Visual Thinking and Learning: ViTaL

Proposers

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Abstract

Visual representations are powerful tools for thinking and learning. Their use has increased dramatically in teaching, learning and communication within Europe's multi-language society. This programme brings together leading researchers and students from many backgrounds to enhance research on a) fundamental aspects of visual thinking and learning, b) development of visual tools, and c) effective applications of these tools. This will be achieved through increasing mobility of researchers, six focused workshops and three integrative conferences. Envisaged outcomes include strengthened European research forming a sustainable basis for innovation and books describing state-of-the-art research and practical guidance for applying visual thinking and learning.

Keywords: Visual representations, pictures, animations, graphs, simulations, modelling environments, virtual reality, thinking, learning, communication, comprehension, psychology, education, advanced technologies.

1. Scientific objectives

Visual thinking and learning is a topic of increasing theoretical and practical relevance especially in the multilingual society of the future Europe. Consequently, the proposal aims to form a programme for coordinating interdisciplinary research on visual thinking and learning at a European level. The purpose of this network is to:

- Bring together leading researchers and talented graduate students from across Europe in order to develop and exchange theoretical concepts and empirical findings which will enhance our understanding of visual thinking and learning,
- Create a framework for collaborative activities for researchers from different European countries and research traditions in order to harmonize scientific activities and promote synergy between different research disciplines and methodologies,
- Strengthen existing scientific activities across Europe in order to enhance the role of European research in visual thinking and learning within the international scientific community.

1.1. Why research visual thinking and learning?

Visualisations have been recognized as one of the most effective tools for accelerating human thinking and learning for more than 300 years. For example, Comenius emphasized the importance of visual information in human learning as early as the 17th century. However, over the last two decades, the use of visual displays has increased dramatically. Newspapers, journals, TV-broadcasts, and pamphlets contain considerably more illustrations, graphics, and diagrams than they did a few decades ago. Visual displays are also used far more frequently in teaching, learning and in cooperative problem solving. Furthermore, visual thinking and learning plays a role at all levels of human endeavour; for example, when children study pictures that illustrate the content of written text, when people follow pictorial instructions to construct newly bought items of furniture; or when scientists draw diagrams to facilitate the discovery of scientific principles.

The increasing importance of visual communication can be observed in most countries in the Western World, but plays an especially important role in Europe with its multi-language society. The growing need of communication, collaboration and joint decision-making between people coming from different countries with different languages requires means of communication, thinking and learning that are less language-dependent. Visual thinking and learning will never replace verbal thinking and learning, but it will complement the traditional, mostly verbally based forms of thinking and learning in a way that will be increasingly important for the future Europe.

The use of visual techniques in thinking and learning has received further stimulation by rapid advances in new technologies that have opened up novel ways for people to get quick and easy access to a multitude of pictures, diagrams and graphs. Visual authoring tools allow individuals to create their own representations in order to communicate ideas in novel ways. Digital media affords people opportunities to interact with visual displays and to explore subject matter by manipulating visual representations provided by interactive simulations. Despite the technical innovations, of course, thinking and learning continues to be subject to constraints of human information processing. Accordingly, the use of new technologies in learning and instruction can only be successful in so far as it takes these human constraints into consideration.

1.2. Defining visual thinking and learning

Visual thinking refers to the use of pictorial representations to acquire specific information for use in making decisions or solving problems. Visual learning refers to the use of pictorial representations to facilitate comprehension or enhance learners' construction of new knowledge. Pictorial representations used in visual thinking and learning include static pictures, photographs and graphs. The invention of broadcast and computational technologies means that these representations can also be presented dynamically; pictures can be presented as animations, photographs as video and graphs plotted dynamically. Interactive visualisations allow users to control content, in addition to the order and speed of displays. Typical examples include interactive animation and video, simulation and modelling environments, visual programming languages and virtual reality (Figure1).

