that it can provide opportunities, but that it should leave freedom of use, interpretation and customization to users, in an open and democratic approach in which people have the last word.

1.1. Topic and main research questions

Can space and place foster child development, and in particular social competence and ecological literacy? If yes, how can space and place do that? This study shows that the answer to the first question is positive and then tries to explain the way space and place can make a difference. In doing that, it revisits the idea of the "environment as a third teacher", introduced by the Reggio Emilia approach in Italy.

The choice of social competence and ecological literacy implies the focus on what goes beyond simple academic achievement: those two "life skills" are important both for individuals – as they have a positive influence on all the aspects of

personal development – and for groups of people – as they are significant aspects for building fair and responsible communities.

In order to show the way space can make a difference, a series of illustrated design criteria has been developed (through a process that is explained in the research methods section). Then, as a consequence, another research question follows: can some general design suggestions be applied to a variety of cases, giving an insight but without being too specific? A possible answer is offering a variety of possibilities for every design problem, rather than just one solution – i.e. various illustrations for every criterion. The cited design suggestions include a series of aspects both related to the outcome, the designed environment, and to the design process.

The final research question is about the possible practical implication of the proposed design criteria: how can such design suggestions be included in policies (including the distribution of funding) and building regulations? Also, how those design criteria can actually make a difference? A possible answer would be distributing economic incentives to the schools that follow such criteria when they design their new facilities or when they renovate the existing ones (voluntary adhesion to the criteria): for example, a score could be given for the number of criteria that has been met. Also, in relation to the school-specific building regulations, these criteria could be made more specific responding to local aspects and then they could contribute to updating and redefining the standards (compulsory adhesion to the criteria). However, in both cases, the criteria shouldn't be too prescriptive and leave a certain degree of flexibility.

The focus of this study is on primary and secondary schools in order to cover a large part of the process of development of ecological literacy and social competence. The different competences of the various age groups will be highlighted and reflected in the design criteria.
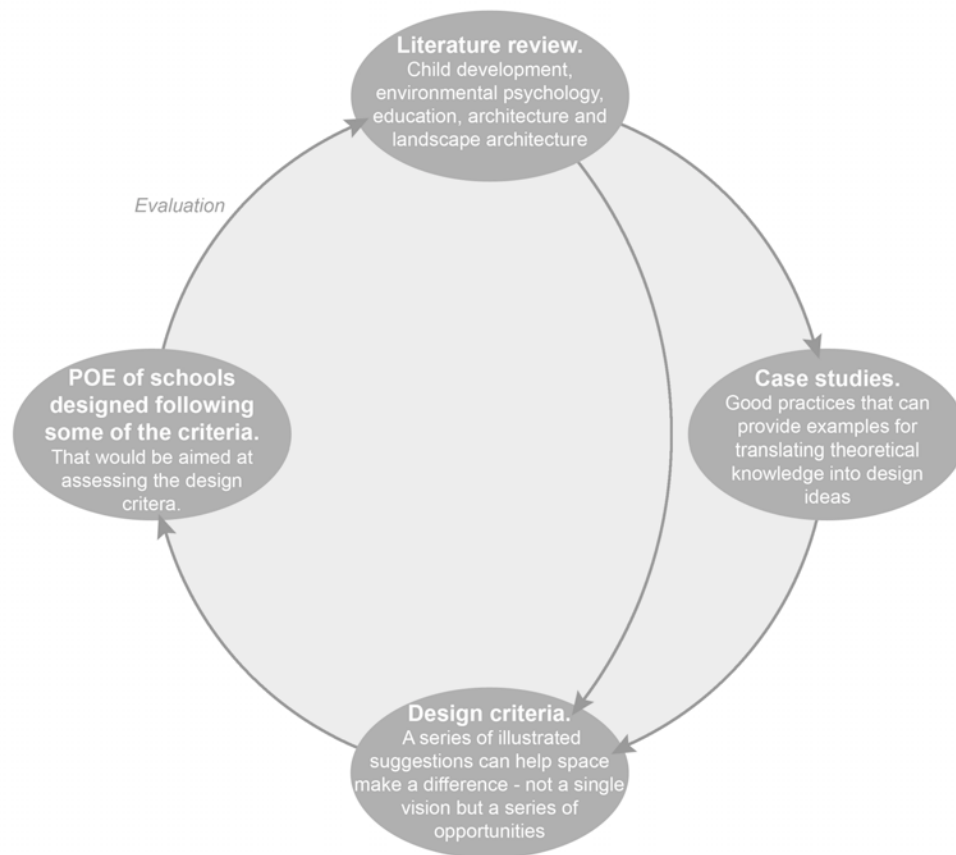
1.2. Research methods

Literature from different disciplines – child development and child psychology, education, environmental psychology, architecture and landscape architecture – is reviewed. Some bridges among such disciplines are created and in some cases the ideas from the different areas of research merge: thus, this is an interdisciplinary study.

The interdisciplinary knowledge from these disciplines is translated into a range of design suggestions that can foster the development of social competence and ecological literacy. Using scientific knowledge from different disciplines is a way of introducing forms of evidence into the development of design criteria. However, the definition of design criteria also has to pass through the study of a series of school buildings and un-built projects: case studies can give a positive contribution because examples and good practices can help "translating" the theoretical knowledge into design ideas and illustrations. To do that, the different case studies have to be assessed in relation to the various themes that emerged in the literature review.

Finally, research by design can be used to help define the illustrated design criteria: based on all the background knowledge that has been built, the role of the designer is to provide a series of different design solutions that can give answers to the different "questions" emerged in the previous work.

Note: A further step of the study, which can't be completed for funding and time reasons, would be the evaluation of such design criteria: post-occupancy evaluation studies focused on the development of ecological literacy and social competence performed on "average" buildings and grounds and on facilities that partly follow such criteria could be a way of assessing the effectiveness of the proposed principles. The completion of this further step would require a team of people from different disciplines (built environment sciences, education, psychology) working full time for a few months. However, the study can be considered complete even

without the fourth step because, as it has been shown, the design criteria have been elaborated based on scientific evidence.

Figure 1.1 The proposed research method

1.3. The outline

This thesis is articulated in three main parts plus a final summary.

In the first (Chapter 2), I review scholarship from different disciplines in order to explore relationships between the different bodies of literature. This also allows me to create a solid body of scientific knowledge on which the following design considerations will be based. The main focus of the section is on the development of ecological literacy and social competence and on the role that space and place can play in that. The common thread of this part is that space and place can make a difference. For each of the two competencies, I developed a

theoretical framework that explains the development of such competences. The section ends with a series of lessons and skills about ecological literacy and social competence that space and place can contribute to teach.

The second part (Chapter 3) presents a critical analysis of a series of exemplary educational facilities located in Europe and North America. Such schools have been selected based on the themes that emerged in the literature review and then summarized in form of lessons and skills. The presented facilities do not aim at constituting an exhaustive overview of the worldwide school building design and construction but they are a biased selection aimed at better understanding design issues related to the literature review themes. Every school has been assessed based on the way it "responds" to the different lessons and skills.

The third part (Chapter 4) constitutes the most original contribution of the thesis. It introduces a series of design criteria that give answers to the lessons and skills presented in Chapter 2. As it has been said, such criteria are based both on the literature review and on the critical analysis of case studies. The nature of the criteria is quite general and comprehensive in order to leave a certain degree of design freedom to the architects and planners who will work with them. Some of the criteria address the theme of ecological literacy, some focus on social competence, and others encompass both themes. At the end of the chapter, I relate the criteria to the lessons and skills to highlight their correlations.

The final part (Chapter 5) summarizes the most important research findings, explores the implications of such findings and suggests directions for further research.

2. Literature review from different disciplines

In order to give answers to the research questions that have been posed, scholarship from different disciplines has been reviewed. Knowledge from child development and child psychology clarifies how children and young people develop ecological literacy and social competence. Scholarship about education explains the contribution of learning activities. Finally, knowledge from environmental psychology, architecture and landscape architecture can illustrate the role of space and place in enhancing ecological literacy and social competence development.

The scholarship is not only analyzed but it is also organized in theoretical frameworks that try to put the existing knowledge into a new perspective. For example, the development of ecological literacy is seen as a product of two components, emotional and rational, that are expressed in empathy to the natural world and in knowledge about the environmental phenomena. Both components can bring about concern for nature in children and young people. Then, they can become stewards for the environment (action) if they are taught some skills and if they are aware that their actions can make a difference.

Also, in this section the role of space and place are analyzed from a perspective that is closer to the one of an environmental psychologist than to the one of an architect. This is aimed at providing a more scientific outlook on which basing the more architect-specific work, in the design criteria.

2.1. The way space and place can enhance personal development

The environment of a school plays an active role in children's development, including the way they learn. This position is held by many developmental psychologists. Piaget and Vygotsky both claimed that learning and development happen through the interaction of children with the environment and people (Hunt, 1969). Psychologist and educator, Loris Malaguzzi (1998), the founder of the Reggio Emilia preschool system, suggested that the environment is a "third teacher", which has the power to speak to children and stimulate them.

The influence of the environment is widely recognized by architects and landscape architects, both in its physical components (space) and its relationship to socio-cultural meanings (place). In relation to schools, Nair and Fielding (2005) point out that the school building and grounds can be considered a three-dimensional textbook, offering curricular information, and helping children learn about social relations and norms (Sutton, 1996).

However most school systems do not see space and place as actors in the learning process. Many school buildings across the world still reflect the traditional pattern of shoe-box classrooms along corridors. Architects can play a role and propose designs based on knowledge of child development, but the change must come from educators and communities (Hertzberger, 2008), the people who give meaning to schools. A deeper understanding and collaboration among school practitioners and designers is the key to going beyond traditional educational facilities.

This thesis helps bridge the gap between educational psychology and architecture by giving evidence for the need for a more developmentally appropriate design. Five main aspects of child development (physical, ego, cognitive, social, and ethical) and their implications for design are discussed. Common themes among the aspects are then highlighted and related to concepts of space and place.

Knowledge about child development

Childhood is a time of rapid development. This development occurs in all aspects of a child's life. For the purposes of analysis, we discuss five aspects of development separately, despite the overlapping and integrated nature of actual development. Knowledge about development in the physical, ego, cognitive, social, and ethical realms each have implications for the design of schools.

Physical development

Physical development refers to changes in the body and one's control over one's body. This involves muscular control, coordination, and an increase in strength. During elementary school years, children learn to coordinate their bodies in relation to other people and space. They also further develop a sense of balance. Children do this through exploration, movement, and adventure. There is a natural desire for children to test themselves physically, much to the chagrin of caretakers who nervously standby as children climb, swing, and engage in other risk-taking behaviors. These behaviors serve an important purpose for a child's physical development. In addition, good mastery of movement and coordination is suggested to be fundamental for intellectual development (Olds, 2001). When children take physical risks, they are working on developing physically.

Children in elementary school are many different shapes and sizes. This is because physical development is different for different children. This is particularly true in the current educational environment, with a focus on including all children in general education classrooms, including those with physical disabilities. Elementary age children are learning how to control and manage their bodies as their bodies transform and grow.

Physical development has several implications for the design of the space and place where children spend more than 1,000 hours each year. First, schools need to provide places for children to develop physical skills (Olds, 2001). Spatial elements should encourage different interpretative ways of getting around, from rolling and crawling to running and skipping. Large areas where children can

jump, swing, climb, etc. are essential to overall child development, they are more than simply places for children to 'let off steam'. This includes playgrounds and gymnasiums, which are often subpar in today's schools (Malone & Tranter, 2003; Moore & Wong, 1997; McKendrick et al., 2000). Playgrounds are intended to encourage good health, allow free movement in a contained space, and provide opportunities to breathe fresh air (De Visscher & Bouverne-De Bie, 2008), all of which are important for development.

Schools should support development with ways for children to challenge themselves physically. The school environment should provide opportunities to develop physical prowess through such activities as walking on small objects, climbing trees, swinging high or cycling fast; additionally, schools should provide elements that challenge balance, such as tree trunks or low walls (Day, 2007). Research shows that although schools provide an area for physical activity, the design of most of these areas leave children bored and uninterested in engaging in anything other than a break from academics (Moore & Wong, 1997). Children are not, in fact, challenging themselves and enhancing their development, due to the few affordances provided to them.

In addition, spaces for physical activity must offer numerous and varied opportunities. Chawla (2006) writes about the importance of thinking about the relationship between the environment and the organisms interacting with that environment, often referred to as affordances. For children to meaningfully interact with their environment there must be affordances. However, affordances lie not in a particular object, but in the relationship between the object and person interacting with it. Based on the knowledge that children develop at different rates, what is an affordance for one child on a particular day may be meaningless to that same child on a different day or to another child. In order to provide all children within a school opportunity for further development, there must be many different objects, all of which will offer different affordances at different moments in time.

Finally, the knowledge that children are different sizes from each other (and from adults) implies that space should be designed from a lower point of view.

Several scholars (Hertzberger, 2009; Lippmann, 2004; Nair & Fielding, 2005) suggest that children like smaller places, more fit to their dimensions. Schools designed with child development as their starting point would include nooks and crannies of different shapes and sizes appropriate for children of different shapes and sizes.

Spaces for children must allow for physical exploration, risk taking, and personal challenges in various ways, but must also be safe. Norris and Smith (2008) list safety as the most important consideration when designing spaces and products for children. Safety is a challenge for designers, considering that children's behavior is unpredictable, due to a natural creativity that leads children to interpret the environment in multiple ways (Day, 2007). This involves paying attention to details and designing spaces that allow for errors. For example, furniture in schools must not only allow for children of different shapes and sizes but must also take into consideration safety issues related to children at various levels of motor coordination negotiating their way around the space. In addition, soft materials, such as rubber or wood chips in exterior settings, reduce the chance of injury due to falling. Trees and other play structures should not be too tall (five to eight feet) for the same reason (Day, 2007). While a certain degree of risk is always present (Hart, 2002), especially when dealing with activities related to physical exploration, the design of both indoor and outdoor objects can play an important role in reducing those risks, thus allowing for the variety of adventures necessary for physical development.

Children develop physically, at different rates, during elementary school. Thus, schools must be designed with varied spaces where children can challenge themselves in safe ways.

Ego Development

During the years a child is in elementary school, that child is developing his/her sense of self. It is the time of life where children begin to understand and speak about the world outside of themselves, in relationship to themselves (Piaget, 1932). Montessori (1967) claims that children absorb all the characteristics of

the environment, which influences who they will become.

In addition to developing a sense of self, children at this age are developing imagination. Common is the image of a young child immersed in an imaginary world that does not reflect reality. Fantasy becomes a bridge between the real world and the development inside the child. Nair and Fielding (2005) claim the importance of both imagination and creativity in today's and tomorrow's world. Nurturing the development of imagination and creativity is an important aspect of schooling for elementary children.

Related to this development of self is the need to feel safe in order to learn (Salzberger-Wittenberg et al., 1983; Watt, 1994). Research shows that children who feel anxious or unsafe are less motivated to learn (Entwistle, 1987). Three major aspects of design influence the perception of safety: the feeling of crowding, the opportunity to know one's location, and physical anchoring. When children perceive crowding, they behave in a more aggressive and less interactive manner (Moore & Lackney, 1994), thus making it difficult for them to effectively learn in a classroom full of other students. It has been found that disorientation brings about a lack of security in people (Hall, 1976). Building on this, one can see how spatial clarity would bring a sense of reassurance to children. If they know where they are and can find their way, they feel more secure and at ease, and are more likely to focus on academic learning. Finally, a secure and solid physical anchor, enhancing the feeling of "refuge", helps foster a feeling of security in children (Alexander et al., 1977; Day, 2007).

In order to support ego development and nurture a sense of self, schools must be designed with this knowledge. For example, the environment should avoid "telling" too much or expressing a too clear symbolic meaning through mediums such as large murals with explicit subjects (Pairman & Terreni, 2001) or stereotypical images, for children can appreciate more complex signs representing nuances of real life objects (Tarr, 2001). With less overt messages children are able to build meanings and develop stories (Gable, 2000). For instance, artwork does not need to be simplified for children, for with guidance, children will make meaning of any piece of art. These opportunities turn the

environment into a teacher, involving creativity and active thinking.

The design of schools should allow for creativity in other ways. Besides the obvious spaces for creative activities such as craftwork and art (Ceppi & Zini, 1998), there can also be other forms of sensory stimulation built into the school's design, such as different forms light and a variety of materials. The school environment can activate a series of sensory activities, particularly through the use of natural elements, helping children develop their personalities in relation to the environment.

The circulation space can also be designed with child development in mind. Long hallways may be frightening to many young children because they are not able to see the endpoint of where they are going (Alexander et al., 1977). For this reason, some points of control along hallways, like narrowing or turning points, would be appropriate (Barret & Zhang, 2009). Also, Alexander et al. (1977) claim that circulation spaces should look more like a room than a corridor: independent zones with three or four classrooms help children identify the location, distinguish their room (Nair & Fielding, 2005), thus make them feel safer. Other ways to enhance the sense of safety is to create space scaled to children's dimensions, like "baskets" or niches (Dudek, 2000), or create a "homelike" environment (Hertzberger, 2008). Those intimate settings, identified as "home bases" with personalized meanings, can be present even in larger schools (Hertzberger, 2008).

The development of self, coupled with the importance of imagination and creativity means that children need schools that provide opportunities for them to determine the meaning of the environment and to learn through the creative use of materials, while feeling safe and secure.

Cognitive Development

Cognitive development deals with an individual's construction of knowledge. While there are many theories about the construction of knowledge, it is generally accepted that children need opportunities to explore, reflect upon, and

talk about new ideas. Children need to explore the world around them in order to learn. As John Dewey (1916) stated, "The development within the young...takes place through the intermediary of the environment" (p. 22). However, experiences alone are not enough to learn (Adams, 1991), for children need to reflect upon the stimuli coming from experiences and compare them to each other (Bruner, 1973, as cited in Adams, 1991). Cognitive development requires making connections between and among experiences (Adams, 1991). The repetition of experiences can help children conceptualize meanings through reflection (Adams, 1991). In addition to exploration and reflection, children need opportunities to talk about ideas with others. Learning is an inherently social phenomenon (Vygotsky, 1978; Wenger, 1998). The cognitive process includes a variety of steps, including experience, followed by reflection, conceptualization, and social interaction; however, this is not a linear progression.

One theory in cognitive development is the concept of multiple intelligences (Gardner, 1983). Gardner suggests there are many different ways individuals can be "smart" and each way is found to varying degrees within an individual. There is not one continuum of intelligence. This theory has had significant effects on education (Bransford et al., 2000). Using Gardner's (1983) premise, Nair and Fielding (2005), suggest that children learn in different ways, in different times, in different places, and from different people or places. Increasing the number of learning modalities addressed in a classroom has been found to significantly improve learning outcomes (Baumgartner et al., 2003; Ku & Sullivan, 2002). Gardner's theory furthers the idea that learning is complex and should be differentiated.

Hence, the designed environment should provide spaces for hands-on experiences, reflection, and social learning while providing teachers access to support each of the ways in which students may be intelligent. Schools should be designed to accommodate the variety of intelligences and individual needs of students (Barrett & Zhang, 2009; Nair & Fielding, 2005). Facilities built in the traditional way, with rectangular classrooms and corridors, do not do so. Changing the spatial features of classrooms and extending the learning settings beyond basic cells are two effective strategies to support all learners. For

example, L-shaped classrooms allow various activities to take place at the same time (Lippmann, 2004). There must be space for both collaborative work and quiet individual study (Baglione, 2006). Spaces out of the classrooms, if designed with certain features (wideness, variety and natural lighting), can become "learning streets" (Nair, 2005) where interactions with other people are positive events.

One of Gardner's (1983) intelligences most relevant to this discussion is spatial intelligence. Spatial intelligence deals with the ability to visualize space, understand how it is organized, and find one's way. Regardless of a child's natural intelligence in this regard, all children are developing their spatial competence during elementary school years. Four spatial features can help children find their way in school buildings: landmarks, spatial sequences, functions and colors. Research shows that children use special points, considered landmarks, to organize their mental map and make decisions about their routes (Biel, 1982; Golledge et al., 1992), and that such devices are easier to memorize when they are placed at nodes (Golledge et al., 1992). Second, children tend to organize their usual routes in different parts, creating a sort of sequence to remember the location of settings along the path (Allen, 1981). Third, children tend to use the function of the destination as a way to orientate themselves (Christensen, 2003; Heft & Wohlwill, 1987). Finally, Olds (1987) suggests that color is the most effective way to visually recognize space. For example, color and other markers used to differentiate the various areas of the school, highlighting the functions or pointing out the presence of landmarks. The combination of these elements can be an effective way to facilitate way finding in school facilities.

Providing multi-sensory stimuli, opportunities for hands-on experiences, and spatial variations are important for creating schools where all students can develop cognitively, regardless of individual differences.

Social development and ethical development – with a focus on ecological literacy – will be analyzed separately in the next sections.

2.2. Focus on ecological literacy and social competence

Schools are more and more asked to offer an education that encompasses a variety of aspects of the whole personal development, going beyond traditional curricula (Payton et al., 2000). Among the aspects that are required, the capacity of positively interacting with other people and being active members of a group (Payton et al., 2000) and a positive and responsible attitude towards the natural environment.

Social competence and ecological literacy developments are connected because they both imply going beyond the self and taking a wider perspective – in relation to nature and to other people.

Social development involves learning to effectively interact with other people and positively contribute to a group. In elementary school, children leave their protected home environment and enter a world of peers with whom they must learn to socialize, sometimes for the first time. In addition to learning how to socialize with peers, elementary age children also learn how to get along with their community at large. Social development is important not only to develop effective social skills, but is also essential to support the learning process. Learning is an inherently social process (Wenger, 1998), thus the ability to interact with others is both a skill and a means to an end.

Ethical development, as defined in this thesis, deals with one's behavior and disposition towards other people and the environment. Developing responsibility and sense of citizenship, a generally accepted goal of schooling, requires the development of care and concern for other living things. This includes a development of right versus wrong, respect for the natural environment, and respect for human diversity. Ecological literacy development can be considered a part of ethical development.

2.3. The way ecological literacy develops and the role of education and, mostly, space and place

The solution to today's environmental crisis requires a different mindset from the one that contributed to create it. Children and young people, as present and future citizens, can be important actors for change. Thus, environmental education is the key to win the challenge of sustainability and of more equitable societies. In particular, education should foster the development of ecological literacy, the capacity to understand nature's ecosystems that support life on earth (Orr, 1992), including the skills to be environmental stewards.

This thesis posits that place, intended as space with meanings (Gieryn, 2000), can foster the development of ecological literacy in children and young people, including the enhancement of environmentally appropriate behaviors. Also, children and young people deal with nature in an emotional and a rational way: their emphatic connectedness to nature and the knowledge of its ecosystems can enhance environmental concern and, possibly, positive actions. Then, place can play a role in both senses, stimulating the development of affection towards nature and being instructive about natural phenomena.

Child psychology research can explain children's relation with nature; the study of educational practices enhancing the interactions with nature can help us to understand the everyday activities fostering ecoliteracy; research in architecture and landscape architecture shows that places, through their language, can establish a communication with children and promote their interest. This analysis highlighted that more research has been developed about natural environments than on designed spaces.

Children and Ecoliteracy, a Theoretical Framework: Empathy, Knowledge, Concern and Action

This section will develop a discussion about the way children relate to nature and to the concept of sustainability, highlighting the roles of education and,

mostly, place. The reviewed child psychology scholarship highlighted that children deal with nature in two ways. First, an emotional component, including empathy and affinity, is present since the first years of life and is prevalent until middle childhood (Carson, 1956; Sobel, 1996). Second, a rational component is developed through education and involves the knowledge of natural phenomena and of the cycles of nature (Chawla, 1998). Also, even if the emotional component develops earlier than the rational one, it is not destined to fade away during lifetime (Chawla, 2007). Then, if children feel an emotional connectedness to nature and know its ecosystems, including their fragility, they are likely to develop a concern for the environment; finally, such concern can lead to environmental responsible behaviors.

Even if education is generally more focused on knowledge building, school should enhance both children's emotional and rational relationships to nature. In that sense, place-based education, focusing on the specificity of local physical, ecological, cultural and social environments, can be a means of encompassing those two major components of dealing with nature: the focus on place enhances children's attachment to it and the knowledge about a complexity of ecological and social phenomena, and generates better results in terms of environmental education (Lieberman & Hoody, 1998).

Research shows that the way space is designed, especially in the outdoors, can make a difference, enhancing its instructive component (Moore & Cosco, 2007; Moore & Wong, 1997; Murphy, 2003). Also, the perspective of place-based education reinforces the idea that places can become "teachers", in their different meanings. In this sense, a semiotic approach can help designers understand the relation between the signs of the designed environment and what the children actually read (Titman, 1994): the "hidden curriculum" of place is made by two components, one related to the physical characteristics of spaces and their affordances, and the other including aspects of culture and social conventions (p. 54). Then, even if the main part of environmental education takes place outdoors, there are also educational activities that can be developed indoor, thus the buildings and the grounds should designed in an integrated way.

This discussion will focus mainly on designed environments, both the ones including natural elements – designed natural environments, like parks and natural playgrounds – and the ones in which the human component is predominant – built environments.

