298. Group Study (1-4)
Prerequisite: consent of instructor. Restricted to graduate students. Group study on focused topics in humanities. Group studies may serve as electives for the designated Emphasis in Human Rights. May be repeated up to 16 units for credit when topic differs. Offered irregularly. (S/U grading only.)—F, W, S. (F, W, S.)

299. Individual Study (1-12)
Prerequisite: consent of instructor. Restricted to graduate students. Individual study for the designated emphasis in human rights. (S/U grading only.) May be repeated for credit.

Humanities

(College of Letters and Science)
Eric L. Russell, Ph.D. (French and Italian)

Program Office, 213 Sproul
530-752-1219; http://humanities.ucdavis.edu

Committee in Charge
Seeta Chaganti, Ph.D. (English)
Liza Grandia, Ph.D. (Native American Studies)
Noah Guyan, Ph.D. (French and Italian)
John Slater, Ph.D. (Spanish and Portuguese)

The Program of Study
The Humanities program is an undergraduate and graduate curriculum emphasizing innovative approaches to ideas that matter. Courses offered through the program are interdisciplinary in scope and aim to develop critical thinking and writing skills in three principal areas: major figures, works, and genres in world cultures; major themes in world literatures; and relationships between history, society, and culture.

Courses in Humanities (HUM)

Lower Division
1. Humanities Forum (2)
Lecture—2 hours. Reading and discussion of a single work representative of a particular culture, historical period, or genre and significant for its ongoing cultural impact in the humanities, sciences, social sciences, technology, and popular arenas. Attention to provocative implications for contemporary society. May be repeated one time for credit if topic differs. GE credit: ArtHum | AH.

1D. Issues and Concepts in the Humanities (2)
Discussion—2 hours. Prerequisite: course 1 concurrently. Small group discussions and preparation of short papers for course 1. May be repeated one time for credit if topic differs. GE credit: ArtHum | AH, WE.

2A. Global Humanities Forum (4)
Lecture—3 hours; extensive writing. Introduction to humanities topics and methodologies; analysis of major figures, works, and genres in world arts and literatures, with emphasis on relationships between history, society, and culture. May be repeated one time for credit if topic differs. GE credit: ArtHum | AH, WC, WE.

2B. American Humanities Forum (4)
Lecture—3 hours; extensive writing. Introduction to humanities topics and methodologies; analysis of major figures, works, and genres in American arts and literatures, with emphasis on relationships between history, society, and culture. May be repeated one time for credit if topic differs. GE credit: ArtHum | AH, WC, WE.

3. Medicine and Humanities (4)
Lecture—discussion—3 hours; extensive writing. Prerequisite: completion of Subject A requirement. Evolution of the "medical arts" into the "science of medicine." The culture of medicine in the context of society, medical ethics. GE credit: ArtHum or SocSci, Wrt | AH or SS, WE.

4. Animals and Human Culture (2)
Lecture—2 hours. The meaning of human relations with animals studied across a variety of historical periods and cultures and from a variety of humanistic perspectives. GE credit: ArtHum, Wrt | AH.

4D. Animals and Human Culture Discussion (2)
Discussion—2 hours. Prerequisite: concurrent enrollment in course 4. Small group discussions and preparation of short papers for course 4. GE credit: ArtHum, Wrt | AH, WE.

7. Travel and Travel Literature (4)
Lecture/discussion—3 hours; extensive writing. Prerequisite: Subject A requirement. History of travel from the age of exploration to the modern era. Contemporary trends in travel, including mass tourism, adventure travel, and ecotourism. Social, economic, and cultural issues related to modern trends in travel. Analysis of literary representations of travel. GE credit: ArtHum, Div, Wrt | AH, WC, WE.

8. Introduction to Perspectives on Narrative (4)
Lecture/discussion—3 hours; extensive writing. Prerequisite: satisfactory completion of Subject A requirement. Interdisciplinary approach to the use of story across time, culture, and discipline. How the telling and retelling of particular stories reflect the values, concerns, and assumptions of their original audiences and genres. GE credit: ArtHum or SocSci, Div, Wrt | AH, WE.

9. Don Quixote and the Modern World (2)
Lecture—2 hours. Reading Don Quixote as emblem of modernity in the West. Issues of reality versus illusion, heroism, freedom and self fulfillment, racial tolerance and love. Don Quixote in other cultural and popular media: film, dance, art, musical drama, and television. GE credit: ArtHum, Div, Wrt | AH, WC, WE.

9D. Don Quixote and the Modern World Discussion (2)
Discussion—2 hours. Prerequisite: course 9 concurrently. Small group discussions and preparation of short papers for course 9. GE credit: ArtHum | AH, WC, WE.