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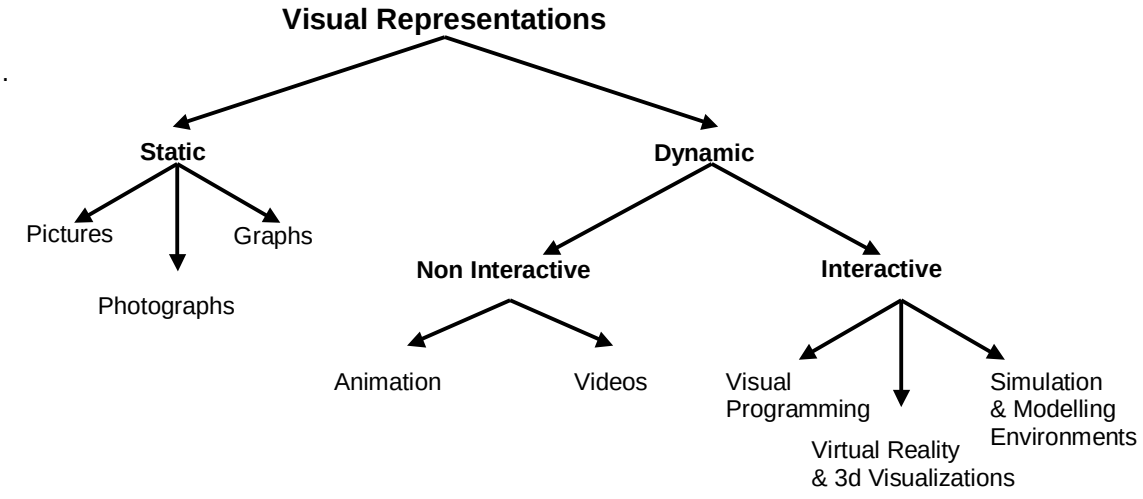

Figure 1. Examples of representations used in visual thinking and learning

1.3. The promise of visual thinking and learning

Over the last 20 years, visual thinking and learning (ViTaL) has been an area of active interest. There is a substantial body of research with traditional forms of static representations, which has identified when visual representations can enhance learning and thinking. Visual representations involve explicit geometric and topological information, which allows learners to benefit from powerful perceptual inferences reducing the amount of effort required to solve problems (Larkin & Simon, 1987; Zhang, 1997). They support the construction of mental models, which is particularly important when communicating and learning about complex subject matter (Schnotz & Bannert, 2003). Visual representations can also enhance learners' metacognitive strategies encouraging them to make more productive use of materials and to learn complex topics more completely (Ainsworth & Loizou, 2003). Visual representations are central to the use of multiple representations (Ainsworth, 1999), which is a fundamental characteristic of expertise. Multiple representations can also support individual differences in learning preferences (Plass et al., 1998) and multiple task demands (Tapiero, 2001). The burgeoning field of interactive graphical communication is exploring how graphics can enhance communication (e.g. Healey, Narayanan, Lee, & Katagiri, 1999) and collaborative learning (Munneke, van Amelsvoort, & Andriessen, 2003; Ploetzner et al, 1999)

Although their full potential is not yet known, there is research showing that dynamic representations can afford novel opportunities for learning. For example, animations can enhance understanding of some forms of dynamic situations (Bétrancourt & Tversky, 2000), and video is used to support communication, for example, subject teaching can be enriched by video-conferencing with experts and practioners (e.g. Gage, Nickson, & Beardon, 2002) and students with poorer literacy skills use video conferencing to contribute to collaborative work (Eales, Neale, & Carroll, 1999).

Visual representations can be further enhanced by their inclusion within interactive technologies. Through interactive manipulation of visual environments, learners can take active control of their own learning and so such construct a deeper understanding of the subject (Schwartz & Holden, 2000). Simulations enhance learners understanding of both the domain under investigation and scientific enquiry skills (de Jong & Van Joolingen, 1998). Modelling environments allow students to interact with concrete instantiations of previously abstract mathematical concepts (Teodoro, 2003), which can promote conceptual change (Vosniadou et al, 1999). Visual programming languages can allow children as young as seven to create their own educational games; teaching about the game's subject and programming simultaneously (Habgood, Ainsworth & Benford, under review). These technologies can provide educational experiences that it would be impossible to achieve in the real world (such as using virtual reality to simulate walking on an asteroid - Johnson, Moher, Ohlsson, & Gillingham, 1999) or which would be difficult for learners to experience naturally (e.g. in the use of virtual cafeterias for teenagers with autism, Parsons & Mitchell, 2002). They can also be used to create educational experiences in settings far beyond the conventional classroom - from digitally enhanced field trips (e.g. Rogers et al, 2004) to interactive exhibits in museums (e.g. Ferris, Bannon, Ciolfi, Gallagher Hall & Lennon, 2004).