Empathy, Education and Place

Most scholars claim that children were born with an innate form of empathy towards nature, involving affinity, and a sense of wonder (Carson, 1956; Cobb, 1977; Kellert, 1993; Orr, 2000; Sobel, 1996). This strong emotional connectedness to nature is a value that has to be cultivated through education and informal experiences, otherwise it risks being overshadowed by the commodity-oriented culture of our societies (Kellert, 1993; Orr, 2000). Chawla and Hart (1995) give a possible explanation for the existence of this empathy, highlighting the role of young children's imagination: in fact, since infants tend to merge themselves in their environment, considering the surroundings as living beings, they develop the idea that the world is something they care about (Chawla & Hart, 1995). This connectedness, as long as it is fed by repeated contacts with nature during childhood that bring emotions and memorable experiences, can last throughout people's lives (Chawla, 2007).

However, today's children are more and more disconnected from nature (Fisman, 2001; Louv, 2005; White, 2006), and this happens primarily for two reasons. First, a generalized sense of fear makes parents allow children less and less independence in walking to school on their own or in exploring their neighborhood (Moore & Wong, 1997): this fear is enhanced by the media and the suburban conditions (Louv, 2005; White, 2006) and by the real lack of safety of some neighborhoods (White, 2006). Second, a shortage of green areas in a walking distance from home, due to the strong urbanization of the last decades (Chawla, 1998) and to deficient urban design, means that children do not have access to nature. The effects of this condition include the "nature deficit disorder" (Louv, 2005), the lack of interest in the natural world (Pyle, 1993), fear (Chawla, 1988) and violence towards nature (Jensen, 2002). Therefore, the few experiences of nature that most children have are mediated by television (White,

2006), which contributes to forming a distorted image of nature (Bohling-Philippi, 2006): for example, the weather is represented by most media as something to be scared about, with frequent images of natural disasters.

Then, most scholars agree about the fact that direct contact with nature is the most important factor in cultivating children's innate empathy towards nature (Chawla, 1988; Chawla, 1998; Hart, 1997; Kellert, 2002; Louv, 2005; Moore & Wong, 1997; Pyle, 1993; Sobel, 1996). In particular, Chawla's study reveals (1998) that "significant life experiences" in nature during childhood and adolescence are the most important factors in developing environmental stewardship during adulthood.

Also, if they are allowed to experience them, children have a preference for natural environments over built ones, because of the good experiences they associate to nature (Titman, 1994). In particular, among all the outdoor areas, wild spaces are the most valued by children (Maxey, 1999) for a variety of reasons related to the feelings they provide: the sensations of "timelessness" (White & Stoecklin, 1998), the uniqueness of every experience in nature, but at the same time the continuity of feelings provided (Chawla, 2007) and the different levels of affordances provided (Titman, 1994).

The role of education. Play in nature is the first, simpler activity that children can develop without the support of education. Before children get a deeper understanding of natural phenomena – which starts happening when they are around nine years old (Kellert & Westervelt, 1983) – play is important to enhance emotional ties with nature. In particular, "symbolic play" has an imaginative component that transforms natural elements into characters of stories (Frost 1992). Then, the enhancement of empathy is the main goal of the early years of education (Sobel, 1996). At this purpose, Chawla (1986) highlights the importance of special experiences of nature, especially in the wilderness: such memorable peak experiences are more effective to develop emotional ties with nature than everyday contacts in familiar places. However, nowadays most children live in cities, far from wilderness, and this trend is going to continue. Then, other strategies have to be pursued, like project-based activities: since the

active participation of students enhances the ties to the topic they are working on (Lieberman & Hoody, 1998), projects involving nature, besides fostering knowledge, can help develop affection for it.

The role of place. Places stimulate some emotional responses in human beings, and those feelings deal mainly with the meanings given by people (de Botton, 2006). These emotional ways of dealing with place are important to explain the way place-attachment is developed, in particular to natural places, hence giving an impulse to environmental stewardship. Therefore, architects should resist the temptation to design spaces for children in a way that pleases the aesthetic of adults (White, 2006) because children have different aesthetic preferences. For example, a playground that is highly appreciated by kids may look messy and unstructured (White, 2006), with elements such as mud and sand enhancing imaginative play (Titman, 1994); the same conditions can be recreated in indoor spaces through different manipulable objects and pieces of furniture. In particular, many scholars highlight the importance of un-designed or unfinished spaces that are more likely to be manipulated by children, enhancing self-confidence and place attachment (Johnson & Hurley, 2002; Malone & Tranter, 2003; Titman, 1994). In this sense, adventure playgrounds allow children to take control of their space, in a flexible arrangement with few permanent elements and large quantities of loose materials, such as logs, sand and tires (Malone & Tranter, 2003). Also, the diversity of vegetation and topography enhances different kinds of play, especially the types of plants, and their density (Fjørtoft & Sageie, 2000): shrubs, for their shape, enhance construction and imaginative play and tend to be interpreted as the "home base". The opportunity to choose the setting that fits better with children's state of mind and play preferences enhances their place-attachment (Tranter & Malone, 2004). Also, places that recreate the feeling of wilderness enhance a sense of emotional connectedness to nature (Chawla, 1986), fostering a sense of magic.

To summarize, children's innate empathy towards nature has to be nurtured through meaningful experiences of designed natural environments and, when possible, wild settings.

Knowledge, Education and Place

Besides emotional connectedness, education can enhance a rational way to deal with nature, based on awareness and knowledge. As children mature and start studying some aspects of nature – among them its fragility –they may develop a special interest about those issues: therefore, caring for nature becomes a mature responsible choice (Chawla, 1988, 1998). After having learned about the fragile condition of nature, the concern may grow rationally: nature's health is also important for human beings because their survival depends on it (Chawla, 1988).

The role of education. Some scholars hold that environmental learning has three components: learning "about" the environment, to develop knowledge about nature, learning "for" the environment, to enhance stewardship, and learning "in" the environment, through direct contacts with nature. (Disinger, 1990; Tillbury, 1995). Since environmental stewardship is the main goal of this discussion, those three characterizations of environmental learning could be read as: by experiencing nature (in), children can develop knowledge (about) and affection for nature, and then they will be more likely to take actions as an advocate on behalf of nature (for).

The idea of place-based learning is central in environmental education, focusing on contact with the local environment in everyday activities. Most place-based approaches and practices are multidisciplinary or interdisciplinary: places, especially outdoors and natural ones, can be used as a way to connect different school subjects (Lieberman & Hoody, 1998) through direct experience and observation. Also, Bowers (2001) recognizes the importance of critical studies about the native cultures of the place, as a way to understand the deep roots that linked human societies to that particular natural place, living sustainably.

Enlarging the picture, Capra (1998) attempted to introduce a new educational philosophy based on the study of ecosystems: the idea of ecoliteracy implies learning from natural ecosystems to derive sustainable and efficient strategies to adapt to human societies. This approach, based on ecology and system thinking,

includes a change of point of view in a variety of subjects: from parts to the whole, from objects to relationships, from objective to contextual knowledge, from quantity to quality, and from structure to process (Capra, 2007). Hands-on experiences should be connected to larger phenomena happening in nature, in a balance between local and global (Capra, 1998). In particular, as nutrition is a fundamental vector of energy in ecosystems, food education could be an effective way to connect everyday life to systems thinking (Stone, 2007), like in the Edible Schoolyard in Berkeley, California. Experiencing plants and harvesting crops and fruits shows children that humans are dependent on nature as their source of food, but at the same time plants and trees surviving depends on humans (Campbell Bradley & Skelly, 1997). Understanding the interconnections between man and nature is an important goal of education (Malone & Tranter, 2003).

The role of place. Space can be intentionally designed to convey information to the people who inhabit it. At that purpose, two design strategies can be followed: the first searches a very direct communication through explanatory posters and signage (Mason, 2009); the second is more subtle, it gives cues through elements of the buildings and of the outdoors that can raise questions, like installing thermometers in different parts of the room. From an educational point of view, the second strategy seems more appropriate because it stimulates active thinking.

Places can provide opportunities for multidisciplinary learning: the experience of green buildings – including the way the adapt themselves to the changing climatic conditions – and of school gardens can help integrate a variety of school subjects. At this purpose, a very important aspect for success is the correspondence between the elements designed as learning tools and the school mission and curriculum (Mason, 2009). Also, the coherency of the "communication" helps children build their big pictures, making intuitive inferences among the different subjects (Taylor et al., 1988). For example, the specific location of the school has a potential in connecting different subjects, like geography, history, ecology and local culture (Gaylaird, 2009).

Also, a variety of phenomena and cycles can be showed through indoor and

outdoor devices, like the water, the food and the energy cycle, hence the need of a strong interaction between the buildings and the grounds. Besides natural elements like plants and stones, that can be simply observed, these devices include:

- Rainwater collection systems (cisterns, exposed pipes, streams, systems of purification), to show the water cycle (Keep, 2002; Wilks & Hes, 2008).

- Greenhouses and glazed facades, to express the ideas of warm and cold, heat loss and gain, the role of the sun (Wilks & Hes, 2008).

- Windmills, to produce energy of just to show the direction and the speed of the wind (Keep, 2002).

- Gardens and composting piles, to show part of the food process.

- Solar or photovoltaic panels, to display the benefits of green technologies using the power of the sun (Heitor, 2009) and make a parallel with the photosynthetic process.

- Local building patterns, including materials, to show how human constructions can adapts to the local conditions (Gaylaird, 2009).

All those features both provide direct experiences about natural phenomena and show children effective ways to be sustainable, saving energy and other resources.

Fostering children's knowledge of natural ecosystems is another important part of education, in which places can play a role if designers and educators highlight their instructive potential.

From Concern to Action

Taking a step forward, Chawla (1988) suggests that concern alone has no positive effects if nothing concrete can be done. Also, in the process that brings ideas into reality, Mussen and Eisenberg-Berg (1977) identify some difficulties

for effective environmental actions: in fact people are not usually aware that their behaviors can make a difference and they often do not know how to act in a proper way. From this perspective, the skills can be acquired through education (Chawla, 1988) and children's actions can make a difference if they act locally, for example in the activity of taking care of a garden (Desmond et al., 2004).

The role of education. Place-based approaches focusing on the specificity of a locale can enhance stewardship (Davis, 1999). Repetitive experiences in familiar natural places are more effective in enhancing children's knowledge and concern about the environment (Hart, 1997; Sobel, 1996). Moreover, Sobel (1996) suggests that educators should present to children natural issues that they are ready to face, that they can have a contact with, avoiding things that are out of reach. Since the attention is on the ecosystem they are part of (natural and built environment), children gain confidence and understand that their behaviors can make a difference. In fact, having studied the local natural situation, they have acquired some skills that can be useful in guiding their actions. Taking a step forward, Gruenewald proposes to include aspects of critical pedagogy in place-based education, introducing a "critical pedagogy of place" (2003); citing Freire (1970-1995), he claims that places provide opportunities to stimulate children to challenge the status quo and get involved. This point opens interesting perspectives for environmental education, especially for fostering stewardship and a greater equity, and for the design of the spaces that support it.

The activities that encourage children to be responsible for some aspects of their place are probably the most valuable ones in relation to environmental stewardship (Basile & White, 2000). Gardening and farming should be central in every environmental educational practice, even for their multidisciplinary learning potential. Another important activity that allows children to be active stewards for nature is recycling; in particular composting is particularly significant because the whole cycle can be developed at school (Bohling-Philippi, 2006).

The role of place. In the perspective of environmental stewardship, all the places that need children to play an active role in their functioning can be

important. For example, school gardens are fundamental settings because the act of taking care of living things enhances children's sense of responsibility (Basile & White, 2000). Also, green buildings may require the active involvement of the users in order to work correctly and save energy: for example, opening windows to enhance natural ventilation or closing them to keep the heat indoor.

Concern for the environment can lead to direct actions and places need to offer opportunities for involvement in their everyday use.
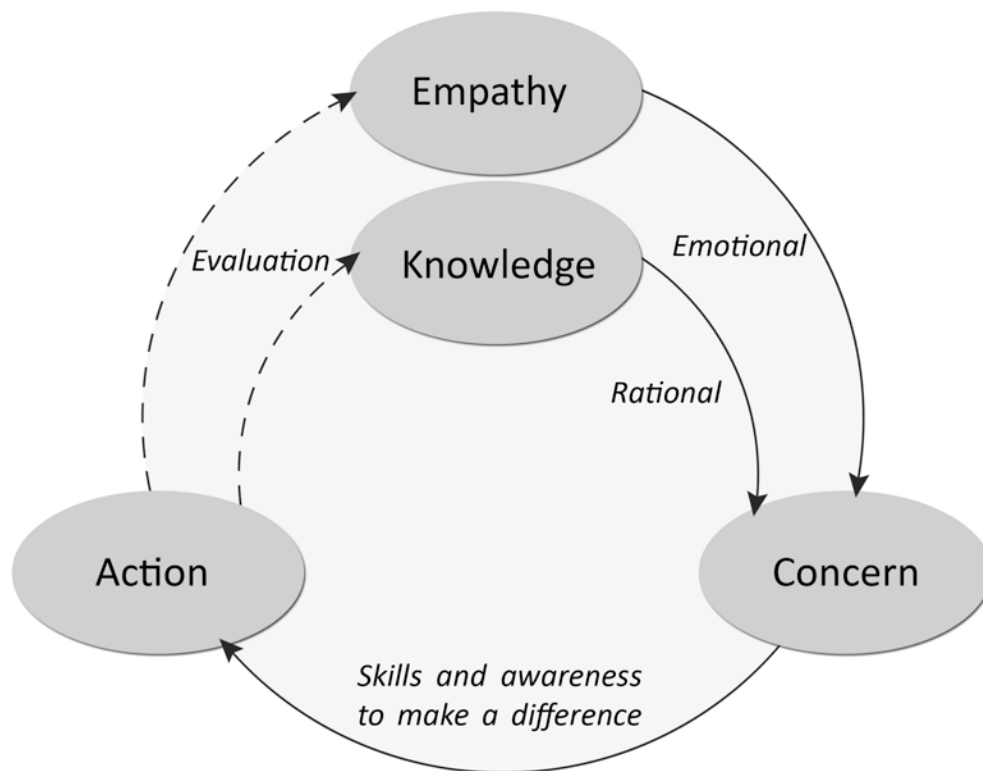
Figure 2.1. The process of developing ecoliteracy: the emotional and rational components of learning to make a difference.

To summarize, the development of environmental concern can derive from emotional and rational reasons, and both can be fostered by education and the experience of places. Then, becoming stewards of nature necessitates some skills and the awareness of being able to make a difference. Finally, children's actions for the environment have to be assessed in order to understand the effectiveness of education (Figure 1).

2.4. The way social competence develops and the role of education and, mostly, space and place

Schools are the places where children enter their first society and start forms of constant interactions with people that do not belong to their family. Social development is a central aspect of a child's growth: in fact, a child's development happens collectively first then individually (Vygotsky, 1978). Also, a major part of the way children evaluate the school experience comes from the social interactions they have there (Furrer & Skinner, 2003). Another critical aspect deals with social cohesion: community is disappearing from schools and societies (Sergiovanni, 1994) and most students describe schools as alienating institutions (Osterman, 2000). A positive social development, besides being evaluated important on its own (Krumboltz et al., 1987, as cited in Wentzel, 1991), is connected to many other aspect of a child's growth: social learning is inherently connected to emotional learning, the idea of the "self" being developed in relation to the "others" (Zins & Elias, 2006). Also, students' social maturity plays a positive role on their academic outcomes (Wentzel, 1991) and socializations in nature can help children develop ecological literacy (Bixer et al., 2002).

This thesis holds that school buildings and landscapes, if they are designed following certain criteria, can play a positive role in enhancing all the aspects of social competence. Such aspects include socialization, the sense of belonging to a group and civic engagement. Research shows that the development of those three social skills is interconnected and consequential.

Children, young people and social literacy, a theoretical framework: socialization, sense of community, civic engagement

This section builds up a discussion about the way children develop social literacy, highlighting the roles of education and, mostly, place. The reviewed child psychology scholarship showed that there are three main social skills that

children and young people need to learn: interacting and socializing with peers, being part of a group and feel belonging to it, and becoming civically engaged. This review will show that these three skills are connected and develop consequentially.

As they enter school, children start to interact and socialize with peers. If such interactions are positive and frequent, children feel part of a group, within a set of social rules, and can experience what a sense of community is (Baumeister & Leary, 1995). Then, students who experienced a higher sense of belonging to their community are more likely to take active roles within the school and be protagonists, leading their groups (Leithwood & Jantzi, 1999, as cited in Osterman, 2000; Royal & Rossi, 1996; Sergiovanni, 1994). In this sense, school works like a training for becoming active citizens in the outside world (Andolina et al., 2003). This progression in skill development happens as children grow up: most research about civic engagement is about secondary school students (Andolina et al., 2003). Also, the ability for being critical and autonomous thinkers, which is fundamental to take initiative, develops during those years (Jennings & Niemi, 1974, 1981, as cited in Andolina et al., 2003). Finally, it can be inferred that, when one becomes protagonist and he or she acts for the group, there's a sort of re-appropriation of the self. This happens because young people become independent from the group, being ready to leave school and to be civically engaged in the real world.

If those processes do not happen in healthy and positive ways, social problems can occur. The lack of a sense of community is likely to bring about behavioral issues (Baumeister & Leary 1995; Royal & Rossi, 1996). Also, failing in being part of a group may cause individuals to be antisocial and excluded by peers, thus being more likely to have social problems (Caspi, Elder, & Bem, 1987, as cited in Wentzel, 1991).

Education could play an important part in enhancing the development of social skills. Even if there are programs aimed at enhancing social and emotional learning (Payton et al., 2000), most schools are generally focused on academic achievement and tend to neglect the other aspects of a child development

(Osterman, 2000). Research shows that children that tend to be isolated from groups can improve their social skills in the short and long term if they receive individual training about the way of interacting with peers (Oden & Ascher, 1984), and this is a first step towards social competence.

The way space is designed can make a difference fostering social development (Johnson, 1982; Gifford, 1987; Goodsell, 1988; Loo, 1972; Read et al., 1999). In other words, every social environment is also a physical environment (Weinstein & David, 1979). As it has been said, this thesis does not take the position that space can shape behaviors, like environmental deterministic theories assume. However, children develop their social relationships even in reference to space. The idea of personal distance (Hall, 1966) is important to understand the way people use space and their possible interactions (Ostermann & Timpf, 2007) and is relevant for design (Hall, 1966; Sommer, 1969). Another concept linking socialization and physical settings is space appropriation, as the process of taking ownership of a space performed by a group of young people (Childress, 2004). Finally, in order to understand the patterns of interaction, place is more significant than space because it includes cultural meanings and social conventions (Giddens, 1984, as cited in Harrison & Dourish, 1996).

Interaction, socialization, education and place

Socialization is a collective process that happens at the group level and not individually (Corsaro & Rizzo, 1998), but it needs some personal competences. The process that brings children to socialize with peers involves a series of steps, which link the self and the development of personal skills to the way of dealing with other individuals (socio-emotional learning) (Payton et al., 2000). First, every child needs to develop the ability to recognize and deal with one's feelings, including the capacity to manage the negative ones (Mayer & Salovey, 1997, as cited in Payton et al., 2000). As a consequence, children and young people can develop self-confidence, which is essential to interact with others (Payton et al., 2000). Another important skill for social interactions is the capacity of understanding other people's points of view (Payton et al., 2000). Besides recognition, the second group of skills that has to be developed deals with the

reasons and the values that guide actions, including personal responsibility (Payton et al., 2000). This can lead the way to taking responsible decisions (Payton et al., 2000). Finally, social interaction skills have to be developed in order to give action to the decisions that have been taken (Payton et al., 2000). Among such skills, language is the most important one and it makes socialization possible (Vygotsky, 1978). Also, language is the main means of interaction and for producing a peer culture that will help children discover the adult world (Corsaro & Rizzo, 1998): for example, social hierarchy among children is built through the use of language. Another interaction competence is the capacity to actively pay attention to other people, in order to show them that they have been understood or appreciated (Payton et al., 2000).

The role of education. Schools generally tend to prevent social interactions rather than fostering them (Goodlad, 1984, as cited in Osterman, 2000). Then, most interactions among students take place during lunch breaks or recess (Phelp, 1990, as cited in Osterman, 2000). However, there are learning activities, like collaborative work and developing projects, that can enhance positive social interactions (Osterman, 2000) and that are particularly beneficial for students with socialization issues (Jones & Gerig's, 1994, as cited in Osterman, 2000). When children are performing an activity, they have a topic to talk about and this helps win the fear of having nothing to say. Also, Oden & Ascher (1984) suggest some relevant components of educating to social interactions: highlighting the ideas that are meaningful to social relationships among children, asking children examples of typical social situations, asking children to assess which play situations can be positive for themselves and others, and giving children opportunities to experience what they have learned in real life.

The role of place. Space can play a role in shaping the socialization pattern, including interaction and cooperation (Gifford, 1987). The Reggio Emilia preschools put an accent on the idea of "relational space", as a setting where activities tend to merge, making connections possible, rather than separating activities in different rooms (Ceppi & Zini, 1998): relationships among different activity centers are made possible and sometimes fostered by finding a balance between sociality and the opportunity to concentrate.

A series of spatial features influence the way socialization happens: size, spatial and social density (crowding), proximity, spatial variety, transparency and boundaries, the availability of activities, type and arrangement of furniture, nodes and attractors, and the outdoors characteristics. First, spaces of appropriate dimensions can give individuals the possibility to choose to stay apart from each other rather than being forced to interact (Zeisel, 1981). Indeed, spaces of limited dimensions that are inhabited by too many people – bringing to a condition of crowding – decrease the likelihood of socialization (Loo, 1972; Moore & Lackney, 1994). In relation that, Loo (1972) suggests that children may play alone in crowded conditions because they want to find a psychological distance from others and compensate for the limited physical distance. However, there should be a balance between too large and too small spaces in relation to the number of occupants. More distance among people means less opportunities for meeting (Gieryn, 2000).

Also, a balanced level of spatial variety (wall colors or changing ceiling height) fosters cooperative behaviors, thus interactions (Read et al., 1999). However too much variety (combining differentiated wall color and ceiling height) brings about the same interaction rates as the ones that can be found in a homogeneous space (Read et al., 1999).

The interaction pattern is partially shaped by the boundaries and connections that space allows, including transparency (Biner et al., 1991). Windows that overlook the public space from the learning units give a greater sense of control and contribute to the metaphor of the street, with "shops" that make it interesting (Nair & Gehling, 2010). In the Reggio Emilia preschools spaces are partially visually connected to ensure a certain width of perception (Ceppi & Zini, 1998).

School public space that fosters the development of activities can promote social interactions (Nair & Gehling, 2010): indeed, if children are occupied in doing something, they are not forced to interact, like in an empty room (Nair & Gehling, 2008). Such spaces, which can be considered activity centers, should be quite visible and accessible (Crumpacker, 1995), forming "events" (like display areas,

seating zones or presentation spaces) along pathways that prompt children to take part to activities. Flow patterns should be considered and circulation spaces should be placed tangentially to rest places, without interfering too much, but allowing the development of interactions (Olds, 2001). The presence of activities is another way of providing passive supervision, hence limiting bullying (Nair & Gehling, 2010).

The size and shape of furniture can also make a difference in the way children interact (Johnson, 1982): round-shaped tables reinforce the feeling of psychological proximity (Sommer, 1959, as cited in Johnson, 1982) and collaborative behaviors (Hall, 1969, as cited in Johnson, 1982), while rectangular tables foster a sensation of "distance" (Hall, 1969, as cited in Johnson, 1982). Also, joining or separating desks is a way to give emphasis to collective or individual activities, facilitating or preventing social interactions (Johnson, 1982): putting a one meter gap between desks means prohibiting any form of communication and collaboration. Also, there is a relationship between circulation and communication (Loughlin & Suina, 1982): if children can move across the classroom they can find occasions to interact with their peers. Paths passing close to activity areas can provide positive interactions so that some student can join the activities (Loughlin & Suina, 1982).

Also, in a given space, there are some elements that naturally attract people (Ostermann & Timpf, 2007), like for example coffee or vending machines, rugs, or steps, like in the schools designed by Herman Herzberger. Such social condensers, which can become nodes in schools and landscapes and enhance casual meetings, need to be carefully designed and strategically placed.

Finally, outdoor spaces are very important for socialization because they are usually associated to the breaks during the school day, when children feel free to talk (Nair & Gehling, 2010). Small areas where children can interact in groups of limited size are preferable to big and uncharacterized spaces (Nair & Gehling, 2010). Also, once that the main outdoor routes (thoroughfares) have been defined it is important to locate "marketplaces" and "meeting places" (from Gehl's theory) along those walkways in order to maximize the opportunities of

interaction (Nair & Gehling, 2010).

Then, socialization involves opening one's perspective from the self to other individuals and learning how to interact with them. Education can play a role by promoting collaborative activities. A few spatial characteristics, like size, connections and furniture type and arrangement can make a difference.

Belonging to a group, sense of community, education and place

After having learnt how to interact and socialize, children may develop the skills for positively contributing to a group and then feeling a sense of belonging to it. Learning to be part of a group, which is regulated by a shared set of rules, is fundamental for social development (Wentzel, 1991). In order to do that, a child needs to understand the different actors that are part of a society (individuals and groups), their relationships and the reason that are behind such relationships (power-weakness, dependence) (Hirschfeld, 2001). At this purpose it is important to introduce the difference between social conventions and moral values: the first can be defined as behavioral norms that regulate the actions of individuals in a social group and they are arbitrary, while the latter are not subjective and they bring people to consider certain behavior "wrong" beyond social rules (Nucci & Turiel, 1978). Those two ideas develop separately in children since the preschool age (Nucci & Turiel, 1978). The social conventions that are valid within a social group influence the way individuals behave (Kohlbert, 1971). Children's actions are partially shaped by the expected behaviors that are commonly accepted in a social group (Jensen-Campbell & Graziano, 2005).