1.4. Managing visual thinking and learning

However, whilst the promise of visual thinking and learning is great, it should not be assumed that simply by employing ViTaL performance will be improved. For example, students' understanding of dynamic situations is not automatically enhanced by employing animations (Bétrancourt & Tversky, 2000, Lowe, 1999), multiple representations can overload learners (Ainsworth, Bibby & Wood, 2002; Mayer, 2002), simulations require learners to engage in complex discovery learning (de Jong & Van Joolingen, 1998) and communication is not always enhanced by the use of graphics (Healey, Narayanan, Lee, & Katagiri, 2002). Consequently, the understanding of ViTaL has now matured to the point of exploring the conditions under which ViTaL is most effective. Research now aims to identify how to design and support ViTaL and even advise when ViTaL is not appropriate. This research is conducted by researchers from many backgrounds including education, psychology, cognitive science, philosophy, semiotics, computer science, and artificial intelligence. Given the complexity and wide-ranging nature of the issues, this diversity is unsurprising. Yet, it does present a challenge to researchers as they struggle with unfamiliar theoretical orientations, terms and methodologies. Consequently, the role of this programme in bringing together researchers from many of these perspectives to learn from each other and to educate young scientists is considered crucial. Such dialogue across fields offers many opportunities for productive interactions, although it will necessitate an exploratory phase to ensure sufficient common vocabulary.

2. Network Scope

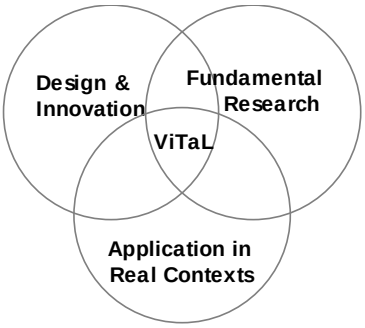

Figure 2. Perspectives on visual thinking and learning

The network is concerned with visual thinking and learning from three perspectives: (a) fundamental research on the psychological processes of visual thinking and learning (b) research oriented development of cognitive tools and learning environments, and (c) research on using the applications of these tools and environments in a variety of real contexts. Furthermore, as Figure 2 demonstrates, there is considerable opportunity for productive interactions between these researchers. Research on visual thinking and learning can be used to design the next generation of innovative visualisations, which in turn can be evaluated and used to test psychological theories. Crucial tests concerning the overall effectiveness of visual thinking and learning can only come from application in real contexts and the changing needs of society in turn informs what new visualisations are developed. Accordingly, the network activities will focus on the following topics and indicative research questions:

(a) Psychological processes involved in visual thinking and learning:

- What perceptual constraints affect the use of visuals as representational tools for thinking and learning?
- How do perceptual and cognitive processes interact in visual thinking and learning?
- How do individual differences in prior knowledge, cognitive abilities, and motivation affect the use of visuals in thinking and learning?
- What are the psychological processes involved in interacting with dynamic representations?

(b) Development of visual cognitive tools and learning environments:

- How should visuals be designed and integrated into environments to enhance thinking and learning?
- How can technologies be designed to exploit their abilities to use dynamic and interactive representations?
- How should visual representations be combined with other forms of representations to enhance their use in thinking and learning?
- How can cognitive tools and learning environments be adapted to individual differences of prior knowledge, cognitive abilities, and motivation?

(c) Using visual cognitive tools and learning environments:

- How should cognitive tools and learning environments be used in order to enhance visual thinking and learning?
- How can individual and collaborative strategies be developed to help people make most efficient use of visualisations?
- How should the design of visual technologies differ depending upon their context of use? (e.g. for formal versus informal learning)
- What should be included in instructional guidelines for the use of visualisation in supporting learning and thinking?

3. European added value

Visual thinking and learning is a research topic that has received a great deal of interest by a considerable number of European researchers during the last decade. Consequently, this network can draw on a significant amount of expertise in the Steering Committee and beyond to many more research laboratories. However, the impact of this research would receive a significant boost if supported by the networking activities advocated in this programme. To date, many of the European experts in their fields co-operate primarily with colleagues in Australia and in the USA rather than with their European colleagues. Furthermore, although new member countries of European Union have distinctive educational practices related to visual learning, relatively little research has been performed on this topic. Consequently, it is envisaged that the ViTaL programme will serve as a means to strengthen existing research activities, develop new research collaborations, and disseminate new research by embedding these activities within a coherent research network at a broad European level.