Also, community is a necessity for human beings (Sergiovanni, 1994) and being part of a group is a basic psychological need (Baumeister & Leary 1995). Community is expressed by a shared vision, based on shared values (Sergiovanni, 1994): for this reason, the sense of community goes beyond the feeling of belonging to a group. Also, within a community it is becoming more and more common to have people with different ethnic and cultural backgrounds. Social identity is built mainly by interacting with other people

(Kohlberg, 1971) and experiencing places (Sutton, 1996). Then, the acceptance and valorization of diversity should be a fundamental theme in schools. This is about meeting who is considered "other".

Finally, the passage from primary to secondary school is usually difficult because the sense of community tends to be lost (Belenardo, 2001): primary schools are environments that have generally limited dimensions and where there's usually a collaborative atmosphere, while secondary schools tend to be organized in different departments and to be more impersonal.

The role of education. Schools have become too organized and institutionalized, giving too much attention to rules and social conventions (Sergiovanni, 1994). The creation of a sense of community is not one the main concerns for schools, being more focused on academic outcomes (Osterman, 2000): for this reason, a real community is very different from what children experience in most current schools (Sergiovanni, 1994). Community in schools generates from the collaboration among children, teachers and parents – in the context of participation and common ethical principles (Ceppi & Zini, 1998). Dewey (1958, as cited in Osterman, 2000) holds that education should propose a series of collective activities that reinforce this feeling of belonging to a group. Parents' involvement can play a very positive role (Belenardo, 2001). Also, the larger group size that people can handle is made of about 150 people because every individual knows most of the other members of the group (Dunbar, 1993). A reduced group size enhances the sense of community (Royal & Rossi, 1996). Finally, the values of the school community, which become a sort of school mission, should be enhanced through a variety of means throughout the school (Sergiovanni, 1994). This could be fostered by a series of activities and by designing spaces that embody such values.

The role of place. A large body of scholarship shows that place can play a role in teaching a set of social conventions and the idea of authority and in enhancing a sense of belonging to a community by expressing its values, including the acceptance of its diversity.

Authority or power can be expressed through the use of designed elements: Goodsell (1988) has conducted a research about council rooms in the USA and some of his findings could be applied to school buildings. In such council rooms, the public could not play any role, being just spectators, and this was imposed through design – fences, barriers between who decides and who's just attending (Goodsell, 1988). This idea could also be found in the way traditional classrooms are and were arranged, with all the students' seats facing the teacher and the blackboard, and sometimes the teacher's desk standing on a podium. Students are relegated to the role of spectators. In Goodsell's view the themes that matter are separation or openness, visual enclosure or transparency, the placement of a given space within the building, and the path that brings to a given room. Accordingly, Johnson (1982) holds that space, in its different organizations (including the furniture), constitutes a sort of three-dimensional textbook that can teach children about the rules shared by a group of people – and the expected behaviors.

The way space is designed can foster a sense of community and place attachment in a variety of ways. The features that matter are size, some spatial characteristics and the opportunity to personalize one's space. First, small schools – or schools within a school – foster a greater sense of belonging because there is a greater reciprocal knowledge, enhancing positive relationships among peers and teachers (Cotton, 1996). Small learning communities provide opportunities for positive social interactions – the commons being inhabited by a group of about 100 students (Nair & Gehling, 2010). School climate improves in small schools because there are more possibilities for direct involvement in several activities (Lindsay, 1982) and students become actors rather than spectators (Pittman & Haughwout, 1987). Second, there are several spatial features that can foster the sense of community. A few of those qualities are present in the Reggio Emilia preschools. A central space, called "piazza", is a way of representing the values of the community (Ceppi & Zini, 1998): it is a place where encounters can happen, helping children develop a collective identity and a public awareness. All the other semi-private spaces (kitchen, labs for adults and children, toilets) do not have hierarchical relationships among them and

should be arranged around such piazza (Ceppi & Zini, 1998). Also, "horizontality" in the building layout (most spaces are on the same level) is a symbol of democracy, showing that there are no spatial entities that count more than others, thus all the individual and groups are given the same value (Ceppi & Zini, 1999). The presence of piazza and the equal rank of the semi-private spaces are only possible in buildings that have very small dimensions, like kindergartens (three to six classrooms). To keep this structure, larger schools should be organized in clusters made by up to six classrooms. At this purpose, spatial hierarchy is a fundamental element in enhancing students' sense of belonging and feeling of safety (Fielding, 2006). Such hierarchy can be expressed in schools by defining different areas as corresponding to the different groups that form the school (Fielding, 2006): starting from the smallest group, the single person, through the idea of "family or extended family" (10-20 people), small learning communities (100-150 people), neighborhoods, and finally the whole school. Third, the sense of ownership includes the opportunity to personalize space, the feeling of control, the opportunity of expressing one's territoriality (as supervision of one's space), and of a direct personal action (Killeen et al., 2003). Children's sense of ownership increases when their projects are displayed permanently in their classrooms and public spaces (Killeen et al., 2003): this happens because students feel members of a community that values their work. Another way of fostering place-attachment is involving children in the design of their school (Hart, 1992). Finally, in relation to the acceptance of the "others" and the appreciation of diversity, a good starting point would be sharing space with them. In particular public space in schools is very important because it is where children meet diversity (Hertzberger, 2008). The Reggio Emilia preschools piazza is an example of such spaces (Ceppi & Zini, 1998). Also, in order to be appropriate to their communities, schools physical environments should embody the richness of cultures of local residents: this is quite a delicate point because there may be minorities that do not feel represented.

To summarize, after having learnt how to interact with others, children can develop the skills to be part of a group, including the understanding and the observation of its social rules. If that group shares some values, they may

experience what a community feels like. Education and place can play a role by integrating such values in learning activities and in physical settings.

Civic engagement, education and place

Civic competence can be defined as the comprehension of the way a group of people is governed and the way individuals can take an active role in such government in a democratic context (Youniss et al. 2002). This means that the development of civic engagement needs the understanding of how a society works. Civic engagement has been one of the most popular themes of discussion in America due to a widespread lack of participation (Andolina et al., 2003). Civic competence develops through three different experiences: family, educational institutions and political participation (Youniss et al. 2002). Crucial to this is the development of social responsibility, the will and capacity to shape one's actions for the benefit of others and of the environment. Also, a clear border between the political and civic ground does not exist, the two realms being strongly connected (Youniss et al. 2002).

Moreover, crucial to understand engagement is that human beings have both the features of "equality" and "distinction" (Arendt, 1958): equality is important for mutual understanding or for promoting visions for the future; distinctiveness is important for building a constructive dialogue, including different perspectives. Public space is where individuals start to recognize the variety of points of view that other people have (Arendt, 1958). Public space implies that there cannot be any dominating point of view (Greene, 1982) because it symbolizes the plurality of thoughts. However, not all the individuals realize that they have a voice and that they can make a difference, mostly because ordinary life does not offer many opportunities to think about that (Arendt, 1958). Also, real freedom is the one that brings people to participate as active individuals in public space (Arendt, 1958; Greene, 1995). At this purpose, children and young people need to be helped be critical thinkers and challenge the status quo (Gruenewald, 2003).

The role of education. In order to shape education for active citizenship it is important to understand civic competence development (Youniss et al. 2002).

Schools are places where civic competence can be taught (Youniss et al. 2002): in particular, it is important that standard education is integrated with real life activities – better if developed in the school's neighborhood, as a form of community service. In order to be effective on the long term, individuals should choose autonomously to perform such services (Youniss et al. 2002). Those activities are more beneficial if they require the direct involvement of people, thus they are "hands-on" (Boss, 1999), and if they focus on local aspects. Active participation during high school is fundamental for being engaged in adulthood (Kirlin, 2002, as cited in Andolina et al., 2003). Also, debates and discussions about political and sociological topics can be very effective in helping the development of civic competence (Andolina et al., 2003). In this context, the passage from apathy to involvement can happen when young people realize that their action can make a difference to defend their own interests (Youniss et al. 2002).

However, civic education in schools is a topic that brings about some issues because there are disagreements about the way a "good citizen" should be like (Youniss et al. 2002): some hold that citizenship is just the knowledge of the rules and allegiance to one's country, while for others it also includes the direct involvement in the social and political life and critical thinking. This thesis takes this second position, in line with the ideas developed by critical pedagogues like Freire (1995) and Gruenewald (2003).

Finally, Youniss et al. (2002) suggest a few lessons about the way schools could address civic education. First, it is important to adopt an approach that valorizes cultural differences, critical thinking and the development of skills to solve conflicts through dialogue. Second, lessons should be integrated with voluntary participation in activities that can be valuable for the community – i.e. schools should give opportunities, not force people. Third, schools should help the integration of different ethnicities, being an example of what present and future societies should look like.

The role of place. Appropriation of public space and the values embedded in settings are important factors for the development of civic engagement skills.

Public space has a political meaning because it is the setting where citizens can gather and take awareness of the potential that they gain from the act of getting together (Greene, 1982): the fact of acting for the same goal and of making it visible by taking ownership of the public space empowers groups of people. Then, there is a hidden curriculum in the spatial ideas of closeness and openness. Schools have generally a quite militaristic aspect where separations and prohibitions are the strongest messages and this goes against the goal of educating children to participate democratically in our societies (Taylor, 1995). Rather, blurred spaces, openness and sense of control are important for enhancing pupils' active engagement (Nair & Gehling, 2008). While corridors with strong public-private limits give the idea of an authoritarian approach to achieving positive behaviors in schools, openness can be a way to make students directly responsible, preparing them for civic engagement: if they are loud, their peers would suffer from that and vice versa (Nair & Gehling, 2008). Accordingly, corridors are considered unfair in the Reggio Emilia approach because they represent the spatial translation of an educational philosophy based on adults' control over children (Ceppi & Zini, 1998). Also, if space is well-kept and taken care of, it can transmit to students a sense of responsibility and attachment to it (Uline et al., 2009), fostering their active engagement in taking care of the space themselves and in other activities. Gardens and adventure playgrounds are examples of places that require students' direct involvement. Finally, including students in participatory design processes triggers their role as responsible actors in placemaking, raising their civic awareness (Hart, 1992).

Then, civic competence can develop after young people have learnt how to deal with a group and it involves the skills of taking action. Engaging hands-on activities and spaces with values and that may require an active engagement can foster such development.
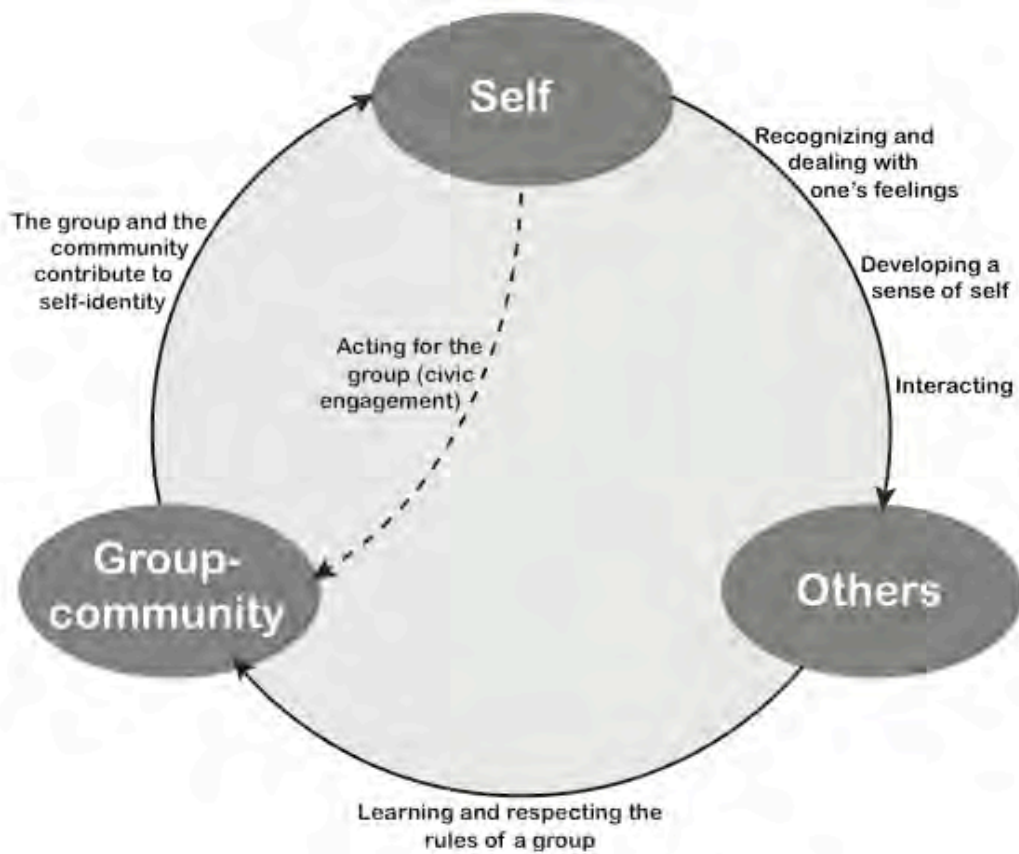
Figure 2.2. The process of developing social competence, including the self, the others and the group.

To summarize, individuals start interacting with others when they are able to handle their feelings and develop a sense of self. Then, after they learn and respect the rules of a group, individuals can become part of a community. Third, the community they belong to influences individuals' identities. Finally, individuals can act for their community, as a form of civic engagement (Figure 2.2).

2.5. Lessons and skills that space and place can contribute to teach

Based on the scholarship reviewed, a number of ideas about ecological literacy and social competence that the space and place can contribute to teach are introduced. Such lessons express some general educational goals and can be considered a sort of design brief for a building.

Ecological literacy

a. Respecting and loving the natural environment
b. Conserving resources and energy
c. The sense of responsibility and taking care of a place or a living being
d. System thinking and connecting action-consequences
e. Nature is everywhere, even in the city
f. Focusing on the "local"
g. Alimentary education and healthy living
j. Dealing with fears and dangers of nature
k. Density and green transportation
h. Sources of energy

Social competence

i. Recognizing and dealing with one's feelings
l. Understanding other people's points of view – perspective taking
m. Developing the skills for positively interacting with others
n. Understanding how a community works and (set of rules) and learning to be part of such group
o. Accepting and respecting human diversity
p. Feeling sense of belonging to a community and a place
q. Developing the ability for being critical and autonomous thinkers
r. Social responsibility and active goal setting
s. Thinking globally, acting locally

Figure 2.3. The proposed lessons and skills about ecological literacy and social competence.

Ecological literacy

These lessons and skills have been analyzed in relation to the theoretical framework about that explains the development of ecological literacy (see Figure 2.4): empathy, knowledge, concern and action. Their order does not imply any developmental sequence.

a) Respecting and loving the natural environment. This general lesson, alone, could encompass all the other ones. It deals mainly with the emotional way of relating to nature, but it also has cognitive components. For example, it is important to know that life is based on and comes from cooperation, networking and partnership, rather than conflict (Capra, 2007).

b) Conserving resources and energy. An ecosystem cycle generates no waste because the waste becomes other Species' nutrition (Capra, 1998). This also means that matter does not disappear but is transformed in something else, through cycles (Capra, 1998). Therefore, the ecosystem functioning shows the importance of recycling both matter and energy. On the contrary, consumerism is based on a culture of waste, of the unnecessary, and a critical perspective should be introduced to the future generations. Also, as nature undergoes cycles, like seasons, and they influence people's lives: our buildings respond in different ways depending on the seasons, and this is part of our way of adapting to nature.

c) The sense of responsibility and taking care of a place or a living being. This can be enhanced, besides concern coming from rational or emotional reasons, by a series of hands-on activities, like taking care of a garden (Desmond et al., 2004) or raising small animals. Being active citizens and participation is a key element to make communities sustainable.

d) System thinking and connecting action-consequences. "Sustainability always involves a whole community. This is one of the profound lessons we need to learn from nature" (Capra, 2007, p. 14). This requires more abstract thinking skills, which are not likely to be present before the late years of elementary school (Kellert & Westervelt, 1983). Thinking in terms of systems, rather than

single parts and in terms of relations rather than objects can help children understand the consequences of human actions on nature and its limits, avoiding the disconnection that is bringing the world to an ecological catastrophe (Seidel, 1998).

e) Nature is everywhere, even in the city. In the context of systems thinking, human activities rely on nature, and cities are complex ecosystems based on the same elements – air, water, soil, etc. – that are present in the wilderness (Spirn, 1984). Therefore human actions in designed environments have consequences for element of nature, linked to the wilderness. This is aimed at avoiding the dichotomy between designed environments and nature.

f) Focusing on the "local." Place-based educational approaches integrate nearby places in the curriculum, including the building, the grounds, and if possible the neighborhood (Davis, 1999). From an ecological point of view, this way of thinking implies focusing on biodiversity, and teaches children its value – as one of the factors that allows ecosystems to survive (Capra, 2007). Moreover, those approaches foster place attachment and stewardship: acting locally can make a difference in the community, showing the connections between one's actions and the outcome.

g) Alimentary education and healthy living. A balanced diet, together with other positive everyday behaviors involving physical activity, is a key element for healthy living. Also, the experience of the Edible Schoolyard shows how growing and eating food can be connected to the cycles of nature. Moreover, local food is more sustainable and teaches children becoming critical consumers.

j) Dealing with fear and the dangers of nature. Besides the stereotyped images of nature that correspond to only a part of its complexity, children should be taught about the "dark side" of nature, the overwhelming and uncontrollable component of it. Events like thunderstorms, tornados, and other apparently "evil" phenomena are part of nature's beauty and if they are introduced gently to children they can enhance their fascination with the environment.

k) Density and green transportation. Children should be introduced to the value of living close to each other, the idea of proximity, because the shortage of rural and natural land is already a big issue in densely populated regions, and this trend is destined to increase. For this purpose, the opportunity to walk or to bike to school, rather than being driven there, can be shown as one of the benefits of density.

h) Sources of energy. The study of ecosystems can show that the sun is the engine of the cycles of nature (Capra, 1998). Therefore, human beings should be aware of the potential of the renewable sources of energy, coming from the sun, the wind, other natural elements (the waves and the heat of the earth), and the waste of natural ecosystem and of human life.
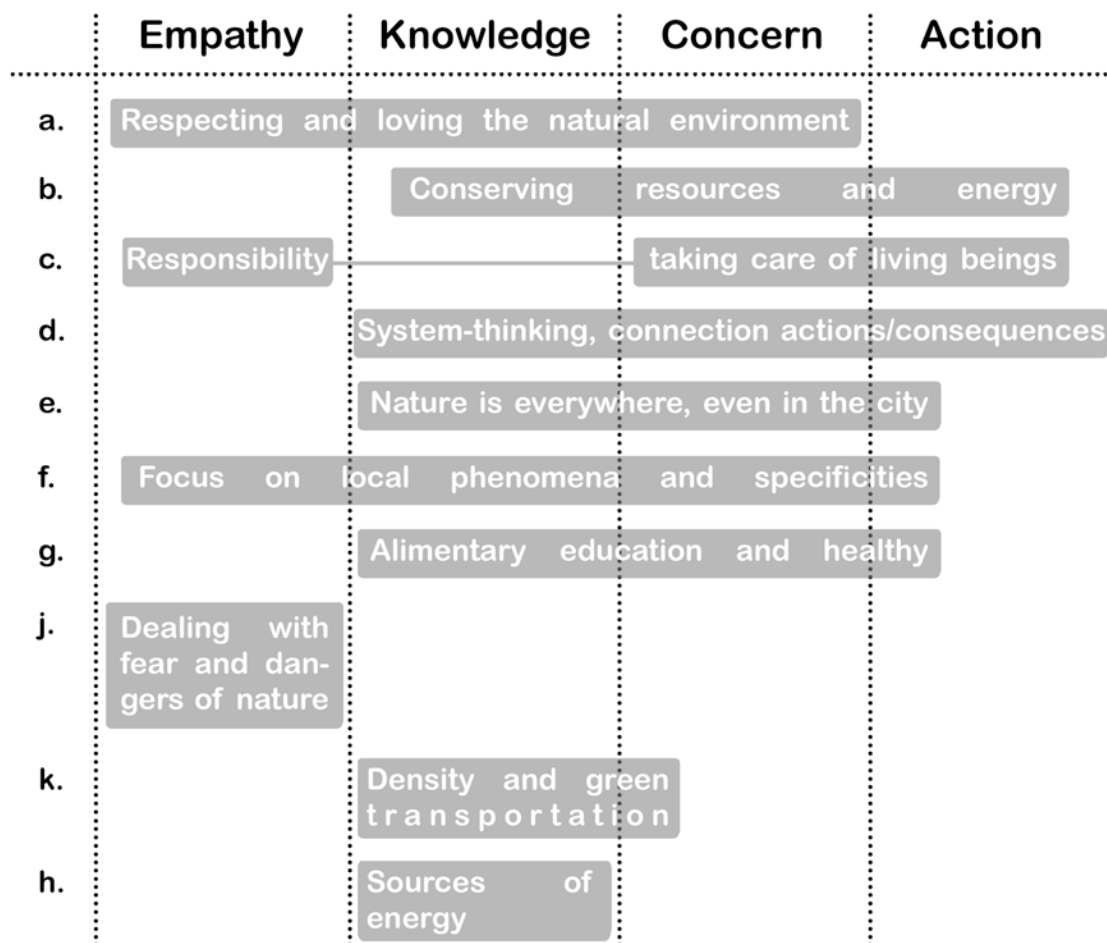
Figure 2.4. The ecoliteracy skills related to empathy, knowledge, concern and action.

As Figure 2.4 shows, all the skills and lesson that foster the development of concern for nature are also related to empathy and knowledge about the environment. This happens because empathy and knowledge are the two main paths leading to the development of a sense o care for nature.

Social competence

The lessons and skills that are included in this section are regrouped in three main areas: interacting and socializing, being part of a group and experiencing a sense of community, and being active citizens (see Figure 2.5). Also, such lessons and skills are consequently related. For example, the second group of skills can develop when the first group has been accomplished.

i. Recognizing and dealing with one's feelings. Mayer and Salovey (1997) explain that the process that brings to socialization has to pass through the recognition and the acceptance of one's self. Indeed, people have to be comfortable with themselves and develop self-confidence before interacting with other people. For example, people have to be able to realize what type of emotions they are having – difference between happiness and sadness (Payton et al., 2000). Also, it is important to act consequently to one's feelings, without overreacting in case of negative situations. Part of this is learning to understand the reasons and goals that influence one's behavior.

l. Understanding other people's points of view – perspective taking. After having learned to deal with one's feelings, individuals need to start to cope with other people and understand their points of view (Payton et al., 2000). This also involves developing the skill of actively listening to other people (Payton et al., 2000). According to Selman (1980, as cited in Hart, 1992), this process encompasses the capacity of taking other people's perspectives, needed for setting up democratic groups (developed between the age of ten and fifteen), and ends with the development of the skill of taking the point of view of a society, made by multiple points of view (starting from the age of twelve).

m. Developing the skills for positively interacting with others. This skill encompasses the competence of communication (mostly language, but also non verbal) that allows people to start and keep a conversation (Payton et al., 2000). Also, individuals need to develop the skill of clearly expressing themselves so that the others understand their mind and feelings (Payton et al., 2000). Interactions can be facilitated when there is an excuse to start a conversation, like an activity that is taking place. Also, the skill of negotiating ideas, which develops during interactions, is a partial consequence of understanding other people's points of view (Payton et al., 2000). Finally, the skill of working with other people is another important part of the interaction competences.

n. Understanding how a community works (set of rules) and learning to be part of such group. Children and young people need to understand the different actors that are part of a society (individuals and groups), their relationships and the reason that are behind such relationships (power-weakness, dependence) (Hirschfeld, 2001). Young people develop a finer knowledge of the way communities work. For that reason, there are often different rules in communities of young children and of teenagers. Learning to respect those rules is a fundamental aspect of being part of a group.

o. Accepting and respecting human diversity. Today's societies, especially in urban areas, are composed by a multiplicity of cultures and religions. Diversity (in terms of age, culture and gender) is an advantage for communities, even in work environments (Kossek & Lobel, 1996). Children and young people have to grow up in physical and social environments where such diversity is seen as a resource rather than an obstacle.

p. Feeling sense of belonging to a community and a place. Community is a necessity for human beings (Sergiovanni, 1994) because being part of a group is a basic psychological need (Baumeister & Leary 1995). Community is expressed by a shared vision, based on shared values (Sergiovanni, 1994): for this reason, the sense of community goes beyond the feeling of belonging to a group.

q. Developing the ability for being critical and autonomous thinkers.
After having learned how to be part of group and to share visions and values
with others, individuals need to re-appropriate of their self and think
independently. This also involves the skill of critically assessing the social rules
and the will to challenge the status quo (Freire, 1970, as cited in Gruenewald,
2003). Place can play an important role in doing that. In particular, public space
has a political meaning, being the setting where people can get together and
express their views (Greene, 1982).

r. Social responsibility and active goal setting. Besides respecting social
rules, individuals have to develop the will to contribute to their community
(Payton et al., 2000): this means that they are acting for their group. At that aim,
children and young people have to learn to define realistic goals (Payton et al.,
2000) and pursue them.

s. Thinking globally, acting locally. The awareness of global phenomena is
important especially for young people, but acting locally is a fundamental part of
being engaged citizens. If they act locally, children and adolescents can see the
outcome of their actions. This makes them aware that they can make a
difference, both as individuals and as a group.

	Interacting and socializing	Being part of a group - sense of communty	Being civically engaged
i.	Recognizing and dealing with one's feelings		
l.	Understanding other people's points of view – perspective taking		
m.	Developing the skills for positively interacting with others		
n.		Understanding how a community works (set of rules) and learning to be part of such group	
o.		Accepting and respecting human diversity	
p.		Feeling sense of belonging to a community and a place	
q.			Developing the ability for being critical and autonomous thinkers
r.			Social responsibility and active goal setting
s.			Thinking globally, acting locally

Figure 2.5. The social competence skills related to the three main aspects of social development.

3. From theory to practice: introduction of case studies

In this section, I introduce a series of case studies and I critically evaluated them in relation to the ideas that I presented in the literature review – and to the lessons that are the outcome of it.

Rather than presenting an overview of the current production of educational facilities, this chapter provides a critical selection of a few case studies that are relevant to the themes of socialization and environmental education. Every case study includes a brief overview, a short discussion about the way space responds to the lessons introduced in chapter 2, a "what we learned section" (i.e. a paragraph about the most significant design features of the school), and original illustrations. A series of symbols that illustrate the lessons are used to facilitate the readability of the themes presented in every case study. Besides the nineteen lessons, a twentieth symbol has been introduced to represent the schools where space is deliberately designed to be informative.

The inclusion of such case studies is aimed at collecting a series of design ideas that can be useful for the definition of the design criteria, presented in chapter 4. This is aimed at integrating the contribution of theory and scholarly research – mostly from child psychology and environmental psychology – to the applied work of design practices.

a. Respecting and loving the natural environment

b. Conserving resources and energy

c. The sense of responsibility and taking care of a place or of a living being

d. System thinking and c o n n e c t i n g actions-consequences

e. Nature is everywhere, even in the city

f. Focusing on the "local"

g. Alimentary education and healthy living

j. Dealing with fears and dangers of nature

k. Density and green transportation

h. Sources of energy

i. Recognizing and dealing with one's feelings

l. Understading other people's points of view - perspective taking

m. Developing the skills for positively interacting with others

n. Understanding how a community works and (set of rules) and learning to be part of such group

o. Accepting and respecting human diversity

p. Feeling sense of belonging to a community and a place

q. Developing the ability for being critical and autonomous thinkers

r. Social responsibility and active goal setting

s. Thinking globally, acting locally

x. Space is informative

Figure 3.0. The symbols related to the different lessons and skills.

3.1. Ecological school in Gelsenkirchen, Plus+ Bauplanung

Location: Gelsenkirchen, Germany

Architects: Plus+ Bauplanung, Peter Hübner

Age group: 10-16 years old

Year of completion: 2004

Gross floor area: 12750 m² (buildings)

Mix: Multifunctional theater, disco, and other spaces for community use

Setting: Suburban

Lessons and skills (themes): b, e, j, m, o, r

Introduction

The school, designed as a village, includes a group of buildings arranged around a central covered street that leads to a public square, placed near the entry. The school has been designed to be a family of rooms rather than a monolithic block. The main public activities – cafeteria, library, chapel and theater – are placed around the public square. Most teaching spaces are located along the central covered path, like shops surrounding a street. Different groups use such spaces at different times during the school day. The main street ends in an open courtyard, around which the architects arranged the workshop spaces.

*Figure 3.1. Exterior view.*

The classrooms were added one by one as a series of side wings away from the central path, in the form of free-standing pavilions, like row-houses. Such wings were designed and built with the direct involvement of students and teachers. Sustainability is a key design aspect and the curriculum integrates elements of the built environment.

Figure 3.2. Site plan.
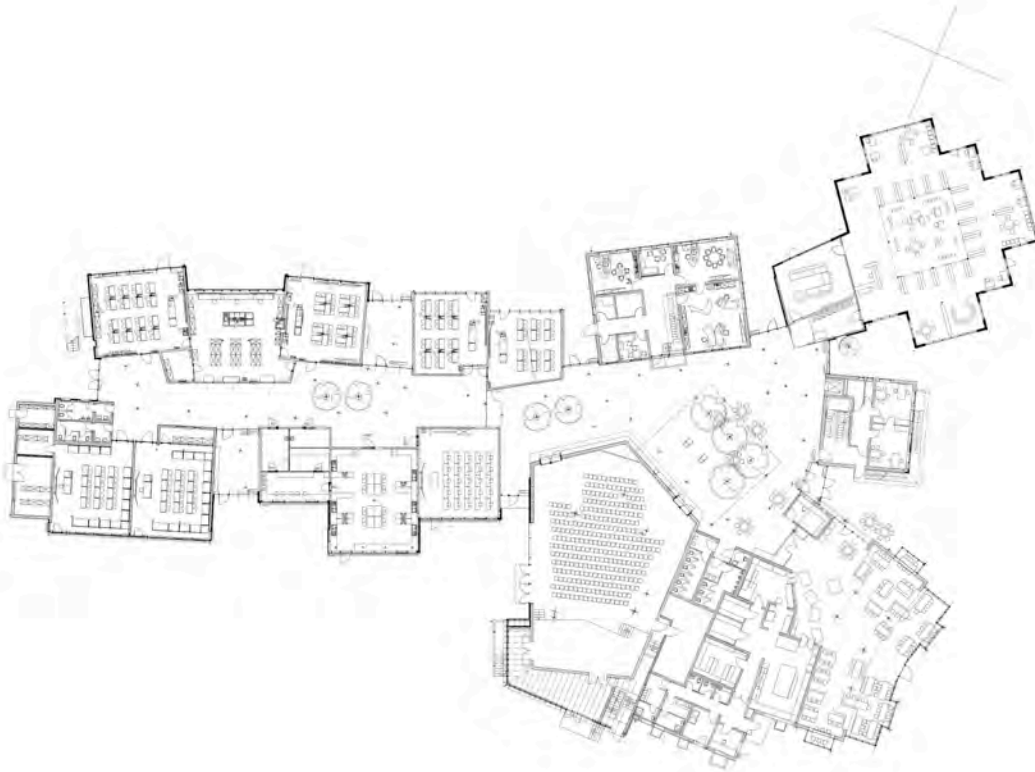
Figure 3.3. Ground floor, including the main square and the interior street.

Lessons and skills

b. Conserving resources and energy.

This is an ecological school that includes a variety of features aimed at saving energy. In particular, the street and the square are unheated and work like a buffer space (temperature moderator between outdoor and indoor). The energy-saving devices show students good examples of sustainable strategies.

e. Nature is everywhere, even in the city.

Some trees and other small plants are placed in the in the indoor street and square. This is a way of reminding students about the presence of nature, even in human-made environments.

Figure 3.4. Views of the main interior square.

j. Dealing with fears and dangers of nature.

The different buildings are freestanding objects within the campus and they are not connected by covered paths. This means that students are often required to exit a building and walk outdoors, whatever the atmospheric conditions are (sunshine or rain, bright or dark).

m. Developing the skills for positively interacting with others.

The school includes a variety of social spaces, where students can meet their peers, teachers and community members. The main street and the square are double-height spaces that visually connect the ground and the first floor. This increases the chances of encounters among students and teachers. Outdoor, a variety of paths and small squares connecting the main building to the classroom wings gives occasions of casual meetings.

o. Accepting and respecting human diversity.

Even if it is an Evangelical school, the school includes students from different religious background – Muslims, Catholics, Protestants. This teaches children

that societies are diverse and multicultural: this means that it is normal for them to share space and experiences with people from different backgrounds. Public space and classrooms is where students can meet such diversity. Also, as the design process included participatory activities with a variety of students and teachers, diversity is embedded in the physical environment.

Figure 3.5. Views of a classroom, with some independent study spaces.

p. Feeling sense of belonging to a community and a place.

The school is organized into different wings that are detached from the main building, thus there are a few distinct "houses" that are inhabited by smaller groups of students. The reduced size of the groups enhances the development of a sense of belonging. The different classroom wings are clad in distinct materials to reinforce the feeling of being in a village, with different "houses".

r. Social responsibility and active goal setting.

Being located in an area with big social issues, the school has the mission of becoming a place where students not only learn academic subjects, but also learn to take responsible decisions. Also, the involvement of students in designing and building the classroom wings enhanced the sense of care for the spaces.
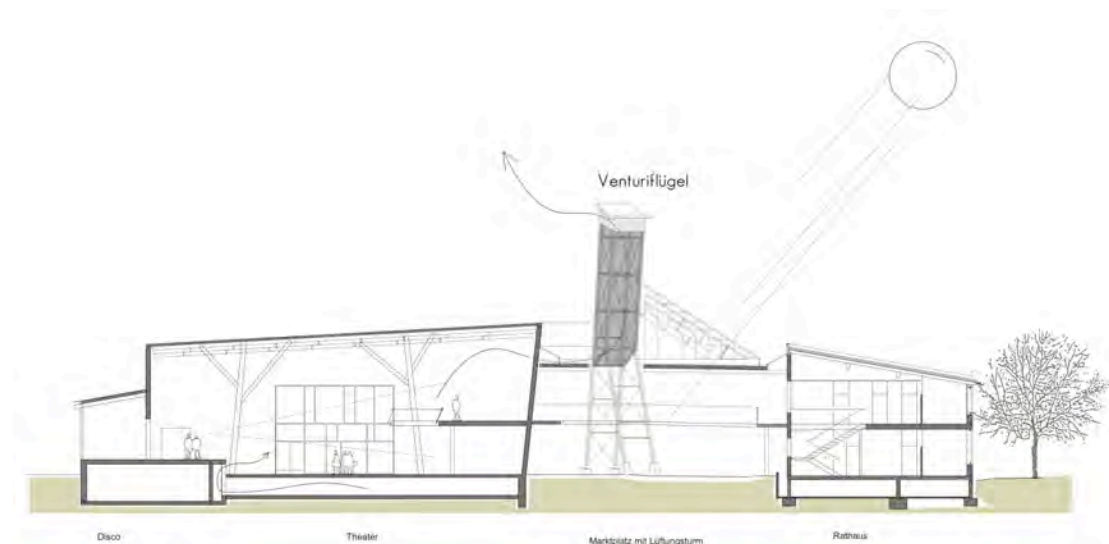
Figure 3.6. Cross-section of the main building

What we learned

The most striking features of this school are the willingness to incorporate and integrate diversity and to improve youth's condition in the neighborhood by providing a site and building layout that resembles a city. This also includes the integration of trees in the atria, which is a meaningful public space where encounters can happen.

Figure 3.7. Nocturnal view of the ateliers.

3.2. IslandWood Environmental Learning Center, Mithun

Location: Bainbridge Island, WA, USA

Architects: Mithun,

Age group: 9-12 years old

Year of completion: 2002

Gross floor area: 4080 m² (buildings), 5560 m² (campus)

Mix: Spaces for community use, housing for staff, lodges for the students

Setting: Natural

Lessons and skills (themes): a, b, c, d, f, g, l, o, x.

Introduction

Located in a forest on Bainbridge Island, near Seattle, WA, IslandWood offers a four-day overnight program during which elementary school children (age 9 to 12) living in cities can experience natural places and are taught about the natural and cultural history of the Puget Sound region. The campus is designed to minimize the impact on the local environment and the designed areas – including buildings – occupy only six acres of the property. The Main Center works as a welcome space for the students of the visitors and includes the administration office. Attached to this building and in proximity of the gardens is the Dining Hall, containing the kitchen.
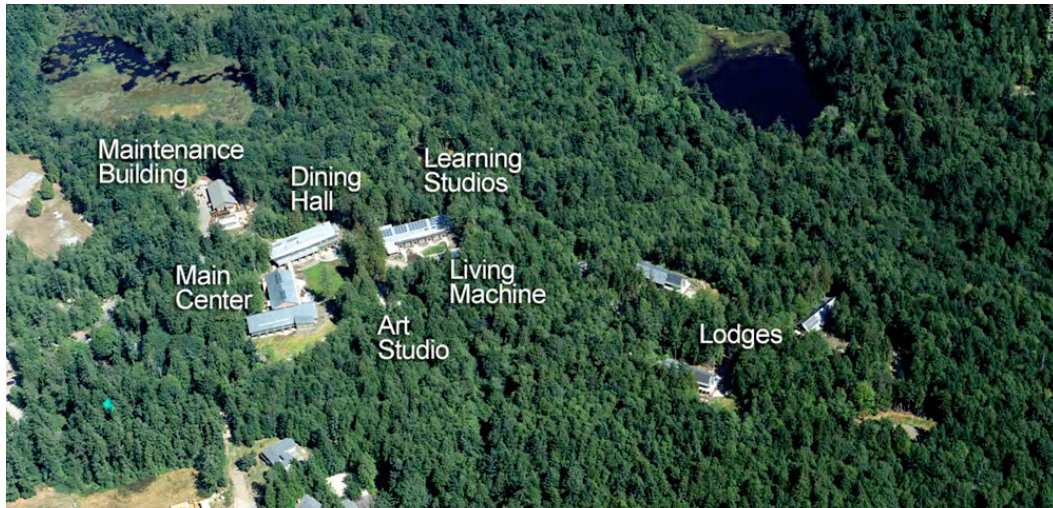
Figure 3.8. Aerial view of the site.

The indoor educational spaces include the Learning Studios building, the "Living Machine", containing a system to treat wastewater, and the Creative Arts Studio. Also, three Sleeping Lodges allow children to sleep "in the woods". A web of trails reaches the outdoor educational spaces. Among them, a series of small constructions like the Tree House and the Friendship Circle, an amphitheater where to meet and share stories. The site includes seven ecosystems that work as outdoor classroom: a pond, several categorized wetlands, a cattail marsh, a bog, a stream, a dramatic ravine, and access to a salt-water estuary park.

Figure 3.9. Aerial view of main buildings.

Lessons and skills

a. Respecting and loving the natural environment.

The learning center is located in an evergreen forest in the Bainbridge Island, close to Seattle, WA. The idea of a "school in the woods" is central in the design and this reinforces the bonds of children with nature. Also, every space has a visual contact with the woods. Locally found materials – like wood and stone – are used to reinforce the connection with nature.

Figure 3.10. View of the learning studios and of the living machine.

b. Conserving resources and energy.

This LEED certified facility shows students how to conserve resources and energy. The design includes a series of sustainability devices: photovoltaic panels, water recycling system (including a living machine), the shape of the buildings (open to the sunshine), abundant natural daylight, composting systems and the use of local and recycled materials. Those features are also intended to be illustrative and informative for children.

c. The sense of responsibility and taking care of a place or a living being.

Children who participate to the IslandWood program get involved in gardening and composting. Also, the interior temperature range is wider than usual and the occupants may have to wear extra-layers of clothes during winter months: this teaches them that sustainable living requires changing their behavior.
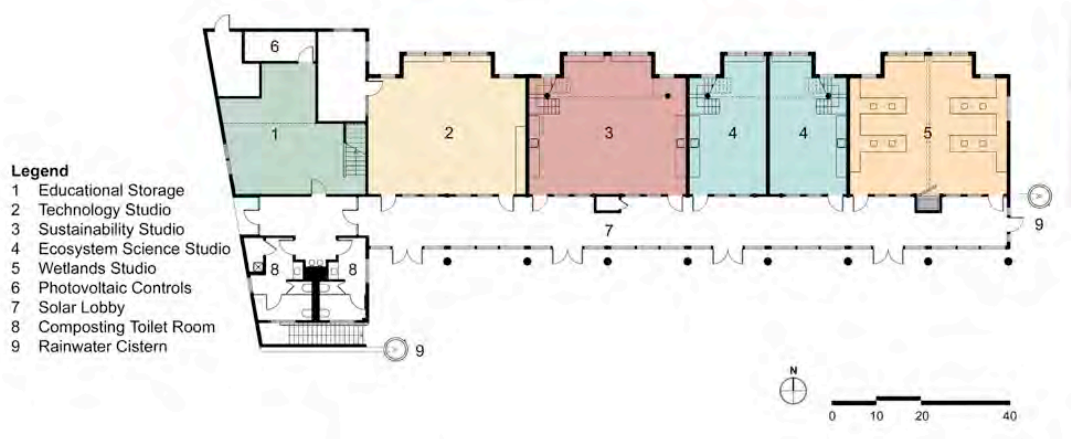
Figure 3.11. Plan of the learning studios building.

d. System thinking and connecting action-consequences.

The food cycle is completely expressed in the buildings and in the outdoor space. Food is grown and harvested in the garden; then it is cooked in the kitchen and eaten in the dining room; then the organic waste is composted and the outcome of it is used in the garden. All the facilities where the parts of such cycle happen are placed in close proximity to each other, to emphasize their connection.

f. Focusing on the "local."

The IslandWood program is focused on the cultural and ecological history of the Puget Sound, the region where the center is located. Besides the visual connection with the forest, the use of local materials, such as wood and stone, enhances the ties with the local environment. In particular the fireplaces, placed in the different buildings, are built with distinctive types of stone that come from the different mountain ranges of the region (Olympic and Cascade Mountains).

g. Alimentary education and healthy living.

The presence of gardens and the focus on the quality of food is an integral part of the IslandWood program. Also, most learning activities take place outside and this puts emphasis on healthy living (physical activity).

Figure 3.12. View of the butterfly-shaped roof and of the main hall.

j. Dealing with fears and dangers of nature.

The school is located in a natural reserve, thus children are continuously in contact with wildlife. Also, since the different buildings are spread out in the forest, all the circulation areas are located outdoors and children have to move through the woods to reach their destinations. Some of these natural environments, which include animals, can be frightening at first (for example, a dark path at night); however, every small group of children is guided by a chaperone that explains them how to deal with their fears.

l. Understanding other people's points of view – perspective taking.

The circle of friendship, a place where children usually meet at the end of the day, can help individuals understand other people's impressions about the day. A place to tell stories and share experiences is very important for children to get used to other points of view.

o. Accepting and respecting human diversity.

The design team involved 250 children in design charrettes, in collaboration with faculty members of the University of Washington, resulting in a series of visions and specific requests that have been included. Participatory design was also extended to educators, and the relationship between the curriculum and the facilities has been interactive. Participation implies including diverse points of view and attitudes in design.

Figure 3.13. View of a learning studio.

x. Space is informative.

Most of the building and landscape features are deliberately designed to be displayed to children, enhance their environmental awareness, and show them how space works. Examples of this are small details like thermometers in different parts of the learning studios – to explain how heat moves – or fishes engraved in sinks – to suggest that what we throw down the sink affects the aquatic flora and fauna.
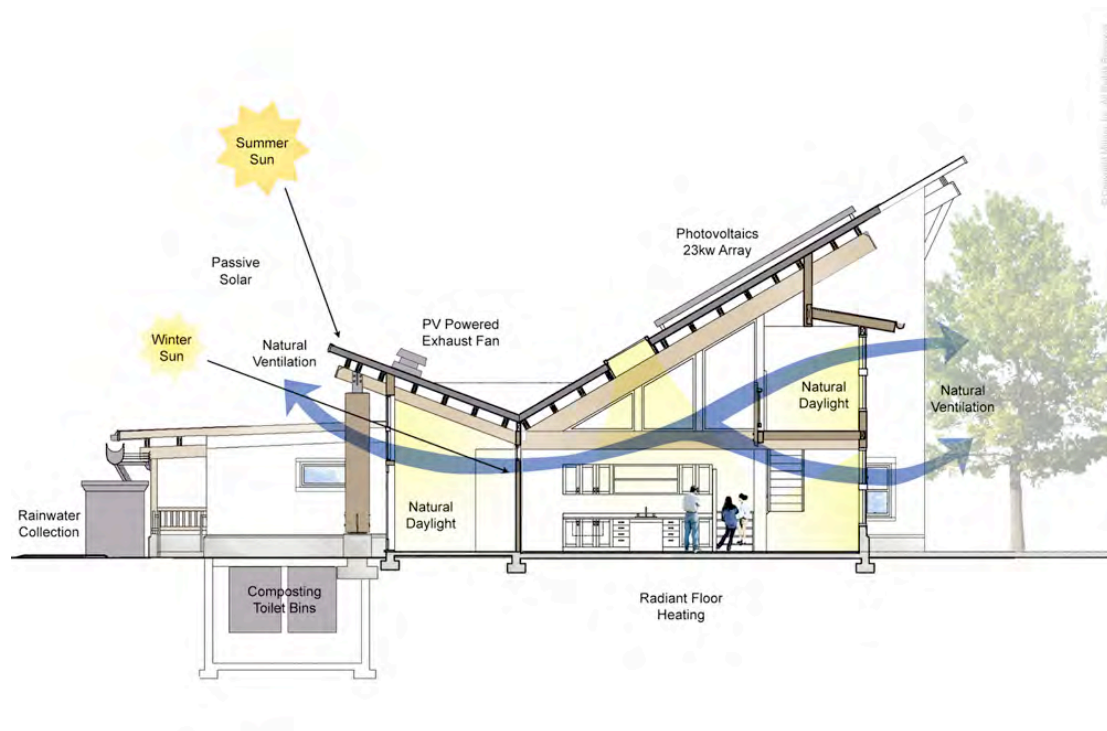
Figure 3.14. Cross section through the learning studios building.

What we learned

IslandWood relies on the magic of the site to enhance children's emotional connectedness to nature through a once in a lifetime experience. The short duration of children's stay at IslandWood plays a further role in that. Every built and natural element is designed to foster such magical experience and to be informative about the relationship between the human and the natural worlds.

3.3. Kvernhuset Junior High School,

Pir II Arkitektkontor AS & Duncan Lewis

Location: Fredrikstad, Norway

Architects: Pir II Arkitektkontor AS with Duncan Lewis

Age group: 13-16 years old

Year of completion: 2003

Gross floor area: 8778 m² (buildings)

Mix: Drama stage for theater plays and other community spaces

Setting: Natural

Lessons and skills (themes): a, b, f, i, m, o, p, x

Introduction

Located in a forest and near an old granite mine, the school puts nature at the center of design and of the curriculum. The latter was defined in accordance with the building design, in order to make space instructive and part of the learning activities. The school draws on a wide range of sustainability features, including the use of local resources. In order to preserve as much as possible of the existing site, the buildings are either carved into landscape – becoming one with the it – or placed gently on top if it. The ground floors are carved into the rock,

using the cut as an interior wall in the hall, giving a "cave" like feeling. The upper levels of the school are three light bars, placed gently on top of the hill, in between the existing trees.

Figure 3.15. Exterior view of the school from the common courtyard.

Lessons and skills

a. Respecting and loving the natural environment.

The school is located in a forest and this enhances the connectedness to nature. The site has many interesting qualities such as the presence of rocks and a small stream. For this reason, each room has a strong visual contact with the exterior. Also, there are several elements of nature that are brought into the building, like small trees, stones and logs. The building (expression of the human action) tries to live in symbiosis with the site (expression of nature): the facilities become part of the landscape and the ground floor atmosphere resembles the one of a cave. Finally, one of the landscape design strategy aims at letting nature reclaim the site throughout the years, so that vegetation can grow on the building and an even stronger human-nature symbiosis is established.

b. Conserving resources and energy.

The building uses a series of sustainability features to smartly use the resources. Among them, natural daylight (skylights and translucent glazing), natural ventilation, geothermal wells, water recycling system and solar panels (in the yellow house). Those features are designed to be educational tools. Also, as the

ground floor is carved in the rocks, the burst rock mass is used as ground floor façade.

Figure 3.16. Site plan.

f. Focusing on the "local."

The main architectural parti is the use of local resources for the construction and the management of the building: this strongly encourages the ties with the local environment. Also, the symbiosis established between the building and the site further reinforces this bond.

Figure 3.17. View of the main interior space.

Figure 3.18. The building is strongly integrated into the site morphology.

i. Recognizing and dealing with one's feelings.

Every group (class) has its home base within the building. Such home bases are clearly recognizable and they are part of different wings, which are characterized by different colors and inhabited by small communities.
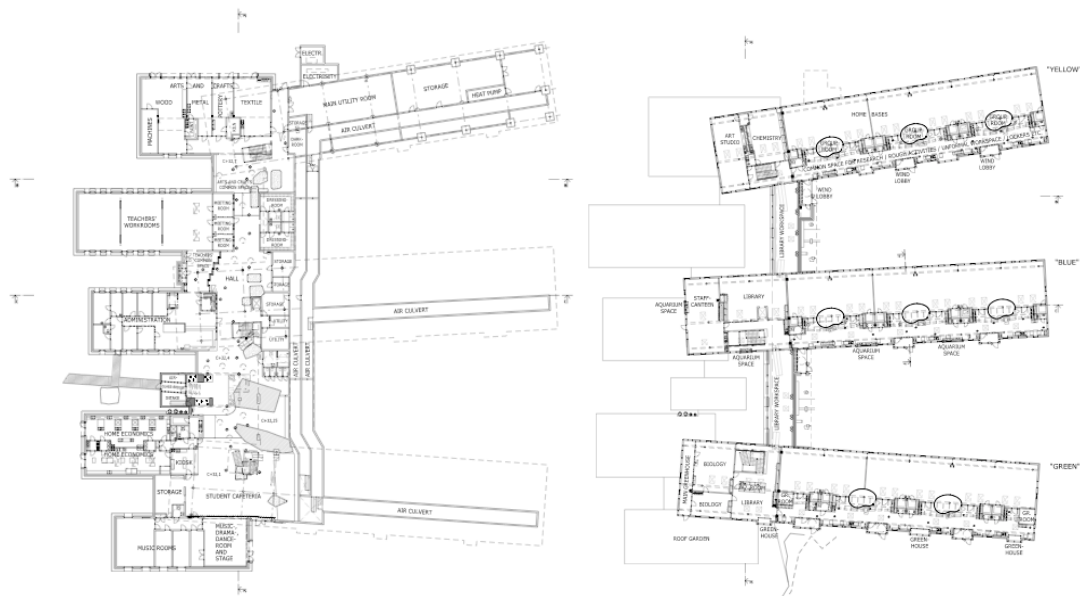
Figure 3.19. Ground plan and first floor plan.

m. Developing the skills for positively interacting with others.