Besides strengthening existing lines of research, understanding visual thinking and learning is also of high practical relevance for a future European society which consists of people from different countries with different languages, but who need to communicate and cooperate on many levels. Visual displays provide a tool of communication that allows easy joint reference to the same objects, easier coordination of perception and thinking by illustrating ideas, by showing the appearance of an object and by pointing at specific parts of objects. Visual displays are therefore a powerful tool to enhance thinking and problem solving, to foster understanding and learning in a manner that is less language-dependent than other kinds of communication.

4. Activities

It is envisaged researchers involved in the ViTaL Programme will engage in the following activities.

- **Multi-disciplinary exchange**: The study of visual thinking and learning depends on interdisciplinary dialogue particular in terms of theoretical frameworks and research methodology. The programme will examine, apply and develop new theoretical and methodological approaches to the study of ViTaL.
- **Support for Young Social Scientists**: the involvement of post-graduate and post-doctoral researchers is of the greatest importance. It is such researchers who have most to offer and learn from multi-disciplinary dialogue. Consequently, a significant proportion of the budget is allocated to support their activities through short visit grants.
- **Electronic Media**: it is vital to disseminate information about the programme activities through electronic media. Consequently, the creation and maintenance of a usable and accessible programme website is of highest priority. Preliminary working papers of the programme will be available to download from the website to initiate discussion rather than awaiting academic publishing. Announcements about workshops, conferences and reports will be also disseminated through appropriate e-bulletins and websites (e.g. EARLI, devEurope, BCS-HCI, AIED, ISLS).
- **Workshops**: Six workshops are planned to ensure that researchers from varied disciplines, perspectives and media specialities meet regularly to work together on common goals (see Figure 3 below). The series is structured such that the first three meetings each focus on one of the key areas (Design and Development, Fundamental Research, Application in Real Contexts). The second three meetings will address the intersections between two of these areas (see Figure 2). Crucial to the success of the workshops is that although each will have a specific perspective, they will be attended by researchers from other areas to enhance synergy and integration.
- **Conferences** Three conferences are planned (Figure 3). The first two conferences will present work equally across all themes of the programme. The plenary conference will showcase the increased understanding of Visual Thinking and Learning that has resulted from the programme.
- **Publishing**: The Programme will produce two edited volumes for commercial publication by a reputable academic publisher (to be determined but likely to be Advances in Learning and Instruction, Pergamon Press). The first will be a collection of academic papers reviewing state of the art in ViTaL. Chapters will be co-authored by two or more members of the network. The second book will address practical issues involved with ViTaL ranging from design heuristics for ViTaL technologies, principles of effective representational design, guidance for using ViTaL and consideration of how educators should be trained to support ViTaL.

- **Highlighting the work of the programme**: Members of the ViTaL community regularly present their research at conferences such as European Association for Learning and Instruction, and American Educational Research Association. Although, this will not be directly funded through the network, the symposium-based structure of these conferences provides the opportunity to showcase the talent of both senior and junior ViTaL members.

5. Programme Management and Budget

The Steering Committee will be responsible for the overall direction of the programme, setting key intellectual goals and monitoring progress towards them. The Steering Committee will meet once per year immediately prior to the ViTaL conference (or in year 2 a ViTaL Workshop). The organisation and day-to-day operation of the programme will be run by a smaller Executive group drawn from the membership of the Steering Committee. The executive group will normally meet an additional two times per year. These meetings will decide upon short visit grants and will set the workshops agenda. Although the overall workshops themes have been planned (see section 4), the focus on the workshops will emerge through discussion and agreement among the executive and steering groups. Attendance at the workshops will come from a broad base including junior members and researchers from many different European research groups.

A programme coordinator will be appointed to support the Chair in preparing and running these activities. In addition to taking control of day-to-day administration, the coordinator will help produce documents (e.g. publicity material for dissemination (e.g. via the website) and reports to ESF), and help organise all workshops and conferences. Table 1 provides an overview of the categories and total level of expenditure that is being requested.

Table 1. Overall programme budget

Activities	Euros over four years
Steering Committee Meetings	22895
Science Meetings (workshops, conferences)	322626
Grants	76920
Publicity, Websites and Publications	12500
External administrative costs	54700
Programme Coordinator	93000
Total	582641
+ ESF @7.5%	626339

Annex 1 presents a detailed breakdown of the programme budget and the assumptions that underlie our calculations.