The school, composed of common areas and three wings with the home bases, offers a variety of spaces for informal meeting and social activities. Such areas are located both in the three "houses" and in the connecting volume.

o. Accepting and respecting human diversity.

The school works as an important community facility both during school activities and out of school hours. The architects undertook a participative design process in which both students and teachers were involved. Students' participation was extended to the construction phase, in particular in the collection of bark samples. Sharing facilities and participating in design give occasions to students to meet diverse people and interact with them.

Figure 3.20. Logs are integrated into the exterior walls: reuse of onsite materials.

p. Feeling sense of belonging to a community and a place.

The school is organized in three different "houses" representing three different aspects of sustainability: energy, water, and ecosystems. The creation of smaller communities with a focus on a theme makes it easier for students to feel a sense of belonging to their group.

x. Space is informative.

Materials that have been found on site are reused and displayed in a very clear way, so that students can see an example of smart use of resources. Creating

different sustainability themes for the different small learning communities is another way to let "the walls speak."

Figure 3.21. View of the learning street of the green wing.

What we learned

The design establishes a very strong relation with the site and the buildings take advantage of the natural resources. Another important design feature is that the materials available on site are clearly displayed.

Figure 3.22. The stair integrates onsite stones and logs.

3.4. Manassas Park Elementary School, VMDO Architects

Location: Manassas Park, VA, USA

Architects: VMDO Architects

Age group: 4-11 years old

Year of completion: 2009

Gross floor area: 13050 m² (buildings)

Mix: Kindergarten, gym, outdoor classroom,

Setting: Suburban/natural

Lessons and skills (themes): a, b, c, f, k, m, p, r, x

Introduction

The school, located close to Camp Carondelet's mixed-oak deciduous forest, is an example of green educational facility both in terms of building performance and in terms of space as a 3d textbook. In relation to sustainability, several design features have been employed: insulation and air-tightness, geothermal wells, daylight harvesting systems (light louvers, sheds, and solar tubes), water-recycling systems, and use of recycled and local materials. One of the premises of the project is that people, especially children, cannot be expected to preserve or protect nature if they do not understand it. Hence, the physical environment – including the sustainability features – is designed to be instructive.

Figure 3.23. View of the main courtyard.

The main building is organized in three different houses, named after the seasons – spring, autumn, summer. These three wings are connected by another volume that houses the most public areas – including the gym and the winter commons. A kindergarten is located in a separate building within the campus, which also includes a variety of outdoor learning spaces, like courtyards, an amphitheater, and a stormwater retention pond.

1	MANASSAS PARK ELEMENTARY SCHOOL (MPES) - 2009
2	COUGAR PRE - K - 2009
3	COUGAR ELEMENTARY SCHOOL - 2001
4	RELOCATED PARKING LOT
5	CAMP CARONDELET
6	MPES GEOTHERMAL WELL FIELD
7	PRE - K GEOTHERMAL WELL FIELD
8	RAINWATER CISTERN

Figure 3.24. Site plan.

Lessons and skills

a. Respecting and loving the natural environment.

The school is located in close proximity to wildlife (a mixed-oak deciduous forest) and there is a strong interior-exterior connection. It can be argued that this is a "school in the woods". Also, elements of the forest, like different types of woods, are brought into the building in order to reinforce the connection with that local natural environment.

Figure 3.25. Plan of the elementary school building.

b. Conserving resources and energy.

Being a sustainable building, this school shows children that energy and resources are limited and that they have to be conserved. There is a series of sustainability design features like natural ventilation devices, good insulation,

geothermal wells, water recycling system, and the use of local and recycled materials. Most of these devices are visible and can work as educational tools.
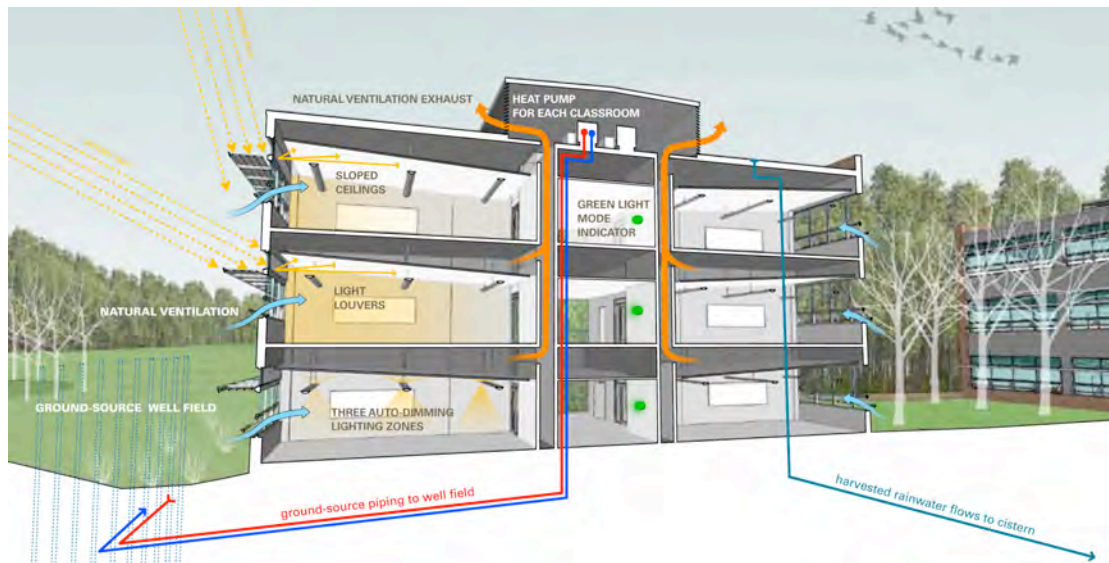
Figure 3.26. Cross section with diagrams of the sustainability features.

c. The sense of responsibility and taking care of a place or a living being.

Students are engaged in managing the natural ventilation system: a green light shows them that windows are open to substitute "dirty" air; when the light goes off because the cleaning of the air has been completed, they have to take action and close the windows. Also, in order to foster children's commitment for nature, the designed environment should be able to explain them how natural phenomena work, especially the ones related to local nature. For this reason every room is very informative about some aspects of the local forest ecosystem: ground dwelling creatures on the first floor, mid canopy flora on the second floor, and treetop/sky inhabitants on the third floor.

Figure 3.27. Views of the interior public space.

f. Focusing on the "local."

Most features of the MPES are aimed at creating strong bonds with the local natural environment: indoor-outdoor connection, the use of local wood, and the emphasis on the deciduous forest ecosystem in the name of the classrooms.

Figure 3.28. View of the kindergarten building.

k. Density and green transportation.

The school is located within a walking or biking distance for most children who attend it. This is a way to foster green transportation to and from school.

m. Developing the skills for positively interacting with others.

The schools has naturally-lit social spaces at every level of every "house". Such system of public spaces could be considered a learning street, i.e. a space where both learning activities and socialization can happen.

p. Feeling sense of belonging to a community and a place.

A sense of connectedness to the local natural environment is strongly encouraged throughout the school and the exterior areas – see focus on the local. Also, since the school is organized in several houses, every house hosts smaller groups of students where people can know each other better.

r. Social responsibility and active goal setting.

Transparency and the presence of mirrors encourage proper behaviors and a sense of personal responsibility. Since other people may be working in the breakout areas, children understand that a certain degree of silence is required.

x. Space is informative.

A touch-screen dashboard in the lobby is located at child-height so students who pass by can pause for a moment to take a look at it. It shows geothermal animations, real-time temperature, and energy consumption in both English and Spanish – which is important because of the school's diversity.

What we learned

The design tries to get students involved in managing some part of the building and tries to make them understand how space work.

3.5. MFC Presikhaven, Herman Hertzberger

Location: Arnhem, Netherlands

Architects: Architectuurstudio Herman Hertzberger

Age group: 2-12 years old

Year of completion: 2009

Gross floor area: 6100 m² (building)

Mix: Childcare, neighborhood center, youth center, gym, library, police station, social welfare services

Setting: Urban

Lessons and skills (themes): k, i, m, n, p, r

Introduction

The facility has been designed to be the new community center of the postwar neighborhood of Presikhaaf, located in Arnhem. The building includes two primary schools, a kindergarten, a childcare center and a series of other spaces for community use. The challenge of connecting and merging such variety of activities in one building has been faced by designing an interior street with continuous skylights, from which all the other spaces can be accessed. Such street links two parallel elongated volumes, in which the levels are split, defining a recognizable spatial theme. On the ground floor, a series of wide steps create spaces for casual meetings: children have the occasion to meet peers from another school or members of the community. In the schools, all the areas can be used for educational purposes. No corridors have been created; rather

circulation areas, connected to the classroom through glazed and movable walls, can host a series of informal activities.

Figure 3.29. View of the building and of the school grounds.

Lessons and skills

k. Density and green transportation.

The facility is intended to be the new center of the Presikhaaf community and at this aim it is located in close proximity to large housing estates. Children can walk or bike to school. Also, the idea of condensing a variety of functions in one building gives children the idea that space is a limited resource that has to be used smartly.

i. Recognizing and dealing with one's feelings.

Every student has a home base, a secure place where he or she belongs and where he or she can return after the learning adventures in the building. Also, there are small nooks (permanent or movable) where children can spend time alone or together: this helps them develop their activity but also a sense of self.

Figure 3.30. View of the main interior public space.

m. Developing the skills for positively interacting with others.

One of the main design features of the building is the central common atrium around which all the different schools are organized. This is a place for meeting and sharing resources with the other schools, such as the library. Also, every school within the building has a series of common areas that do not look like corridors but as meeting and working spaces. The presence of furniture makes those spaces real places where things happen and children have the chance of interacting with peers and teachers.

n. Understanding how a community works and (set of rules) and learning to be part of such group.

Inside the building, all spaces are visually connected. Open spaces and transparent separations allow pupils to see what is happening and how other people interact among them. This can help them learn the rules of human interaction – rather than having enclosed cells where it is impossible to look in. As they see other people interact, children may start to learn the rules of their

community. Also, they can notice that such community is open and based on reciprocal respect, rather than based on adults' authority.
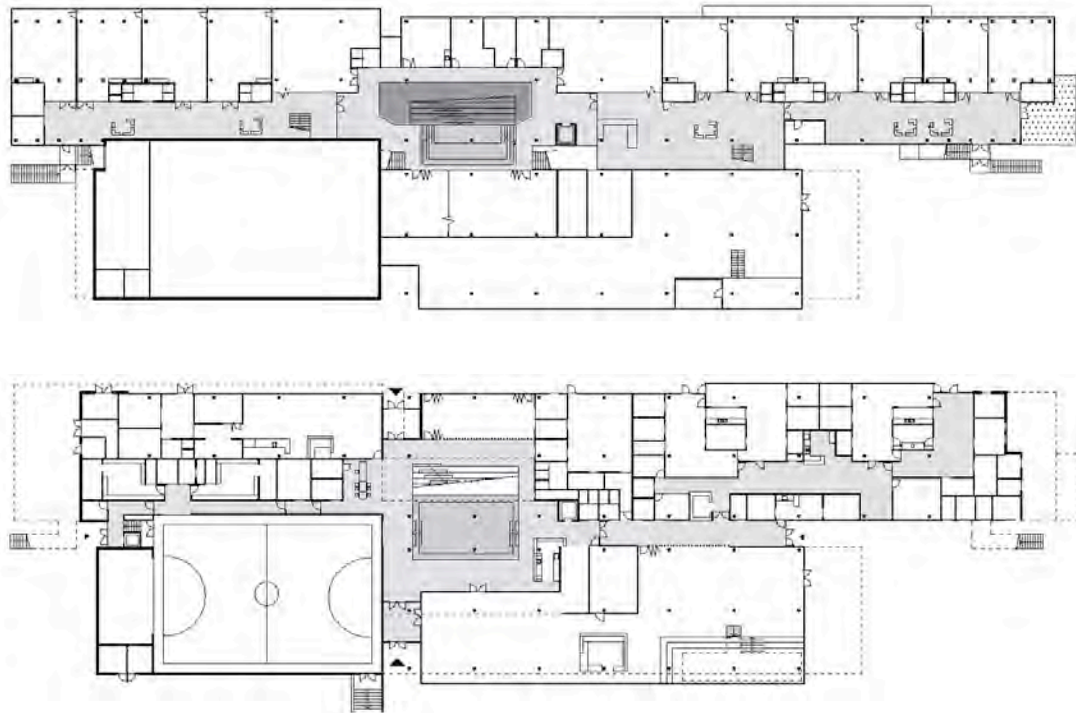
Figure 3.31. Plans of the ground and of the first floor

p. Feeling sense of belonging to a community and a place.

The building organization includes different schools of limited dimensions. Each school has a central public street that children can identify with and where the common activities take place. The presence of such public spaces, which are visually connected with the home bases, is fundamental for children to develop a sense of belonging. Also, the main hall of the building is aimed at creating attachment to the larger community, made of different schools. It is a place where children can go and meet the others.

r. Social responsibility and active goal setting.

Transparency and open borders enhance children sense of responsibility toward their peers. If one is seen, it is less likely that he or she acts in inappropriate ways.
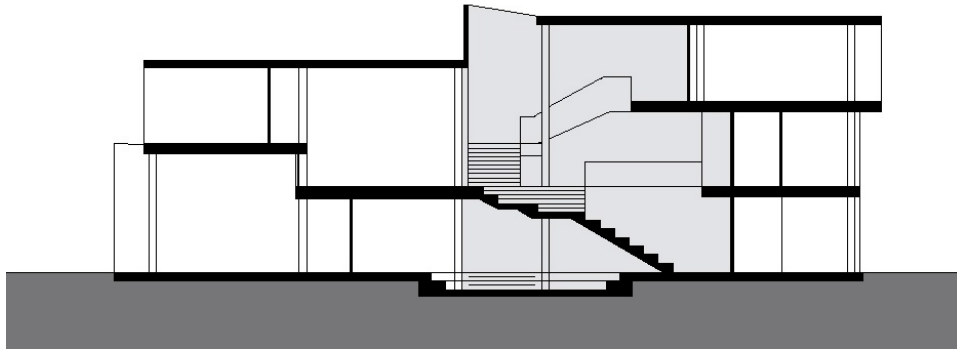
Figure 3.32. Cross section showing the central public space.

What we learned

Different schools and various public institutions can be integrated in one building, optimizing the use of space as a limited resource and creating a center for the neighborhood. This integration is made possible by providing a street-like interior public space that connects the different functions and offers occasions for meeting.

Figure 3.33. Full-height spaces including shared public activities.

3.6. Poquoson Elementary School, VMDO Architects

Location: Poquoson, VA, USA

Architects: VMDO Architects

Age group: 8-11 years old

Year of completion: 2008

Gross floor area: 7430 m² (buildings)

Mix: Gym, cafeteria/theater, and library

Setting: Suburban/natural

Lessons and skills (themes): a, b, f, m, p, s

Introduction

The school is located near a wilderness conservation area, including wetlands and a saline marsh. The school is intended to create a link from the city to the water – the area being one of the few public parts of the coastline. The building is formed by two distinct parts, one including the public and community spaces, and one including the classroom. The latter is organized in three different grade houses (grade 3 to 5), which define learning communities that are distinct but connected. Outdoor, a series of trails connect the school to the water. The campus includes a few outdoor instructive spaces, like the biofilter and stormwater retention and the constructed wetlands. A series of design features have been used to create a sustainable building: insulation, daylight harvesting, systems for reducing water consumption, and recycled materials. Also, space has

been designed to work as an educational tool – including the large sundial placed close to the main entrance.

Figure 3.34. Nocturnal view of the school.

Lessons and skills

a. Respecting and loving the natural environment.

The facility position, near a wilderness conservation area (wetlands and a saline marsh), enhances a strong bond to the natural environment. Large windows offer generous views of the wildlife habitat. Also, the volumes define three courtyards, two of which are open to the natural area.

b. Conserving resources and energy.

This green building (LEED gold certification) shows students how to use energy and other resources in a smart way. The sustainability design features (water recycling system, heat pumps, abundant natural daylight, and the use of local and recycled materials) are also designed to make the facilities a sort of three-dimensional textbook about nature.

SITE PLAN

1 NEW ELEMENTARY SCHOOL
2 BUS DROP OFF / PICK UP
3 AUTOMOBILE DROP OFF / PiCK UP
4 BIOFILTER / STORMWATER RETENTION
5 CONSTRUCTED WETLANDS
6 GEOTHERMAL WELL FIELD
7 ROOM TO EXPAND
8 EXISTING MIDDLE SCHOOL
9 FIRE STATION

Figure 3.35. Site plan.

f. Focusing on the "local."

The school features several aspects that are intended to build strong connections to the local natural environment and community: indoor-outdoor relationship, the emphasis on the wetlands ecosystem in the name of the "houses" and of the classrooms, and the fact that the school recreates a public connection between the city and the waterfront.

m. Developing the skills for positively interacting with others.

The school is organized into three different "houses" and each has a central double height common space where students have opportunities to socialize. The double height space connects visually different levels and increases the opportunities of encounters.

p. Feeling sense of belonging to a community and a place.

A sense of connectedness to the local natural environment is strongly encouraged throughout the school and the exterior areas – see focus on the local.

Also, the school is organized in several "houses" named after the different types of ecosystem that are present in the region, and such strategy creates smaller communities of students: this helps the feeling of belonging to those realms.

Figure 3.36. Ground floor plan.

s. Thinking globally, acting locally.

Besides the focus on local ecosystems and phenomena, children at this school are made aware of global phenomena. The local ecosystem is connected to larger sea phenomena, like for instance sea level rise. The school was rebuilt in 2008 after that in the fall of 2003 Hurricane Isabel flooded much of the city of Poquoson, including the elementary school. The new school has been built on higher ground (11 feet above the sea level) in order to avoid future flooding.

Figure 3.37. View of the library – visual connection with the outdoors.

What we learned

The school design tries to reconnect the city to the waterfront, thus the facilities play a civic role that goes beyond the academic outcome. The landscaping respects the characteristics of the protected area and tries to multiply the occasions to learn about natural phenomena.

3.7. Sydhavn Skole, JJW Arkitekter

Location: Copenhagen, Denmark

Architects: JJW Arkitekter

Age group: 0-9 years old

Year of completion: 2012

Gross floor area: 9500 m² (building)

Mix: Community spaces (kitchen, etc.), sport center, science center

Setting: Urban

Lessons and skills (themes): a, c, e, g, k, m, n, o, p

Introduction

Located in the harbor of Sydnhaven, a newly redeveloped neighborhood of Copenhagen, this new school will be focused on science and on water. A sports center and a science center will be built close to the school to reinforce the public identity of the area. The three facilities will be surrounded by a green area and connected by pedestrian paths. The school is formed by a sloping five-storey building linking the city to the water. This organic shape creates large green terraces on the roofs of the lower volumes. Inside the building, space is very fluid and there are very few enclosed spaces. The architects use the metaphor of the city to explain the interior layout: a main square, placed near the entrance, is

connected by a few streets to a series of smaller spaces like houses and shops. Thus, the plan is not completely open but it includes some acoustically insulated spaces. Another important design idea is that the school aims at becoming a district's community center at all hours, where students, teachers and parents can meet.

Figure 3.38. Aerial view of the project.

Lessons and skills

a. Respecting and loving the natural environment.

Although it is located in an urban setting, the school includes a variety of outdoor spaces, like the terraces where trees will grow, becoming a sort of oasis in the city. The strong relationship with the water also reinforces the bonds with the natural environment.

c. The sense of responsibility and taking care of a place or a living being.

The school will include small kitchen gardens and children – together with teachers and parents – will be required to take care of them.

Figure 3.39. View of one of the school gardens.

e. Nature is everywhere, even in the city.

Since the school is located in a harbor, it has a strong relationship with the water, a natural element. Also, the presence of large terraces with vegetation brings nature above the school, re-naturalizing the city.

Figure 3.40. Diagram of the interior layout.

g. Alimentary education and healthy living.

The design offers several opportunities for practicing sports, both in the terraces for breakout activities and in the sport center. Also, the school will be located within a walking distance from most housing estates in the neighborhood, so

that children can walk or bike there. Moreover, small kitchen gardens will be placed in the terrace, and children will be able to taste locally grown healthy food.

k. Density and green transportation.

The design makes use of a site of modest dimension and makes the most out of it, creating green spaces on the rooftops of the lower volumes. This shows children that space is a limited resource and that it has to be used smartly. Also, the school will be located close to one of the main cycling routes of the new neighborhood that links the area to a subway station.

Figure 3.41. View of the urban side of the school.

m. Developing the skills for positively interacting with others.

The design includes a variety of relational spaces, both in large settings, as the main square at the ground floor (steps to sit on), and in smaller settings, like the breakout areas between the learning spaces. Also, the school kitchen is intended to become a meeting point for children, teachers and parents.

n. Understanding how a community works (set of rules) and learning to be part of such group.

Since learning spaces are quite open and learning happens everywhere, children have to behave positively in order not to cause troubles to their peers when they are at work (for example by avoiding talking too loud). In open spaces, everyone has to learn the rule of mutual respect.

o. Accepting and respecting human diversity.

The school is designed to be a small city, with public space connecting different private areas. Cities are places that provide room for diversity, especially in public space.

Figure 3.42. Cross section.

p. Feeling a sense of belonging to a community and to a place.

The school has a series of major public spaces that are connected through double height voids, providing a sense of cohesion and spatial continuity.

Figure 3.43. View of one of the playgrounds.

What we learned

The terraced shape provides outdoor spaces at every floor that include grass and plants and that overlook the water– thus multiplying the contacts with nature. Several terraces form a sort of mountain natural landscape that brings surprise to Danish children.

3.8. De Titaan, Hoorn, Herman Hertzberger

Location: Hoorn, Netherlands

Architects: Architectuurstudio Herman Hertzberger

Age group: 12-16 years old

Year of completion: 2004

Gross floor area: 10300 m² (building)

Mix: Large multifunctional space in the main square

Setting: Urban

Lessons and skills (themes): m, n, p, r

Introduction

The school is composed of a compact cube volume placed on a larger podium. Being a VMBO school (secondary intermediate vocational education), it includes several spaces for practical learning, especially workshops – situated on the ground floor, in the cited podium. The main entry, located on the first floor and reachable via a large exterior stairway, opens onto the central square, which is the social heart of the school. Above this space, a central void links visually all the four floors above. Such floors are reachable via an open stairway. The first part of it, which is about 17 meters wide, forms a kind of stand that can host a large amount of students, both for informal meetings and for small recitals or other plays. Each floor above the first constitutes an autonomous spatial unit inhabited by a defined group of students, though the different levels are visually connected. Every spatial unit includes a space for informal and practical work

outside the classrooms, facing the central void. Glass accordion doors enable the surrounding classrooms to be opened up to this area. Such common working areas are not stacked directly above each other, but are rotated 90° each floor, in order to provide transversal views and make space more dynamic.

Figure 3.44. View of the entrance of the building.

Lessons and skills

m. Developing the skills for positively interacting with others.

At every floor, there are several common areas facing the big central void. Such spaces are used for educational activities during all the school day. As students are engaged in learning activities in an informal space, it is easier for them to start a conversation and maybe collaborate with others to develop their task. This provides occasions for meeting and visual connections among the different floors.

n. Understanding how a community works and (set of rules) and learning to be part of such group.

The design includes "open" areas for work: students have to respect their peers who are working and the atmosphere of space gives an idea of that. Transparency enhances the active control of spaces: this is also a way of stimulating students not to hide themselves. The openness also allows students to overlook other peers interacting and learn the social rules: since there are different age groups, the younger kids may look at the older ones.
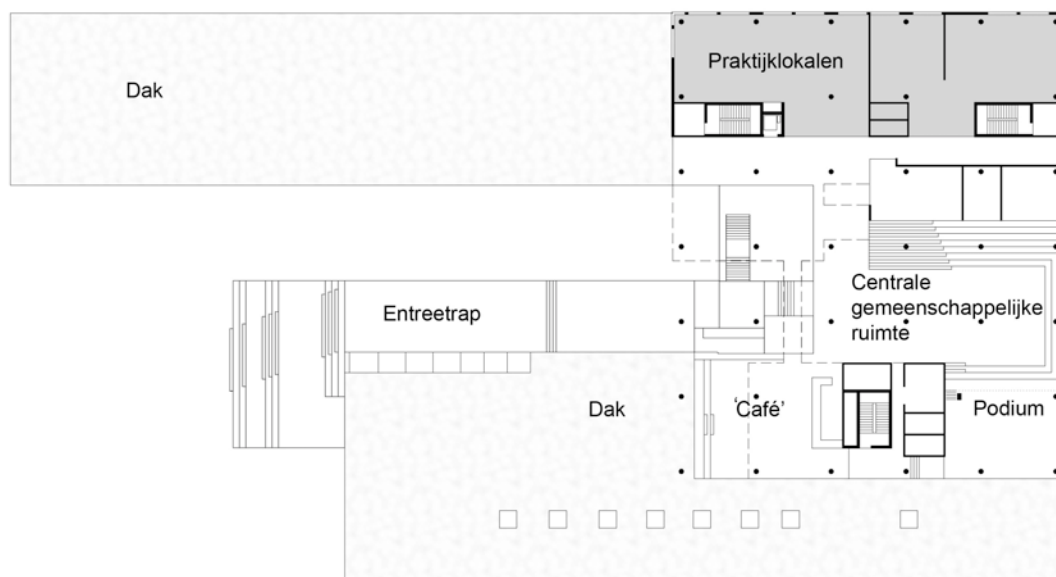
Figure 3.45. First floor plan – entrance level.

p. Feeling sense of belonging to a community and a place.

The spatial cohesion given by the full-height atrium enhances the sense of togetherness and the idea of community. People at the different floors can see each other and start to interact. The open work areas located at each floor "belong" to the group of classrooms located at that level. Hence, there are smaller communities within the whole school community.

Figure 3.46. Views of the main central void.

r. Social responsibility and active goal setting.

The environment is stimulating and open: there are resources all around the central atrium, like computers overlooking the void. Students are allowed to take their decision on where to go and perform their activities.

Figure 3.47. Diagrams of the private and public space at every floor.
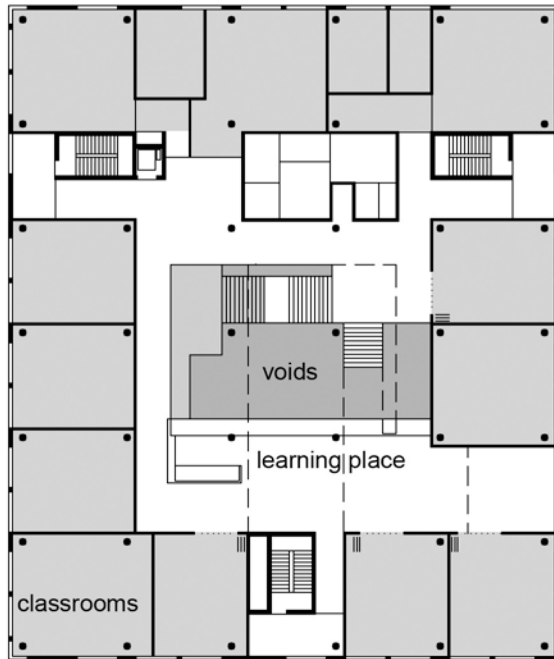
Figure 3.48. Typical floor plan.

What we learned

The central void of the school provides spatial cohesion and puts an emphasis on public space. This is very important given the high grade of students' diversity in this school. Arranging breakout areas around such void is a way to make such public space really inhabited by students.
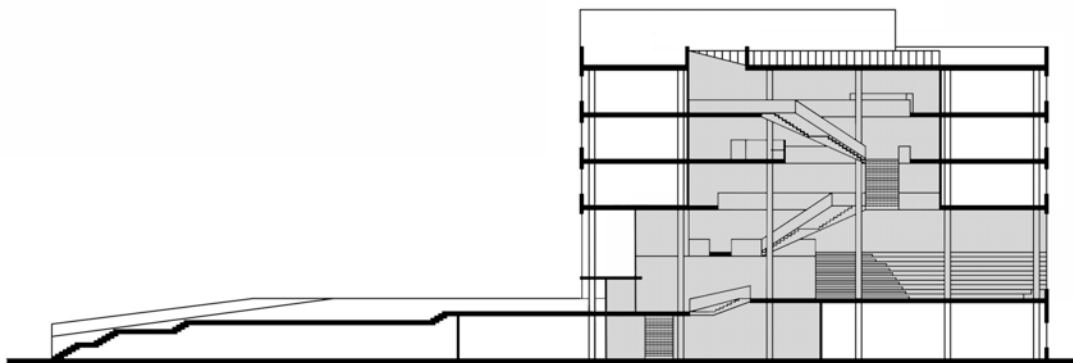
Figure 3.49. Section through the entrance and the main central void.

4. Design criteria for enhancing social competence and ecological literacy development

The proposed design critera are aimed at enhancing the role of places in fostering the development of social and ecological literacy in children and young people. This takes the assumption that space and place can make a difference. Also, such criteria include cross theme ideas because some of them are related to both social competence and ecological literacy – giving further evidence to the connections between the themes.

4.1. The design criteria

The interdisciplinary knowledge deriving from the review of several disciplines has been translated into a range of design suggestions that can foster the development of social competence and ecological literacy. Using scientific knowledge from different disciplines is a way of introducing forms of evidence into the development of design criteria. However, the definition of design ideas also passed through the study of a series of school buildings and un-built projects: case studies have given a positive contribution because examples and good practices can help "translate" the theoretical knowledge into design ideas and illustrations. Then, the last step in the definition of such criteria is research by design: the role of the architect is to provide a series of different design solutions that can give answers to the different "questions" emerged in the previous work.

Since most building codes require public facilities (including schools) to adhere to the principles of sustainable design, most of those facilities built in the next decades will be "green" – and these design criteria take this assumption. Also, even if the role of public space and of the outdoors is fundamental for developing social competence and ecological literacy, those guidelines take the assumption that schools will be no longer places where space for learning – expressed by classrooms – and space for socializing – expressed by corridors and school grounds – are separate entities (Nair & Gehling, 2008): in that sense, a certain

degree of complexity provides the opportunities that are needed for socialization to occur (Hertzberger, 2008).

In defining the design criteria, especially in the ones that put emphasis on social competence, the work by Herman Hertzberger has been very influential. Both in his built works and in his books, he has been giving great relevance to the role of school commons as a space for meeting peers and for learning. Another work that has been very significant for these criteria is "The Language of School Design" by Prakash Nair and Randall Fielding (2005). Its approach based on a pattern language and on connections between research and practice has been particularly useful in defining general design criteria.

01. Maximizing the presence of nature
1.1. Buffer spaces inside buildings
1.2. Maximizing the accessibility to open-air spaces at every floor
1.3. Forms of gardening that are spread throughout the school site
1.4. The active use of the rooftops
1.5. Designing buildings as separate entities within the campus
1.6. Keeping cars out of sight

02. Unfinished and modifiable spaces: appropriation and customization
2.1. Including framing elements that constitute the "hardware" of the place
2.2. Space should be flexible enough to be modified easily
2.3. Opportunities for appropriation
2.4. Displaying students' work

03. The local dimension of physical elements
3.1. Including native species of vegetation
3.2. Built environments should recall the local architectural patterns
3.3. Including a local identification

04. People and nature: coexistence and interdependence
4.1. Highlighting the difference between natural and artifact elements and displaying their friendly coexistence
4.2. Continuity between indoor and outdoor space
4.3. Nature should be brought to students' "home base" within the building
4.4. Nature should reclaim the site after the human intervention has taken place

05. Students-friendly displayed technologies and artworks
5.1. Technology should reveal how the building and the landscape work
5.2. Hi-tech and low-tech technologies should be easy to understand for students
5.3. Focus on specific sustainability themes in some parts of the building
5.4. Artworks can highlight the beauty of some natural places
5.5. Including unusually displayed recycled materials
5.6. Displayed elements for learning math, logic, and language skills

06. Articulation of public space and activity centers
6.1. Activating public space
6.2. Indoor activity centres
6.3. Outdoor activity centres
6.4. Social attractors
6.5. Balanced relationships among activity areas indoor and outdoor
6.6. Variety of outdoor spaces, integrating the multidisciplinary curriculum
6.7. Space should facilitate an integrated curriculum for ecoliteracy
6.8. Every school should have a garden or a greenhouse

07. Spatial cohesion, hierarchy and scale
7.1. Spatial features enhancing cohesion
7.2. The hierarchy of spaces, a place to belong
7.3. Including streets and squares in public space
7.4. Schools of small dimensions and small learning communities
7.5. A balanced spatial density

08. Enhancing a positive school atmosphere
8.1. Breaking down the barriers between students and adults
8.2. A "homelike" look, a relaxed atmosphere, and stimulation
8.3. Including informal and comfortable seating

09. Student's participation in design
9.1. Involving students in meaningful participation
9.2. Focusing the attention on small parts of the school
9.3. Including cultural diversity in design

10. The school and the neighborhood: location and connections
10.1. Location: close to home, close to nature
10.2. A "diffused school" made of different places within the neighborhood
10.3. Sharing facilities with the neighborhood
10.4. Open borders

Figure 4.1. The proposed design criteria.

1. Maximizing the presence of nature.

As the literature review showed, direct experiences of nature are the most important factor in enhancing ecological literacy in children. Contact with nature, valued as an informal setting by children and young people, can also foster socialization (Moore, 1986). Therefore, even in densely populated cities, designers have to find a way to maximize nature in places for children, even in indoor environments.

   1.1. Buffer spaces inside buildings. The idea of nature within the building implies some in-between spaces, like greenhouse or atria where small trees or other plants can be grown (Moore & Cooper-Marcus, 2008) or where placing other natural elements, such as water. These spaces are particularly valuable in cold climate zones because they work as buffer spaces – to regulate the temperature – but they are also useful in temperate climates for the fall and winter seasons. One of the most important design issues to consider is the control of the temperature within these spaces. At this purpose, it should be possible to open parts of these greenhouses in summer. Also, the choice of the species to plant has to be very accurate because of the microclimate generated inside these spaces. Fruit trees have been grown in greenhouses for a long time. Thanks to that, schools could have fruits out of season and students could participate in collecting them. Also, the limited height of such trees makes them suitable for most interior spaces. At the same time, exterior sheltered areas can be effective spaces even in extreme weather conditions (rainy or hot weather).

Figure 4.2. Indoor atria including plants.

1.2. Maximizing the accessibility to open-air spaces at every floor.
Since the outdoors is the major source of natural experiences (Nelson, 2006), schools should provide opportunities to experience it. Not only the ground floor has to be connected with outdoor spaces. The upper levels should include terraces and loggias. This can be done by diminishing the depth of the building at every floor (thus partially resembling the shape of a stairway) or by creating wide loggias in the volume. Those spaces should be used to perform activities that integrate the ones developed indoors.
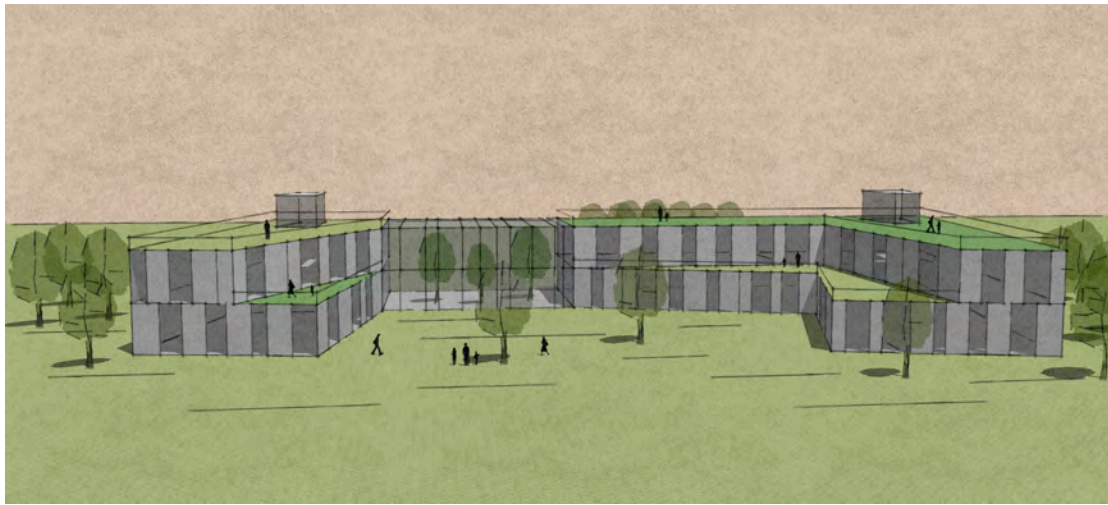
Figure 4.3. Outdoor spaces provided at every floor.

1.3. Forms of gardening that are spread throughout the school site.
Gardens should be placed in different settings around the school (Lucas, 1995), even in indoor spaces. This can multiply students' interactions with the outcome of their gardening efforts, displaying in everyday public space examples of their involvement.

Figure 4.4. The rooftops may include gardens or other green areas.

1.4. The active use of the rooftops. This can increase the presence of nature especially when space on the grounds is limited. Rooftops can be used for gardens, renewable energy installations, or other kinds of "green" technologies (water collection and cleaning devices). Using the roof as a learning space can also be a way to teach children that space is a limited resource, to be used smartly.

Figure 4.5. Loggias at every level multiply the interaction with outdoor spaces.

1.5. Designing buildings as separate entities within the campus. In case of schools of large dimensions, the school masterplan could resemble the ones of most university campuses, with different buildings placed in a green area and connected by paths. This requires students to go outdoor several times during the school day, multiplying their contacts with nature.

Figure 4.6. The school spaces do not have visual contacts with cars and parking lots.

1.6. Keeping cars out of sight. Maximizing the presence of nature also means minimizing the impact of artificial elements like cars. Displaying a car-

free environment is a way to show students that it is possible to enjoy places without automobiles and that life is possible without that. For doing that, the parking areas on campus should be hidden (Nair & Fielding, 2005). This can be done by creating visual barriers with evergreen hedges and shrubs between the spaces for learning and relaxing and the parking lots, or by lowering the latter.

2. Unfinished and modifiable spaces: appropriation and customization.

The idea of un-designed spaces, leaving opportunities for interpretation and modification, allows the users to transform spaces into places, giving them their individual and social meanings. Children have a preference for places that offer multiple affordances and opportunities of manipulation (Malone & Tranter, 2003; Titman, 1994). Also, in a critical perspective, if children do not learn to be involved and care personally about issues, they will most likely passively accept their lives and their places, never questioning their conditions (Freire, 1970-1995, as cited in Gruenewald, 2003), and in particular their environmental aspects. Thus, designing modifiable spaces can be a way to let people challenge the status quo of space and get involved. In this framework, the challenge is finding a balance between the permanent elements of space and its parts that can be transformed.
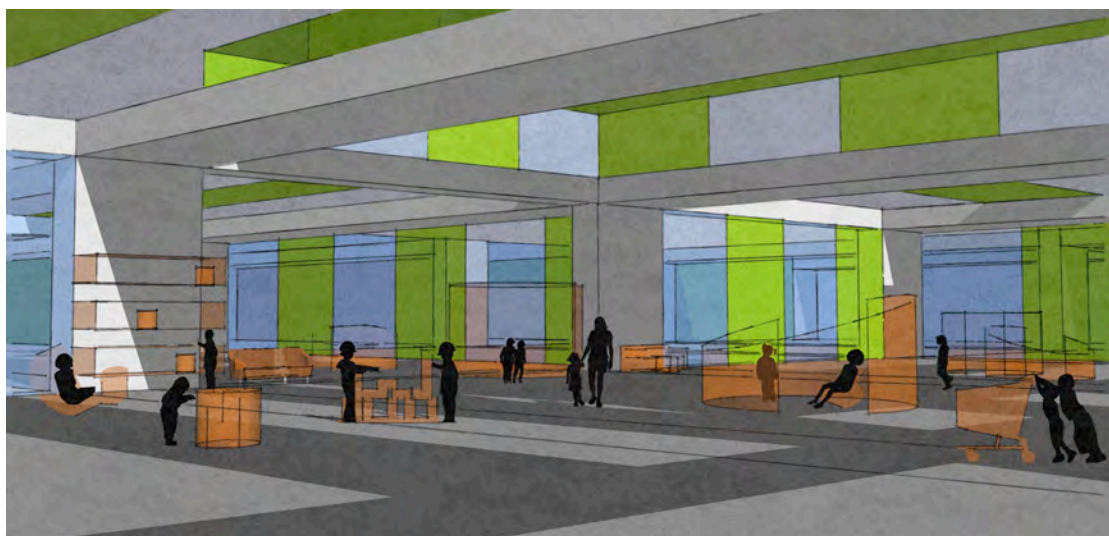
Figure 4.7. The modifiable elements can have a specific chromatic characterization.

2.1. Including framing elements that constitute the "hardware" of the place. The permanent elements express the values of communities, like public space in a city, and make space recognizable for most users. In relation to children and young people, a series of studies showed the elements through which they build their maps and organize their paths (Allen, 1981; Christensen 2003; Golledge et al., 1992; Olds, 1987). This body of research has been combined with the studies conducted by Lynch about the image of the city (1960). The outcomes are six elements that contribute to making a place recognizable: the singularity of every space, the presence of landmarks or other figurative elements, the simplicity of form and articulation, the continuity of paths, the hierarchy between public and private space and the directional differentiation along paths.
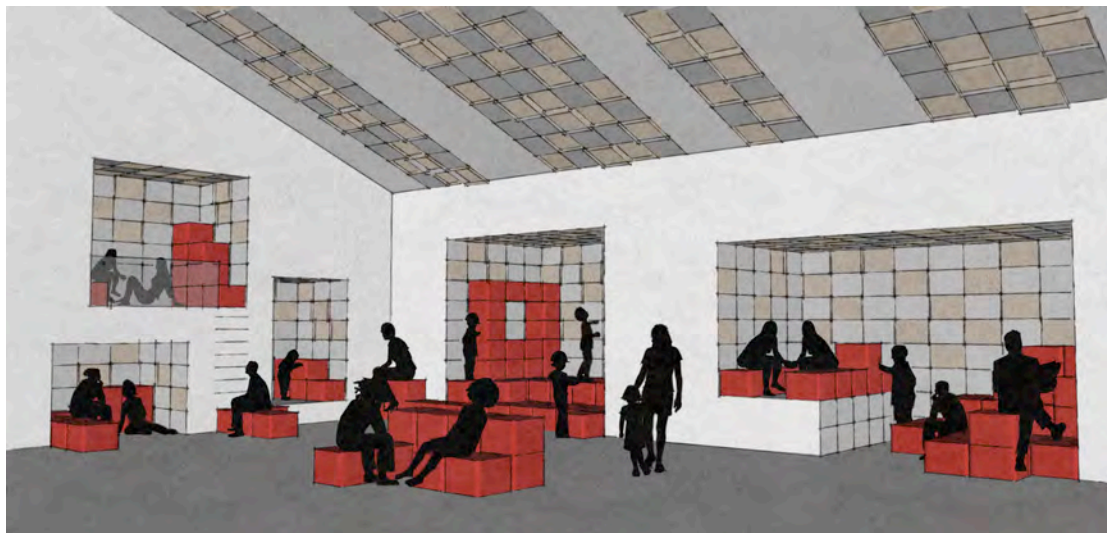
Figure 4.8. Soft cubes can interact with space to create diversified environments.

2.2. Space should be flexible enough to be modified easily. Some elements of space, furniture, movable walls, and learning objects, are more likely to be modified. Such objects need to be carefully integrated with the design of the permanent elements. The idea of modifiable spaces involves the concept of affordance, as introduced by Gibson (1979): it is important to understand the way spaces and objects afford modifications in relation to children's abilities. Also, students have to be stimulated to transform space. Thus, the physical environment, in coordination with teachers, must offer some invitations to action. Such invitations can be provided by the creation of metaphors – so that students can build stories – (Bullivant, 2005), or by designing informal and un-

finished spaces, which stimulate students' will of acting. Finally, gardens are examples of modifiable spaces, allowing continuous participation and involvement in taking care of them.

Figure 4.9. Movable partitions and furniture allow the creation of small group areas.

2.3. Opportunities for appropriation. Since the sense of ownership of indoor public spaces can help reduce social issues (Wilcox et al., 2006), designers should elaborate strategies to facilitate space appropriation: offering multiple affordances through furniture, movable partitions, unfinished parts (lacking colur, for example) and learning material (for younger children) can stimulate students' interventions on space. The space in-between classrooms and commons provides a transition and can foster different forms of space appropriation (Hertzberger, 2008).

Figure 4.10. Students' artworks or projects displayed in the school commons.

2.4. Displaying students' work. Displaying students' artwork and projects is a way to give relevance to their efforts. Such works should be integrated in the school public space. For example, specific display areas could be placed close to the entrance, so that the newcomers can see the students' projects and have an idea of what the school is about (Nair & Fielding, 2005). Also, every classroom could have a storefront facing the public space in order to show to the rest of the school what the class is working on.

3. The local dimension of physical elements.

Children and young people can be effective stewards for nature if they act locally in specific activities, like gardening, hence the role of place-based education in the study of local ecosystems. In this perspective, places can become instructive by displaying aspects of a specific community or region.

Figure 4.11. The school reflects some of the neighborhood patterns.

3.1. Including native species of vegetation. Local species are preferable to invasive ones in order to enhance the regional biodiversity and foster connectedness to the local aspects of nature. Also, research suggests that invasive species tend to have a negative impact on native species (Vilà & Weiner, 2004). The difference between those two groups of species could be highlighted and used as a learning resource for students: flowerbeds with native and invasive species could be placed close to each other. Thus, students could see the way the two different types of species develop and the influence of the invasive ones on the native ones over the months.

Figure 4.12. Native and invasive species are displayed and put in close relationship.

3.2. Built environments should recall the local architectural patterns. Local architectural patterns should highlight the way the building responds to the local climate, and the way they reflect and reinterpret some elements of the specific neighborhood. For example, the use of bricks to create a thermal mass in temperate climate areas is a way to regulate the interior temperature both in winter and in summer. Furthermore, the shape of the roof tells students about the quantity and frequency of snow precipitations in the school region. Then, since this approach implies using local materials, it contributes to sustainable physical environments. Such building patterns reinforce the links to the local identities because they are related to the consolidated image of the city and of the region, which in some cases can have a thousand-year history. This means including the *genius loci* in design, as described by Norberg-Schulz (1980).

Figure 4.13. Building patterns reflect the local specificities.

3.3. Including a local identification. Every school should have a

landmark, placed close to the entrance, which expresses the specific and irreproducible characteristics of that school, the ones that make it unique (Nair & Fielding, 2005). The meaning of this sign has to be clearly understood by students and community members (Nair & Fielding, 2005). Also, it could be designed and built in collaboration with them, in order to include their identity. The design of the landmark is easier for thematic schools, like the ones involving science or art (Nair & Fielding, 2005). Architecture itself can become a signature element, or freestanding objects like sculptures and fountains can be used (Nair & Fielding, 2005). In this case, their function is purely communicative. Finally, these landmarks work as visual destination elements, attracting people's attention, and can make the school visible from different parts of the neighborhood.
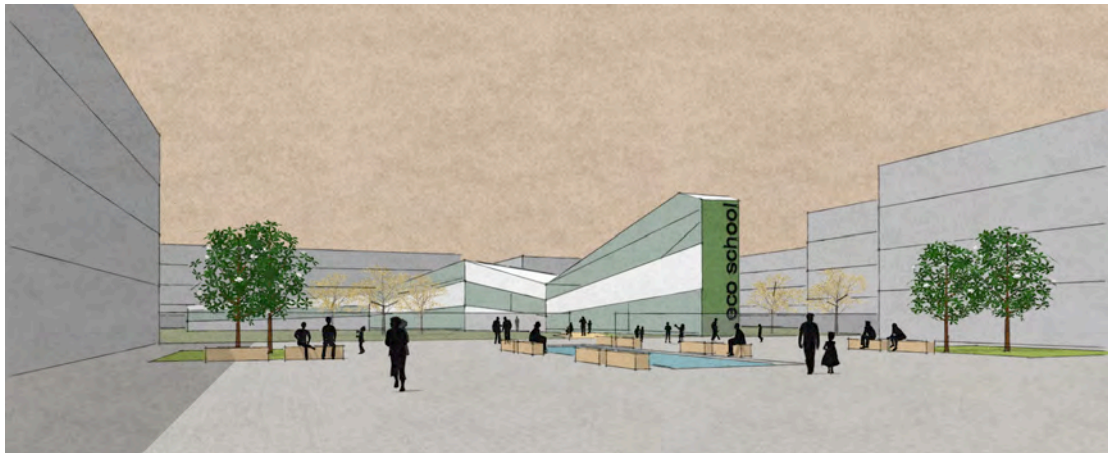
Figure 4.14. The school signature that creates a link to its neighborhood.

4. People and nature: coexistence and interdependence.

Places can play a role in showing students the reciprocal interdependence between people and nature, and the harmonic relations that can be established between them. Humans rely on nature for the supply of resources (like air, food, water, etc.) and their survival depends on it (Chawla, 1988). At the same time, humans have reached the power to negatively influence nature's health, putting themselves in danger.

4.1. Highlighting the difference between natural and artifact elements and displaying their friendly coexistence. The difference between what is

natural and what human beings shape is still recognizable, but these two realms are merging more and more (nature is influenced by human action and vice versa). In order to make space instructive about these ideas, designers have to address a series of questions: for example, how can technology help nature? How can designers display the difference between artifact and natural elements? What can people learn from nature about the efficient use of resources and energy? For example, cleaning water systems can de-pollute the water collected in urban schools and then such water can be used to green the school grounds, *helping* the presence of nature in the city.