6. Key Milestones and Achievements

Figure 3 shows an indicative timetable for programme meetings, although the exact dates of the meetings will be negotiated in the event of a successful application. The first year of the programme will necessarily focus on set-up and initialisation of network. Emphasis will be placed on recruiting the widest range (by geography and discipline) of well-recognised researchers and talented graduate students. This will necessitate liasing with organisation mentioned above, and the development of publicity and website material as well as exploiting the extensive contacts from the steering group. Consequently, towards the end of year one a conference is planned to bring together all these people for the first time. Throughout years one and two, workshops will take place at regular intervals and will focus on the three key aspects of the programme. Year three and four turn the emphasis at the workshops and intermediate conference to the interdisplinary questions of the programme. In year four the focus will be on preparing for exit by presenting the results of the programme in final plenary conference, and by reviewing the activities of the programme in the creating sustainable relationships beyond the end of funding.

Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Year 1												
Executive		**X**				**X**			**X**			
Steering.		**X**							**X**			
Workshop						**W1**						
Conference									**C1**			
	Up to 10 travel grants awarded											
Month	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Year 2												
Executive			**X**						**X**			
Steering.									**X**			
Workshop			**W2**						**W3**			
Conference												
	Up to 12 travel grants awarded											
Month	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**
Year 3												
Executive		**X**				**X**				**X**		
Steering.						**X**						
Workshop		**W4**								**W5**		
Conference						**C2**						
	Up to 20 travel grants awarded											
Month	**37**	**38**	**39**	**40**	**41**	**42**	**44**	**44**	**45**	**45**	**47**	**48**
Year 4												
Executive			**X**						**X**			
Steering.			**X**						**X**			
Workshop			**W6**									
Conference									**C3**			
	Up to 20 travel grants awarded											

Figure 3. Indicative timetable for Programme Activities

These activities are designed to achieve the following concrete outcomes:

- A body of young social scientists enthused to continue working in Visual Thinking and Learning who have been provided with the opportunities to develop multi-disciplinary skills and interests.
- Two books illustrating both state of the art research and practical guidance in the application of Visual Thinking and Learning
- A strengthened European research network in Visual Thinking and Learning whose members will continue to collaborate beyond the end of the programme leading to higher quality research with greater impact.

7. Available facilities and expertise

The Proposers (sections 7.1, 7.2) and the Steering Group (section 7.3) have considerable expertise in Visual Thinking and Learning and in research management. Researchers come from a wide range of backgrounds, primarily representing education, psychology and computer science departments, with complementary theoretical perspectives and methodologies. Furthermore, all are well versed in inter-disciplinary research and communication.
Facilities to support the programme (e.g., computers, photocopiers, office space) will be provided by the Multi-media research group of the Universität Koblenz-Landau and the Learning Sciences Research Institute at the University of Nottingham.

7.1. Dr. Wolfgang Schnotz

Current Position

Full professor of General and Educational Psychology and Head of Multimedia Research Center, in the Faculty of Psychology of University of Koblenz-Landau.

Education

Habilitation in Psychology (University of Tuebingen), PhD (1978) Technical University of Berlin, Dipl.-Päd (1977) Technical University of Berlin, Dipl.-Psych. (1973) Free University of Berlin.

Research Interests and Experience

Prof. Dr. Wolfgang Schnotz has more than 20 years research experience in the field of Applied Cognitive Science, Learning and Instruction with a special focus on comprehension of and learning from text, comprehension of and learning from graphics, learning from animation and multimedia learning. He has published 98 journal articles and book chapters as well as 3 monographs. He has also edited 9 books and Special Issues of international journals. Dr. Schnotz has served in various functions in the European Association for Research on Learning and Instruction as well as the Educational Psychology Section of the German Psychological Research Association. He has been the Chief Editor of the international journal Learning and Instruction since 2002. He has reviewed for key journals, edited books and conferences in the field, for the Deutsche Forschungsgemeinschaft, the Swiss Science Foundation, the Austrian Science Foundation, and the Israel Science Foundation.

Five Most Relevant Recent Publications

Schnotz, W. (2002). Towards an Integrated View of Learning from Text and Visual Displays. Educational Psychology Review, 14(2), 101-120.