Figure 4.15. The buildings originate from nature.

Also, photovoltaic panels and trees could be placed in close proximity to explain the different ways in which they contribute to reducing the emission of carbon dioxide. This can also show that these two elements, representing technology and natural elements, are both necessary in today's environments and that they can coexist.
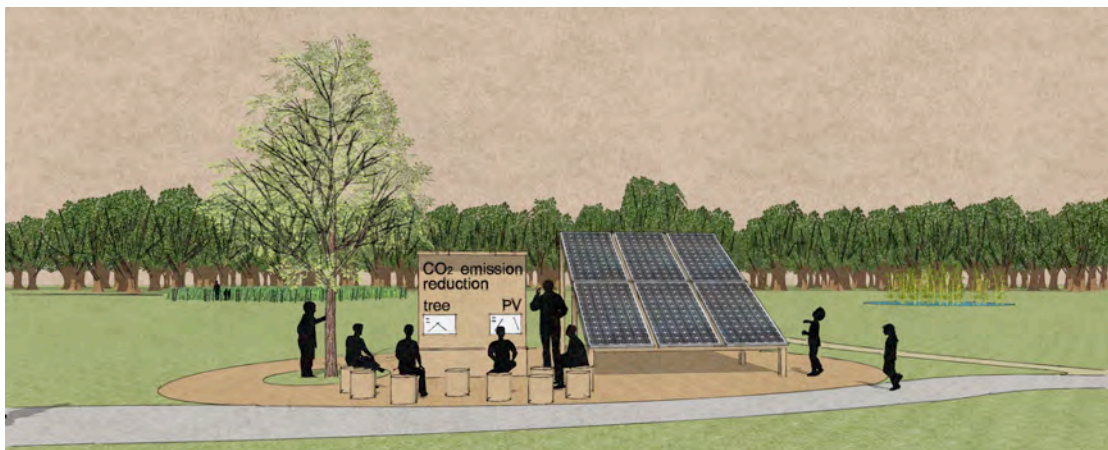
Figure 4.16. Comparing a tree to PV panels: same outcome.

4.2. Continuity between indoor and outdoor space. This connection can be achieved by bringing natural elements inside the buildings, like vegetation or locally found stones, by enhancing the visual connections and by using natural materials indoors. This is also a way of giving a feeling of connectedness to the exterior world, avoiding the dichotomy between the designed environment found indoors, and nature, found outdoors.
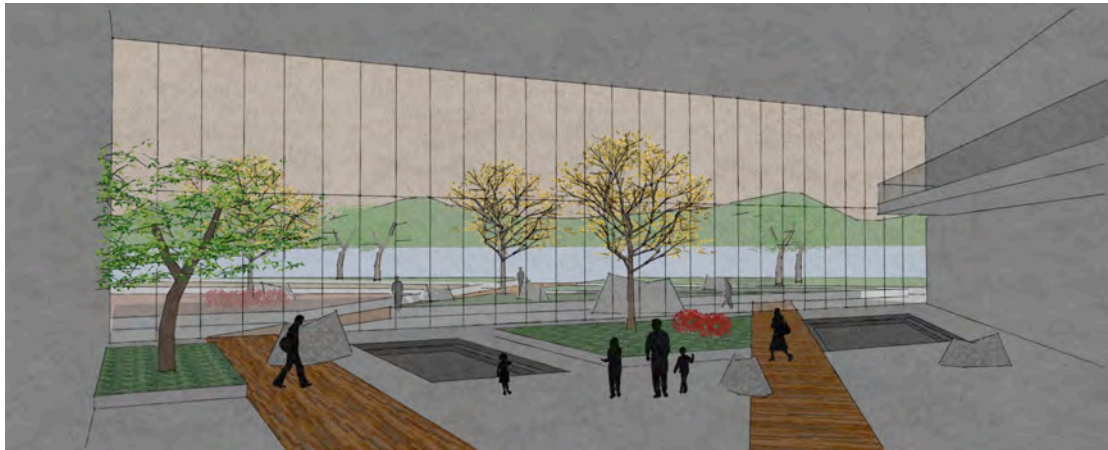
Figure 4.17. Indoor-outdoor visual connection: continuity of the elements.

4.3 Nature should be brought to students' "home base" within the building. This could be done by growing small plants that can live indoor in classrooms or other home bases or by placing small patios in close proximity to such spaces. The presence of nature in students' home base is a way to welcome nature in their most secure place, creating deep emotional ties with it.

Figure 4.18. Small plants in classrooms enhance the emotional connectedness to nature.

4.4. Nature should reclaim the site after the human intervention has taken place. Outdoors spaces and building surfaces can be re-naturalized during

the life of the facilities: ground cover should be limited and the exterior building walls should allow plants to grow on them by providing some sort of support. This could be a way to explain that nature is timeless. On the contrary, human interventions are temporary and nature will always take over on them. Practically, this means limiting the maintenance of the outdoor spaces in terms of presence of vegetation – besides a few spaces to play.

Figure 4.19. Vegetation grows over buildings and the landscaping.

5. Students-friendly displayed technologies and artworks.

There is a big difference between what designers and teachers intentionally display to teach specific ideas and what children can discover by chance in their daily explorations, with a larger freedom of interpretation. In the first case, specific planned activities can be performed in relation to such objects or spaces. Displayed objects should be placed in the school public space, so that they are visible by most students and their size should be appropriate for their task. Also, signage can be used to further explain concepts. That needs careful graphic design in relation to the skills of the different age groups.

5.1. Technology should reveal the how the building and the landscape work. Space could be instructive and *tell* students about some features of the building and of the school grounds. Sustainability features are particularly

interesting in this *communication*. For example, expressed structures and pipes can help students understand the way materials are used and how water and air move through the building. Also, photovoltaic panels should be placed where they can be highly visible by students, for example close to the entrance (Nair & Fielding, 2005). To summarize, all the opportunities to teach students about energy conservation and use should be seized.
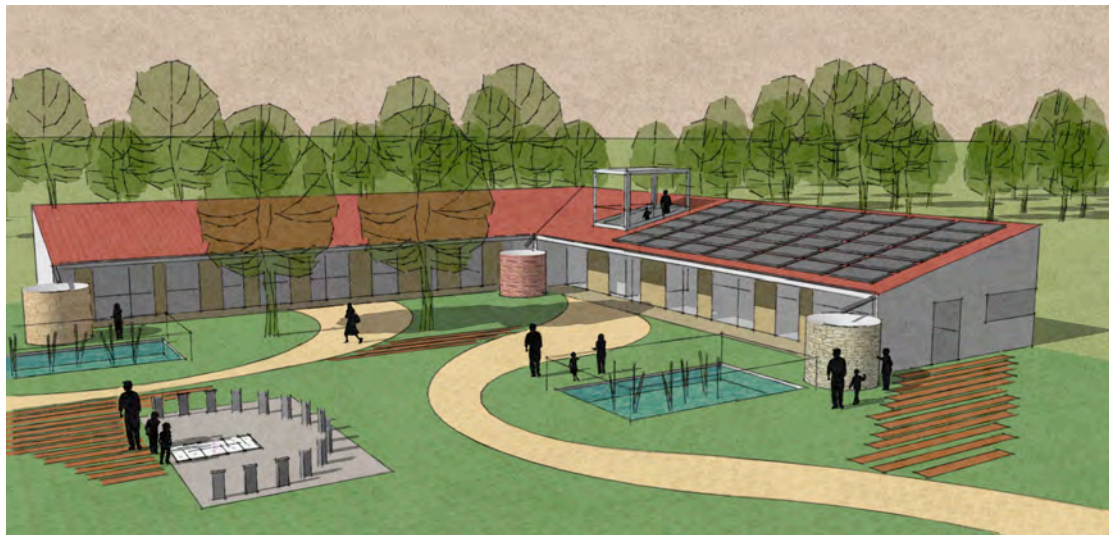
Figure 4.20. A variety of displayed elements to show students how space works.

5.2. Hi-tech and low-tech technologies should be easy to understand for students. Green technology should allow errors and different levels of interpretations. Devices that are too difficult and abstract can have the opposite effect, bringing on a refusal of every technology involving an increased effort (Blyth, 2009). An example of low-tech display is the water cycle: since water is fundamental to most natural cycles, the physical environment should show the ways water is used, collected, treated and reused. For example, barrels for collecting water can be visible from the street, as a public display. Then, more advanced technologies can be displayed, like solar or photovoltaic panels, to teach students about the cycles of energy and about the importance of the sun.

5.3. Focus on specific sustainability themes in some parts of the building. Different areas of the school could focus on a specific theme of sustainability (for example, the water cycle or the solar energy) or on different parts of an ecosystem (for example, flora and fauna). This, besides helping the development of place attachment to the different areas of the school, is a way to

focus students' attention on a single topic. Then, as students explore their school, they discover different aspects of sustainability and they connect them to different spaces.
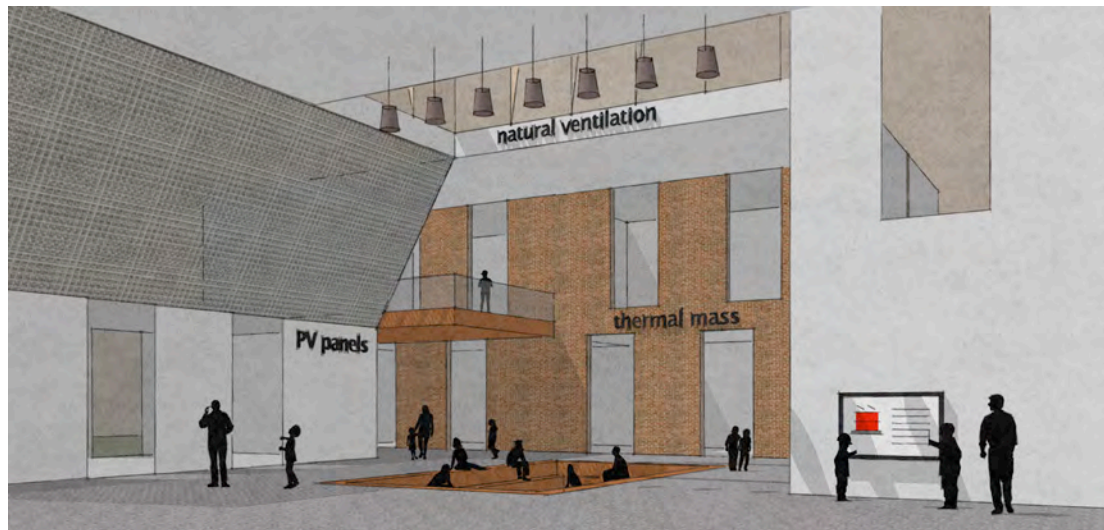
Figure 4.21. Energy saving strategies are displayed and pointed out.

5.4. Artworks can highlight the beauty of some natural places. This can enhance the development of emotional bonds with nature through art, highlighting children's imagination. Art can play an important role in enhancing children's place attachment and involvement, especially when they are allowed to speak their mind about the meaning of places. For example, gateways, fences or benches could be designed and made by students themselves during art projects.
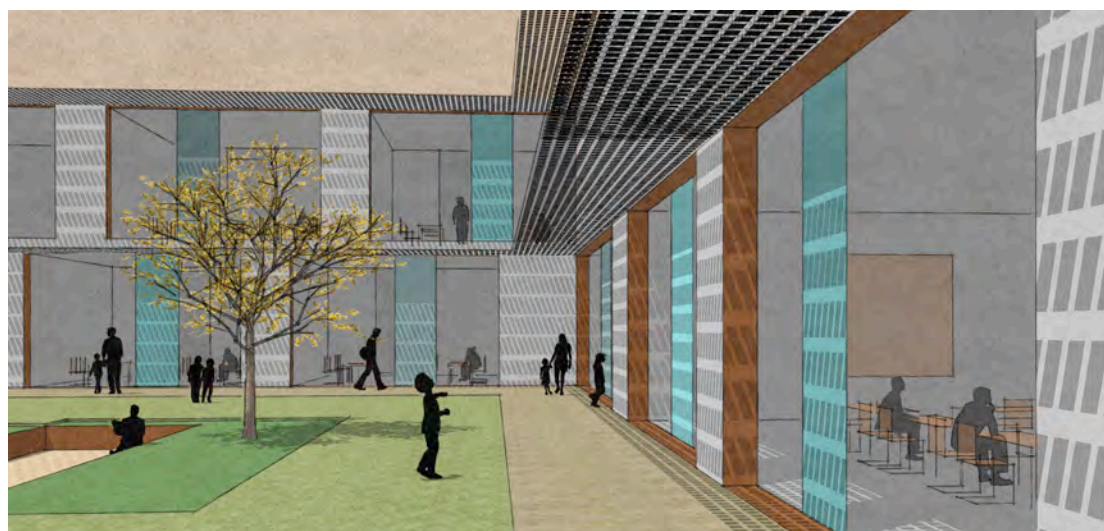
Figure 4.22. PV panels location makes them clearly visible for students.

5.5. Including unusually displayed recycled materials. Such elements, used both in everyday environments and art installations, can help students reflect on the significance of waste and the opportunities of reusing it. For example, recycled or loose materials – like pieces of wood and rocks from the site – can be used in an inspirational way and they become "displayed" with an educational purpose.

Figure 4.23. Logs and barrels can be re-used in unusual ways.

Figure 4.24. The building elements can be displayed rather than hidden.

5.6. Displayed elements for learning math, logic, and language skills. A series of tools can be used to teach math and languages. Montessori's and Froebel's learning objects have also been developed at that aim, especially for preschools and elementary schools. Such objects imply the idea of learning by

doing – actively including the physical world in learning. Also, *learnscapes* are spaces that are designed for the development of a learning activity that includes the interaction with such spaces. The need of an active involvement of students is the most interesting characteristic of these environments. Some outdoor *learnscapes* can be aimed at teaching mathematics and logic: in elementary schools this can happen in a playful atmosphere. Moreover, research shows that place attachment can be developed during leisure activities (Bricker & Kerstetter, 2000; Moore & Scott, 2003).
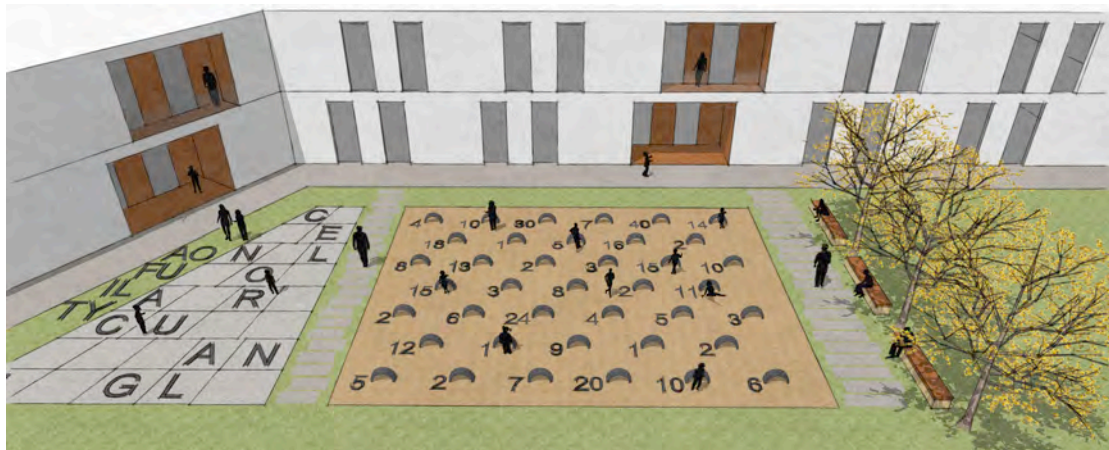
Figure 4.25. Students can learn math and language skills by playing.

6. Articulation of public space and activity centers.

Public space in schools plays a fundamental role in defining the common ground where students meet and learn the values of the community. Most schools do not give importance to it and consider it only as space for circulation. This criterion gives insights about the way public space can be articulated and host the development of meaningful activities.

      6.1. Activating public space. Public space, besides providing room for circulation, should be meaningful, economically effective and safe. To do that, it should foster the development of a series of formal and informal activities, by providing a series of activity centers. These are spatial units that can be recognized as distinct and where students can sit and perform a task: if some activities are happening, socialization can happen more spontaneously and space is safer for the passive supervision provided by people.

6.2. Indoor activity centers. Atria and learning streets (with a convenient width and natural lighting) are preferable to corridors. Such spaces can include some spatial devices that foster the formation of activity centers, suggesting a relaxed work environment (Hertzberger, 2008): first, spatial articulation brings about the formation of corners, places where tables can be put and activities performed; walls and floors should have a certain "depth", so that a variety of horizontal planes can be formed; also, modulating the height of walls and partitions helps separate visually and acoustically different areas. However, some countries' building regulations do not allow the use of common areas for any activities if they are considered fire escape routes: at this purpose, such routes could be placed outside through a series of balconies.

Figure 4.26. Steps enhance casual meetings or planned activities in the school commons.

6.3. Outdoor activity centers. The school grounds should be designed to host meaningful learning activities that can become important parts of the curriculum, especially for subjects like ecology and biology. Such subjects are important in the development of ecological literacy: this involves observation and direct action. Activities that focus on natural elements are possible even in urban settings, where apparently nature is absent: for example, activities involving water and shadows. Outdoor spaces are also important for the development of social skills. For example, sandpits are spatial solutions for environments that promote creative play outside (Hertzberger, 2008): since the activities to be performed are very easy, sandpits can become ideal places where children from different backgrounds and cultures can meet and socialize. Also, a

hilly terrain provides many more opportunities to play creatively than a flat one and it can be integrated with some stairs that also provide seating (Hertzberger, 2008).

Figure 4.27. Gardens are places where students can gather and collaborate.

6.4. Social attractors. Spaces where people naturally stop and gather are important both in public spaces and in classrooms. Their position and their physical characteristics are two important factors: first, they should not interfere with circulation and should include some permanent elements, besides furniture. For example, steps define a sense of place, not being temporary like tables and other types of furniture (Hertzberger, 2008). They can create a sort of theatre, encouraging people to stop and join in. Steps become a sort of social attractor because they give protection from the back (physical anchor) and let the vision open in front of people. The sheltered area under the stairways can become another "place", especially if the floor is lowered (Hertzberger, 2008): this also gives a sense of protection, enhancing quiet activities. Finally, semi-built furniture elements as "objects in space" can work as social attractors because they foster the development of activities, providing some sort of shelter.

6.5. Balanced relationships among activity areas indoor and outdoor. The different activities that take place in the indoor public space and in the school grounds need to be carefully considered in order to avoid potential conflicts and foster positive interactions. Even if it is impossible to predict all the behaviors, the likely activities can be studied and assigned a "footprint", i.e. the space needed for such activity to develop (Ostermann & Timpf, 2007). Then,

groups of compatible activities can be assigned to different areas, according to their need of space.

6.6. Variety of outdoor spaces, integrating the multidisciplinary curriculum. Variety and possibilities of flexible uses are important characteristics of public space for learning and playing, especially outdoors. In fact, the activities aimed at environmental stewardship require free play, guided experiences and interactions with adults, even in form of lectures (to explain the phenomena and to transmit the love for nature). Space should be able to host formal, non-formal, and informal education (Moore and Wong, 1997). For example, since interaction among activities is important, settings to sit and discuss close to the experience and play areas – like small amphitheaters or informal seating on logs – should be included in the design.

Figure 4.28. The school grounds should offer a variety of opportunities for students.

6.7. Space should facilitate an integrated curriculum for ecoliteracy. This follows the ideas developed by Capra (2007) about system thinking, inferences among subjects, and networks mapping. Therefore, facilities should be designed in a way that spaces where the different phases of cycles happen are connected or placed in close proximity. Taking the food cycle as an example, gardens, kitchens, dining rooms, and composting areas should be placed in close relationship to each other. In particular, schools should include a special kitchen where students participate in the preparation of food after having being involved in the choice of the menu (Nair & Fielding, 2005). This increases their awareness of the food related issues and informs them about healthy food.

6.8. Every school should have a garden or a greenhouse. Among the outdoor activity centers, the role of gardens has to be highlighted because it is the most powerful way to teach children about natural cycles (Capra, 1998) and about specific aspects of nature, like through theme gardens. Gardens are places that require the active involvement of students for learning a variety of subjects, like biology, botany and horticulture (Nair & Fielding, 2005). Moreover, gardens are among the few elements of the physical environment that can show children the direct consequences of their actions. For example, if they do not water plants, they will not grow. Finally, greenhouses are more appropriate in some climates that are too cold for growing crops during the school year.

7. Spatial cohesion, hierarchy and scale.

The relationship between public and private space in school can be explained with the metaphor of the city. The school can be seen as a small city where public or relational space, made by interior streets and squares, represents the collective identity of the school, while classrooms and other private space are the houses that express the individual and small group identities. Also, designs should find a balance between spatial articulation and spatial cohesion (Hertzberger, 2008). This means that public space should be organized in different areas and that such areas should be visually connected. Hertzberger (2008) also holds that spatial cohesion can bring about social cohesion.

7.1. Spatial features enhancing cohesion. Some spatial devices can foster the sense of togetherness. First, connecting visually different levels through voids (split-level division) – taller spaces and daylight make these spaces resemble the outdoors (like a city) (Hertzberger, 2008). Second, making the indoor network of open spaces very visible, by allowing connections (Hertzberger, 2008) and through the use of a specific color for public space. Finally, making circulation visible within the school, for example by making stairways evident (Hertzberger, 2008). Even if there is no optimal design type because the choice of it depends on a variety of factors (including the educational level, the school size, and the location), research shows that clearly recognizable layouts reduce the chances of behavioral issues (Wilcox et al.,

2006). For example, a courtyard layout is appropriate in schools that give emphasis to outdoor activities because it can bring about spatial cohesion in the school grounds. Rather, full height atria highlight the role of the indoor space as the social hub of the school. To reinforce the urban feeling, the interior walls of such atria could be designed as facades of building in cities, including windows and storefronts. Also, links between indoor and outdoor spaces, enhanced mainly by transparency, allow students and teachers to be aware of what is happening in other spaces. This fosters students' sense of control and allows a more effective supervision of outdoor areas, and can significantly reduce behavioral issues (Wilcox et al., 2006).
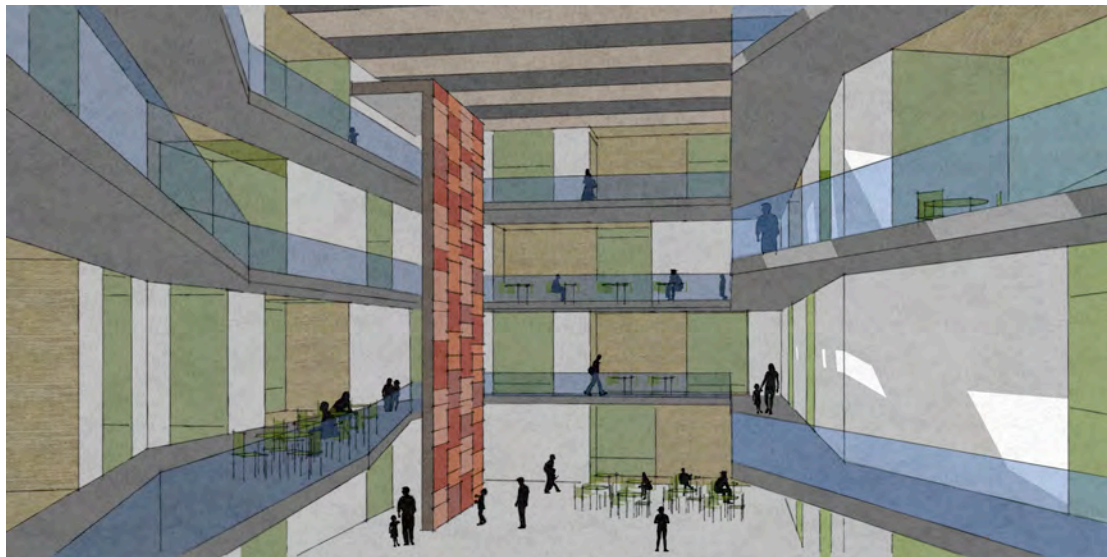
Figure 4.29. Full-height atria provide visual connections between the different levels.

7.2. The hierarchy of spaces, a place to belong. Designers should provide different "homes" for different social groups within the school, from individuals to the whole school community (Fielding, 2006). Hertzberger (2008) introduced the metaphor of the city to state that a completely open-plan layout, where there are no "solid" elements, has to be avoided. First, individuals need a personal "home base", a place where they belong to (Hertzberger, 2008), made with furniture within a larger space and including an individual storage space (Nair & Fielding, 2005). The home base is necessary because students spend most of their day at school and sometimes they need a rest, a secure place (Nair & Fielding, 2005). Then, "families" (groups of 10-20 people) can be hosted in small rooms or within larger rooms shared with other people, depending on the activities. Small learning communities (SLCs, 100-150 people) are reflected by

the common spaces that constitute the core of every cluster. This core can become a "destination", thus a place, rather than a simple path if it has a central-plan rather than a linear one (Nair & Fielding, 2005). The different SLCs should have a distinctive spatial character that makes them clearly recognizable: for example, through the use of distinct colors and materials. Neighborhoods can regroup various SLCs and can have their learning streets or squares. Finally, the whole school must be reflected in a main public space, generally a square, which gives the sense of a larger community.
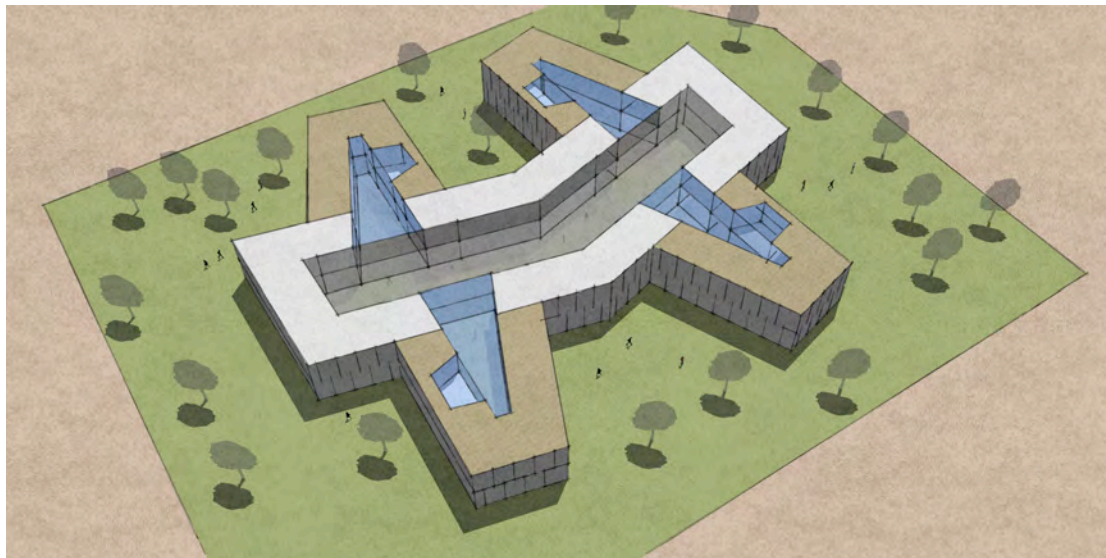
Figure 4.30. Schools can be organized in different "houses" for different groups.

7.3. Including streets and squares in public space. Those are centripetal spaces that keep people together because they are "relational spaces" (Hertzberger, 2008, p. 129) and both work as attractors. In a street there is a chance to meet other people during a walk, while in a square meetings are usually wanted, planned, or expected. Also, streets are where everyday life happens, while squares are for special events, like markets (Hertzberger, 2008): those two different functions are both important in a school.

7.4. Schools of small dimensions or small learning communities. Research is quite consistent about the benefits of small schools over larger facilities (Cotton, 1996; Lindsay, 1982; Pittman & Haughwout, 1987). A reduced school size is particularly positive in primary schools in order to make the passage from kindergarten more gradual. Then, secondary schools can have a bigger size, for young people can handle different types of relationship and open themselves more to the outside world. Moreover, organizing the school in small

learning communities is a way of reducing the perceived scale of the building and defining groups of limited dimensions, in which everybody knows each other (Nair & Fielding, 2005). For this reason, students can feel a greater sense of belonging to their group. In order to work properly, small learning communities have to be complete, i.e. include, besides classrooms or home bases, a variety of integrative spaces like special labs, spaces for teachers, toilets and a central common area (Nair & Fielding, 2005). Both in the case of small schools and of small learning communities, the development of place attachment may foster students' involvement in taking care of their place.
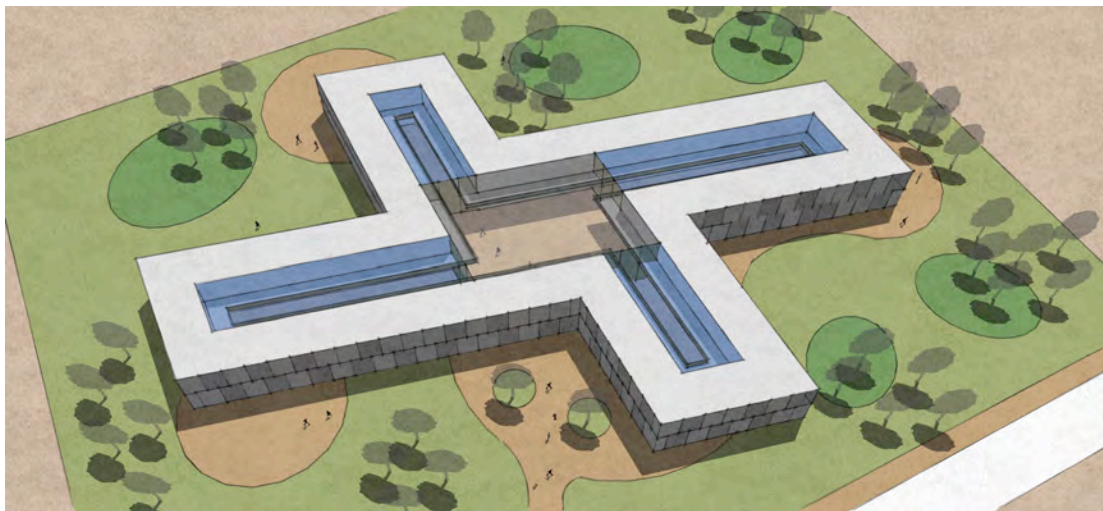
Figure 4.31. Streets and squares can constitute the backbone of the school public space.

7.5. A balanced spatial density. In relation to spatial density and crowding, spaces that are too small for a certain group of people bring about less interactions (Loo, 1972), but if spaces are too large the opportunities for interaction tend to decrease (Gieryn, 2000) and a sense of togetherness is less likely to be perceived (Hertzberger, 2008). Thus, even if there is not an optimal spatial density, space dimension should be carefully designed in relation to the expected number of people.

Figure 4.32. Different areas with different functions can be laid out in learning units.

8. Enhancing a positive school atmosphere.

Research shows that space can play a role in limiting social issues in schools (Kumar et al., 2003; Wilcox et al., 2006) and that it can contribute to creating an enjoyable school climate. This has been found to reinforce place attachment (Cemalcilar, 2010): indeed, the feeling of safety and the sense of control are the factors that most influence students' perceptions.

8.1. Breaking down the barriers between students and adults. The idea of no borders means that all the spaces of a school should be accessible, allowing students to explore the school and making them confident in what the staff is doing for them – because they can see them working and they can easily interact with them. On the other hand, teacher and parents are allowed to see students at work. In terms of design, it means allowing connections among different spaces, without defining insuperable borders, hence the role of sliding walls, sliding doors, and transparency. In particular, transparency enhances the idea that learning should be visible and celebrated (Nair & Fielding, 2005). Glazed walls help rethinking the border between the main learning spaces and the commons. This approach is also a way of making children responsible and making them reflect about their behavior, like talking too loud or disturbing peers. At this purpose, schools could be organized in different acoustic zones, hosting a series of noise compatible activities. To this effect, transparency can be

a way of separating such zones acoustically, while keeping them connected. Finally, the idea of openness is more likely to work properly in small schools like kindergartens.

Figure 4.33. Schools without barriers, allowing students to freely navigate in them.

8.2. A "homelike" look, a relaxed atmosphere, and stimulation. The look is an important factor that influences the atmosphere of the school: a "homelike" feeling can enhance students' sense of belonging to their school (Ceppi & Zini, 1998; Hertzberger, 2008), as well as other informal looks like the ones of a library or of a coffee shop (Bunting, 2004), especially at the primary level. Places that look more formal, like offices, do not provide the same "warmth". A domestic atmosphere is connected to the idea of the home base, enhancing the emotional connectedness to a place (Hertzberger, 2008). Also, the school entrance, being the interface between the school and the community and the first part of the school students see everyday, should be welcoming (Nair & Fielding, 2005). For this reason, the entry should not be overly institutional and forbidding. A sheltered buffer space provides a gradual transition between indoor and outdoor, a place where people can stop and talk and contributes to the entrance being welcoming (Nair & Fielding, 2005). Finally, the "homelike" look should be integrated with elements providing some sort of stimuli (Hertzberger, 2008): an empty box can be quite intimidating especially for young children, limiting the occasion for talking and socializing.

Figure 4.33. A playful and homelike atmosphere can characterize the commons.

8.3. Including informal and comfortable seating. Furniture is a fundamental aspect in defining a student friendly environment and it has to be taken into account carefully. Soft seating is one of the most frequent requests by students when asked about their learning environments (Nair & Fielding, 2005). This can help students feel "at home", as they find similarities with their residential environment. Such pieces of furniture can be used both for learning and for relaxing, enhancing the idea that these types of activities are interconnected. In classrooms, soft seating could be placed in a zone where students study independently or meet in small groups (Nair & Fielding, 2005). Breakout areas in public spaces are other areas where this type of furniture can be used.

Figure 4.34. Soft seating enhance the feeling of comfort.

9. Students' participation in design.

The involvement of all the stakeholders in design brings about positive outcomes for the project itself, providing important insights from the people who will use those spaces, making them places. This means that students and families can give meaning to the physical environment and include their personal and collective identity in the newly designed school (Rigolon, 2011). Also, participation in design includes a series of educational activities that are beneficial for students' personal development (Hart, 1997). This and criterion 2 are the only criteria that focus on the process, rather than the outcome.

   9.1. Involving students in meaningful participation. Meaningful participation in design happens when students choose independently to be involved in the process and when adults accurately take into account students' contribution (Hart, 1992). This form of participation brings about place attachment (and by consequence, sense of belonging to one's community) and helps students shape their active citizenship skills (Hart, 1992).

Figure 4.35. Design charrettes organized in small groups.

Students should be involved both as informers and as decision makers. In the design process, these roles correspond to the analysis phase and to the design phase. The first one is aimed at collecting information about the way students perceive and use places (Sutton & Kemp, 2002). This can be done in two main ways: analytical techniques – numeric data, theme conceptualization through questionnaires and interviews – and visual methods – maps, drawings and

pictures, which are more effective for younger students (Sutton & Kemp, 2006b). The outcome of the analysis phase is the definition of a series of design themes on which the design, the second phase, can be based. The technique of the interdisciplinary and multigenerational charrette searches an "informed creativity" by merging and balancing the creativity typical of design and the scientific data coming from social work research (Sutton & Kemp, 2006b). The focus on a single topic, a tight time schedule and an artistic atmosphere are among the main characteristic of design charrettes (Sutton & Kemp, 2006a).

9.2. Focusing the attention on small parts of the school. The objects of participatory design could be small parts of the school, rather than the whole facility. This choice improves the feasibility of the project and shortens its duration (Hart, 1992). Short-term goals are more controllable by children and can help seeing faster result, enhancing self-confidence and competence (Chawla, 2002b). Those types of projects also make children more likely to participate actively, as they feel a greater sense of control (Bandura, 1997). For example, gardens and other parts of playgrounds, or art installations within the school, can be managed quite easily, and the participation could extend into the construction phase.

Figure 4.35. Art projects within the school can be lead and built by students.

9.3. Including cultural diversity in design. In relation to design, if all the different social groups are engaged, participation can be a way of including social diversity and different identities in the school physical environment – rather than providing a neutral "white box". It is quite likely that communities have a

prevailing local culture and identity, which will influence the final design more than the others. This does not mean that minorities have to be left out. For example, displaying religious symbols (like the Christian cross) in public schools should be avoided. Then, finding a balance between different cultures and identities is not an easy task, but it can be achieved through transparent and democratic discussion.

Figure 4.36. The main public space is where students meet diversity.

10. The school and the neighborhood: location and connections.

The idea of schools as centers of their communities has to be highlighted because it can foster social competence and ecological literacy development in students. This idea enhances the civic role of the school, representing a public presence in neighborhoods that often lack public space and facilities. This concept also fits the idea of lifetime education because community members could be allowed to use schools resources. Libraries and IT rooms can be examples of that: computer and language classes for newcomers could be offered in those spaces.

10.1. Location: close to home, close to nature. Schools should be located in a place that can be reached by walking or biking every day: in this sense, greenways connected to schools are very important (Moore & Cooper-Marcus, 2008). The proximity to one's home also reinforces the attachment to the local community – in relation to which one's identity is partially shaped. At the same

time, school facilities should be located close to natural areas, like forests, lakes, etc., so that children can experience wilderness almost every day (Moore & Cooper-Marcus, 2008). Those two recommendations could be conflicting: in fact, if building a school close to a forest means that parents are forced to drive children to school every day, the facility being too far from home to walk or bike, it may be a good choice for exposure to nature, but it does not contribute to a sustainable schooling system. In a more realistic situation, schools should be located close to neighborhood parks and other small green areas.

Figure 4.37. Proximity to housing and to nature is possible for schools.

10.2. A "diffused school" made of different places within the neighborhood. This is an occasion of creating strong bonds between the school and the neighborhood. This idea is possible if a network of secure pedestrian and bicycle paths – that could also work as ecological corridors – connect the different places. The attention on green mobility should be enhanced mostly in residential areas and around school campuses. If children start biking and walking when they are young, they will be more likely to use those forms of transportation when they grow up (Moore & Cooper Marcus, 2008).

Figure 4.38. In a pedestrian-friendly neighborhood, schools facilities can be placed in different locations, enhancing a diffused presence of public spaces.

10.3. Sharing facilities with the neighborhood. This opportunity can enhance interactions among people of the same community. If schools collaborate with communities and become the centers of their neighborhoods, the opportunities for students to get involved increase. The collaborations with the neighborhood work if there is a mutual exchange: schools could open their facilities during out of school hours but community members should provide volunteering to supervise those spaces and run some of the activities. Even if primary schools are generally more diffused in the territory, there are opportunities for secondary schools as well, for such facilities usually have higher rank spaces (gyms, auditoriums, etc.), and teenagers are more skilled to take initiative than children (Hart, 1992). Also, students can learn the idea that sharing space is a smart and sustainable way to use it. From a design standpoint, the shared spaces should have a double entrance: one from the school building and one from the exterior. This allows people to use a facility, for example a gymnasium, independently from the rest of the school.

Figure 4.39. School can share facilities with the neighborhood – with separate entrances.

10.4. Open borders. The school grounds could be integrated to the city public space (Hertzberger, 2008). Indeed, besides enclosed areas for young children, the high fences between playgrounds and streets could be avoided (Hertzberger, 2008). The transition between city and school should be more symbolic than physical (Hertzberger, 2008). The playground can become part of the street, bringing about more spatial cohesion with the neighborhood and more "social control", especially out of school hours.

Figure 4.40. Open boarders enhance the school friendly attitude.

4.2. The connection between the design criteria and the lessons and skills

The goal of the proposed guidelines is facilitating the design of spaces fostering the development of social competence and ecological literacy. At that purpose, it seems useful to relate the guidelines to the lessons and skills that are part of the outcome of the scholarship review. This is aimed at assessing if the design criteria respond the developmental needs. Figure 4.41 shows the connections that can be established between design criteria and the development of the presented skills. For every guideline-skill connection, a short explanation has been given.

The lessons and skills a-h refer to ecological literacy, while the competences i-s are about social literacy. The guidelines 1-5 are mostly referred to ecological literacy issues, while the guidelines 6-10 address more social competence themes. As a result, the table has two areas with a higher density of boxes indicating connections, placed diagonally. However, there are several interconnections between social competence and ecological literacy themes.

The table also shows that most criteria have been targeted to the creation of places requiring students' active involvement, as a way to enhance environmental stewardship and civic activism. This highlights the fact that students' direct engagement is a cross-developmental theme that is relevant both for social and ethical development.

design guidelines / ecoliteracy lessons	a. Respecting and loving the natural environment	b. Conserving resources and energy	c. Responsibility and taking care of living beings	d. System-thinking and connection actions/consequences	e. Nature is everywhere, even in the city	f. Focus on local phenomena and specificities	g. Alimentary education and healthy living	j. Dealing with fears and dangers of nature	k. Density and green transportation	h. Sources of energy	i. Recognizing and dealing with one's feelings	l. Perspective taking: other people's points of view	m. Developing the skills for positively interacting with others	n. Learning to be part of a group (how a community works)	o. Accepting and respecting human diversity	p. Feeling sense of belonging to a community and a place	q. Being critical and autonomous thinkers	r. Social responsibility and active goal setting	s. Thinking globally, acting locally
1. Maximizing the presence of nature	Exposure to nature is crucial for developing ecoliteracy				Nature is expressed by a variety of elements, like water			Contact with all natural elements, including the fearful ones	Green rooftops are examples of a smart use of space				Nature: informal space where socialization happens						
2. Unfinished and modifiable space: appropriation, customization			Modifiable spaces need action and care: this enhances students' involvement	Modifying a space requires taking decisions and evaluating the consequences					Allowing multiple uses for space is a way of using it smartly, thus saving space			Modifying space implies taking decisions, i.e. dealing with other people's points of view	Modifying space enhances social activity, i.e. an excuse to start a conversation	Space can be modified but within some rules: one's need has to be confronted with others		Modifying a space according to one's identity increases the attachment to it	Modifiable space allows students to question the way space is arranged	Modifying space implies taking decisions and assess them (self-evaluation)	
3. The local dimension of physical elements		Using local materials and resources is an example of sustainability	Acting locally for nature allows students to make a difference			Local flora is important for local fauna: this allows to observe local ecosystems										The focus on local identities reinforces the ties with one's local community			The focus on local physical elements enhances one's local knowledge
4. People and nature: coexistence and interdependence	If students know that humans rely on nature they will be likely to respect it			Showing human-nature connections enhances system thinking	Human-nature links explain that nature is needed in cities, the human realm			Nature reclaiming the site means that it is timeless while human action has an end											Being aware of local and global natural phenomena enhances the local action
5. Students-friendly displayed technologies and artworks	Forms of art involving nature foster imagination and love for the environment	Displaying elements producing renewable energy is a way to show sustainability		Knowing how the building and the landscape work enhances system thinking						Displayed PV panels or wind turbines can show students how energy is produced						Art is a way of enhancing emotional connected-ness to a place			
6. Articulation of public space and activity centers	Gardens, requiring care, reinforce students' ties to nature		Gardens include living beings that need constant care: students responsibility	Displaying a whole natural cycle (food) enhances system thinking	Gardens introduce nature in urban schools		Gardens and other forms of farming: production of local and healthy food	Gardens usually include little animals					Activities in public space enhance interactions, like social attractors		Public space is where individuals meet the "others", i.e. diversity	Leisure activities in public space: leisure brings about place attachment	SLCs in small group it is easier to be protagonists	Students have to take care of their SLC or of their "family"	
7. Spatial cohesion, hierarchy and scale											The presence of a home fosters the development of a sens of self		Spatial density, size diversity influence the way students socialize			Spatial cohesion, SLCs, spatial hierarchy foster sense of belonging			
8. Enhancing a positive school atmosphere						Designing within one's community: learning local phenomena					A homelike feel: people can be themselves, they feel at ease	Interacting for design implies dealing with other people's points of view	Designing requires interacting with other people	Openness implies some rules, like being quiet and behave	Openness means equality and same opportunities	Openness: positive and social feel enhancing cohesion	Designing for change implies challenging the status-quo	Openness: students are responsible for their behaviour	Designing one's school means acting locally
9. Students' participation in design				Designing requires system thinking: various topics							Individuals have to think about what they want in the design	Sharing space meeting community members and knowing their points of view		Participation activities have rules, like communities: decisions, etc	Participation means including everyone in design	Participation in design brings about place attachment		Participating in design is an exercise of civic responsibility	Participation in community activities with shared facilities
10. School and neighborhood: location and connections			Natural spaces designed by students: sense of care		The location close to urban parks: presence of woodlands, grasslands	Connecting with one's community is focusing on the local realm	Schools close to home allow students to bike or walk there: healthy lifestyle		Schools close to home allow students to bike or walk there: green transportation							Local connections improve the cohesion within the neighborhood		Participating locally brings about place-attachment	

Figure 4.41. The way the proposed design criteria contribute to teach the lessons.

5. Summary and perspectives for development

5.1. Summary of the findings

This thesis showed that places are potentially instructive, communicating to students issues about nature and providing opportunities for sharing experiences with others. Furthermore, places can contribute to the enhancement of students' environmental and socially responsible behaviors. In relation to ecological literacy, the theme of outdoor spaces has been the object of several studies but there is a partial lack of studies about buildings. Hence, this topic has been analyzed from a research by design perspective, even through the study of exemplary educational facilities, and some new ideas have emerged.

Hence, the main findings, which may constitute original contributions to the literature, have been expressed in the lessons that space and place can contribute to teach and in the design criteria that respond to those lessons.

In the lessons, I summarized the main skills about ecological literacy and social competence that students should learn and framed them in the context of two theoretical frameworks, about the two main topics. In the one about ecological literacy, knowledge about nature and empathy for the environment are seen as the main paths that can bring about environmental concern. Then, environmental action can be a consequence of environmental concern if students are taught the skills for doing so and if they are made aware that they can make a difference at the local level. In the social competence theoretical framework, the evolution of children's relationship with others is described. After having learned to deal with their feelings, children may start to develop the skills to interact with peers and adults and get out of their self-contained world. If such interactions are positive, children and young people may learn to be part of a group and experience a sense of community. As they grow, adolescents may find a balance between belonging to a group and independence and then start to take action for their group, as a form of civic engagement.

The criteria express design ideas that, if applied to the conception of educational facilities, may contribute to the positive development of ecological literacy and social competence. Such criteria are based both on the literature review presented in chapter 2 and on the critical analysis of exemplary school facilities presented in chapter 3. Again, I would like to highlight that the criteria are based, as much as possible, on scientific evidence and that I have tried to limit the introduction of my subjective views and biases. Some of the criteria are aimed at responding to the ecological literacy lessons – for example, number 1, "Maximizing the presence of nature", or number 4, "People and nature: coexistence and interdependence". Others are focused on social competence, like number 6, "Articulation of public space and activity centers" and number 7, "Spatial cohesion, hierarchy, and scale". Also, there are some criteria that go across the two main themes – and this shows that the two themes are strongly interconnected: number 2, "Unfinished and modifiable spaces: appropriation and customization" and number 10, "The school and the neighborhood: location and connections". Figure 4.41 expresses the way the proposed design criteria contribute to teach the lessons about ecological literacy and social competence.

5.2. The way this research can bring advancement to the field and its practical implications

This study builds bridges among different disciplines by connecting ideas from various areas of research. The specific contribution of an architect is the translation of such knowledge into design criteria and the visualization of them. The proposed design solutions are deliberately very general and flexible so that they can apply, if conveniently modified, to different contexts and situations.

Research has to be relevant and related to the real world. Such criteria could be used in a variety of ways.

First, they can be used to assess proposed designs. For example, they can be used to give scores to proposals in architectural competitions for the design of educational facilities. Also, cities and school districts could use these criteria to

assess proposed designs for school buildings and grounds, in order to distribute funds or give incentives to the different schools or neighborhoods.

Second, the criteria can be used to evaluate existing school buildings – for example, in a municipality or county – and decide which ones have to be refurbished or demolished and rebuilt.

Finally, the criteria could contribute to updating school-specific building regulations. For example, Italian school building codes date back to 1975 and they obviously need a revision in light of the new educational needs and of the ever-changing societal trends. Integrating ecological literacy and social competence issues in building codes would give municipalities strong instruments to control the quality of their schools. This could significantly improve the instructive power of place in terms of ecological literacy and social competence.

5.3. Further directions for research

As reported in the introduction, the next step of the research would be evaluating whether school buildings and ground that are designed following some of the proposed criteria actually cause increased level of ecological literacy and social competence in students.

To do that, I would conduct a series of post-occupancy evaluations of schools focusing on students' ecological literacy and social competence, in which exemplary facilities are compared to standard school buildings. Such studies should include surveys about the levels of students' social competence and ecological literacy, interviews about the way the facilities are perceived and used, and an evaluation of the quality of the facilities themselves – which can be done by using the proposed design criteria. The assessed schools should be matched in pairs according to similar contextual, educational, economic and ethnic characteristics. The only variable that has to differ in these pairs is the presence of design features enhanced by some of the proposed design criteria. This strategy would rule out the effect of other potential explanations (such as

the social context and education) for increased levels of ecological literacy and social competence and isolate the effect of design and place. Such a study would create an important source of evidence for developing a deeper analysis about the instructive power of school buildings and grounds.

The completion of this further step would require a team of people from different disciplines (built environment sciences, education, psychology) working full time for a few months. However, this thesis can be considered complete even without the fourth step because, as it has been shown, the design criteria have been elaborated based on scientific evidence.

6. Photo credits

Chapter 2

Figures 2.1 – 2.5: Author's elaboration

Chapter 3

Figure 3.0: Author's elaboration

Figures 3.1 – 3.7: Plus+ Bauplanung

  Figure 3.1. Photo by Suhan Klein

Figures 3.8 – 3.14: Mithun

Figures 3.15 – 3.22: Pir II Arkitektkontor AS

  Figure 3.18. Photo by Philippe Ruault

  Figure 3.20. Photo by Jarl Anderson

Figures 3.23 – 3.28: VMDO Architects

Figures 3.29 – 3.33: Architectuurstudio Herman Hertzberger

Figures 3.34 – 3.37: VMDO Architects

Figures 3.38 – 3.43: JJW Arkitekter

Figures 3.44 – 3.49: Architectuurstudio Herman Hertzberger

Chapter 4

Figures 4.1 – 4.41: Author's elaboration

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