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Schnotz, W. & Kulhavy, R. W. (1994). Comprehension of Graphics. Amsterdam: Elsevier. (A volume in the series Advances in Psychology).

7.2. Dr Shaaron Ainsworth

Current Position

Lecturer, School of Psychology and Learning Sciences Research Institute, University of Nottingham

Education

Ph.D. Psychology – Educational Cognitive Science (University of Nottingham, 1997), M.Sc. Knowledge Based Systems (University of Sussex, 1993), B.Sc. (Hons). Psychology, First Class (Portsmouth Polytechnic, 1991).

Research Interests and Experience

Dr Shaaron Ainsworth has over twelve years of research experience in Visual Thinking and Learning. Her research interests involve asking fundamental questions about the processes involved in learning with visual and multiple representations. She is also involved with the development and evaluation of innovative ViTaL technologies especially those involving simulations, authoring tools and multimedia. This research been supported by the ESRC (Economic and Social Research Council) and EPSRC (Engineering and Physical Sciences Research Council) in the UK and Office of Naval Research in the USA .She has published 30 journal papers, high quality conference papers and book chapters on these topics. She sits on the management board of the University of Nottingham’s Learning Sciences Research Institute, a joint venture between the Schools of Psychology, Education and Computer Sciences. She teaches and supervises PhD students for all three schools. As a result, she has

considerable experience in managing multidisciplinary and interdisciplinary research. Dr Ainsworth has considerable contacts amongst European researchers demonstrated by her invitations to give seminars, teach postgraduate courses and attend invited workshops. She reviews for key journals and conferences in the field, for the ESRC and EPSRC, the Deutsche Forschungsgemeinschaft, the Israel Science Foundation and the American National Science Foundation.

Five most relevant recent publications

Ainsworth, S.E. & Van Labeke (2004) Multiple forms of dynamic representation. *Learning and Instruction, 14(3),* 241-255.

Ainsworth, S.E & Loizou, A. (2003) The effects of self-explaining when learning with text or diagrams. *Cognitive Science, 27,* 669-681.

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8. Possible cooperation and interaction with other international and/or national programmes and organisations

The programme for research on visual thinking and learning will cooperate closely with the Special Interest Group “Comprehension of Texts and Graphics” within the European Association for Research on Learning and Instruction (EARLI). This collaboration has been explicitly welcome by the Coordinators of the Special Interest Group, Professor Dr. Eduardo Vidal-Abarca (Valencia, Spain) and by Dr. Herre van Oostendorp (Amsterdam, The Netherlands). The network has also received explicit encouragement of the President of EARLI, Professor Dr. Filip Dochy (Maastricht, The Netherlands) and Professor Claire O’Malley, the President-Elect of the International Society for Learning Sciences (Nottingham, UK).

Furthermore, the network will collaborate with the already existing Consortium for Research on Visual Thinking and Learning that has been established between the University of Koblenz-Landau (Germany) and the Curtin University of Technology in Perth (Western Australia). In addition to various publications on visual learning with new technologies, this consortium is funded by the Australian Research Council to deliver a joint project on learning from animation.

There is also the potential to collaborate with existing European Networks which have related agendas. For example, there is considerable emphasis in Europe (and elsewhere) on the use of ICT in education which has obvious links to this Network’s focus on Visual Learning. Thus, the connections will be made through relevant members of the Steering group to the Flemish Powerful Learning Environments network and the Europe-wide Kaleidoscope Network.

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Year 1													**Assumptions (all costs in Euros)**
Coordinator												22500	.5 FTE post-doc in Germany
External Admin.												13325	adhoc secretarial support (1day per wk), phone, fax, stationary, post, etc
Publicity												2000	Printing brochures
WWW creation												2000	Creation of website to w3c compliance
Short Visits	10	400	4000					10	85	10	8500	12500	
	Travel			**Accommodation**				**Subsistence**					
Month 1	**#N**	**rate**	**Sub**	**#N**	**Day rate**	**#Days**	**Sub**	**#N**	**Day rate**	**#Days**	**Sub**		
Executive	5	400	2000	5	110	2	1100	5	63	2	630	3730	1 day meeting, so 2 days subsistence, 3 meals at 21 Euro, 3 star hotel in major European city (booked in advance through web)
Steering	7	400	2800	7	110	2	1540	7	63	2	882	5222	
Month 6													
Executive	5	400	2000	5	110	4	2200	5	63	4	1260	5460	as above with 2 workshop + 1 day meeting
Workshop 1	18	400	7200	18	110	3	5940	18	63	3	3402	16542	
Workshop Costs												1600	include room rate, refreshments, printing of proceedings
Month 9													
Executive	5	400	2000	5	95	4	1900	5	63	4	1260	5160	assumes 2.5 days conf + 1 day steering meeting room discount assumed greater as larger numbers
Steering	7	400	2800	7	95	4	2660	7	63	4	1764	7224	
Conference 1	40	400	16000	40	95	3	11400	40	63	3	7560	34960	
Conference												3000	include room rate, refreshments twice a day, printing of proceedings
ESF costs												10142	7.5% of total for yr 1
											Year 1	**145365**	
Year 2													costs as per year 1 assuming limited inflation
Coordinator												23000	as above
External Admin.												13525	less than yr 1 as no conference
Publicity												1500	less than yr 1 as maintenance less then creation
WWW Main.												1000	more than yr 1 as more participants assumed
Short Visits	12	410	4920					10	85	10	8500	13420	more than yr 1 as more participants assumed
Month 15	**Travel**			**Accommodation**				**Subsistence**					
Executive	5	410	2050	5	110	4	2200	5	68	4	1360	5610	as above with 2 workshop + 1 day meeting
Workshop 2	18	410	7380	18	110	3	5940	18	68	3	3672	16992	
Workshop Costs												1600	
Month 21													
Executive	5	410	2050	5	110	4	2200	5	68	4	1360	5610	as above with 2 workshop + 1 day meeting
Steering	7	410	2870	7	110	4	3080	7	68	4	1904	7854	
Workshop 3	18	410	7380	18	110	3	5940	18	68	3	3672	16992	
Workshop Costs												1600	
ESF costs												8153	7.5% of total for yr 2
											Year 2	**116856**	

Year 3													costs as per year 2 assuming limited inflation
Coordinator												23500	as above
External Admin.												13825	as above
Publicity												2000	greater than yr 2 as conference
WWW Main.												1000	as above
Short Visits	20	420	8400					20	85	10	17000	25400	more than yr 2 as more participants assumed
Month 26	**Travel**			**Accommodation**				**Subsistence**					
Executive	5	420	2100	5	115	4	2300	5	70	4	1400	5800	as above
Workshop 4	18	420	7560	18	115	3	6210	18	70	3	3780	17550	as above
Workshop Costs												1600	as above
Month 30													
Executive	5	420	2100	5	100	4	2000	5	70	4	1400	5500	assumes 2.5 days conf + 1 day steering room discount assumed greater as larger numbers
Steering	7	420	2940	7	100	4	2800	7	70	4	1960	7700	
Conference 2	40	420	16800	40	100	4	16000	40	70	3	8400	41200	
Conference Costs												3000	
Month 34													
Executive	5	420	2100	5	115	4	2300	5	70	4	1400	5800	as above with 2 workshop + 1 day meeting
Workshop 5	18	420	7560	18	115	3	2070	18	70	3	3780	13410	
Workshop Costs												1600	
ESF costs												7737	7.5% of total for yr 3
Year 4											**Year 3**	**176612**	costs as per year 3 assuming limited inflation
Coordinator												24000	as above
External Admin.												14025	as above
Publicity												2000	as above
WWW Main.												1000	as above
Short Visits	20	430	8600					20	85	10	17000	25600	as above
Month 38	**Travel**			**Accommodation**				**Subsistence**					
Executive	5	430	2150	5	120	4	2400	5	74	4	1480	6030	as above with 2 workshop + 1 day meeting
Steering	7	430	3010	7	120	4	3360	7	74	4	2072	8442	
Workshop 6	18	430	7740	18	120	3	6480	18	74	3	3996	18216	
Workshop Costs												1600	
Month 45													
Executive	5	430	2150	5	105	4	2100	5	74	4	1480	5730	assumes 2.5 days conf + 1 day steering room discount assumed greater as larger numbers
Steering	7	430	3010	5	105	4	2100	7	74	4	2072	7182	
Conference 3	50	430	21500	50	105	4	21000	50	74	4	14800	57300	
Conference Costs												3300	
ESF costs												13082	7.5% of total for yr 4
											Year 4	**187507**	
											Total	**626339**	