13. Witches: Myth and Historical Reality (4)
Lecture—3 hours; extensive writing. This course examines the historical construction of the witch. The four areas covered are: European pagan religions and the spread of Christianity; the "Burning Times" in early modern Europe; 17th-century New England and the Salem witch trials; and fairies. GE credit: ArtHum, Div, Wrt | AH, WC, WE.—Krimmer

15. Language and Identity (4)
Lecture/discussion—3 hours; extensive writing. Introduction to topics related to the construction of identity through language use, including geographical and social factors affecting language groups. Language ideology affecting linguistic groups, including bilinguals and non-native speakers of English. GE credit: ArtHum or SocSci, Div, Wrt | AH or SS, WE.

60. Narrative and Argumentative Approaches to Global Issues in the Media, Culture, and Society (4)
Lecture/discussion—3 hours; term paper. Prerequisite: English A or the equivalent. Interdisciplinary approach to contemporary issues (abortion, AIDS, civil rights, war and peace, welfare state) around which individuals, communities and institutions define themselves in American society, by applying principles of narrative theory to the narratives where those issues are embedded. GE credit: ArtHum or SocSci, Div, Wrt | AH or SS, WE.

92. Internship (1-12)
Internship—3.36 hours. Internships in fields where students can practice their skills. May be repeated for credit. (P/NP grading only.)

Upper Division
144. Marx, Nietzsche, Freud (4)
Lecture/discussion—3 hours; term paper. Study of major texts of Marx, Nietzsche, and Freud, selected with an eye to their impact on 20th-century economics, ethics, and attitudes toward others. Particular focus on conceptions of the self and the individual's relation to society. (Same course as German 144.) GE credit: ArtHum, Wrt | AH, WE.

180. Topics in the Humanities (4)
Lecture/discussion—3 hours; term paper. Analysis of interdisciplinary issues in the Humanities. Topics will vary. May be repeated one time for credit. GE credit: ArtHum, Wrt | AH, WE.

192. Internship (1-12)
Internship—3.36 hours. Internships in fields where students can practice their skills. May be repeated for credit. (P/NP grading only.)

198. Directed Group Study (1-4)
Prerequisite: consent of instructor. (P/NP grading only.)

299. Special Study for Advanced Undergraduates (1-4)
Prerequisite: consent of instructor. (P/NP grading only.)

Graduate

250. Topics in the Humanities (4)
Seminar—3 hours; term paper. Prerequisite: graduate standing or consent of instructor. Topics in the humanities, selected by the instructor. May be repeated one time for credit.

292. Graduate Internship (1-15)
Lecture—3 hours; lecture/discussion—1 hour. Prerequisite: consent of instructor required. Individualized supervised internship, off campus, in community or institutional setting. Developed with advice of faculty mentor. May be repeated for credit up to 15 units. (S/U grading only.)

298. Directed Group Study (1-5)
(S/U grading only.)

299. Individual Research (1-4)
Individual research in the humanities resulting in a formal written research report. (S/U grading only.)

Professional

396. Teaching Assistant Training Practicum (1-4)
Prerequisite: graduate standing; consent of instructor. May be repeated for credit. (S/U grading only.)

Hydrologic Sciences (A Graduate Group)

Gregory Pasternack, Ph.D., Chairperson of the Group

Group Office, 1152 Plant and Environmental Sciences Building 330752-1669; http://hsg.ucdavis.edu

Faculty
Fabian Bombardelli, Ph.D., Assistant Professor (Civil and Environmental Engineering)
William Casey, Ph.D., Professor (Chemistry)
Randy Dahlgren, Ph.D., Professor
Academic Senate Distinguished Teaching Award
Helen Dahlike, Ph.D., Assistant Professor
Fahim Fagg, Ph.D., Professor (Civil and Environmental Engineering)
Timothy Ginn, Ph.D., Professor
Grisha Grimmer, Ph.D., Assistant Professor
Peter Hoagman, Ph.D., Professor
Jan Hoagman, Ph.D., Professor
William Horvath, Ph.D., Professor
John Largier, Ph.D., Professor (Bodega Marine Laboratory)
Mark Lubell, Ph.D., Professor (Environmental Science and Policy)
Jay Lund, Ph.D., Professor (Civil and Environmental Engineering)
Douglas Mackay, Ph.D., Adjunct Professor
Gregory Pasternack, Ph.D., Professor
Kyaw Tha Paw U, Ph.D., Professor
Carlos Puente, Ph.D., Professor
Samuel Sandoval Solis, Assistant Professor
Cooperative Extension Specialist
Courses in Hydrologic Sciences (HYD)

Graduate

200. Survey of Hydrologic Sciences (1)
Seminar—1 hour; term paper. Prerequisite: open to students in the Hydrologic Sciences program. Seminar course exposes students to the diversity of sciences involved in the program. Students prepare a paper and presentation in their area of research interest. May be repeated twice for credit. (S/U grading only.)—F [F] Grismer

205. Continuum Mechanics of Natural Systems (4)
Lecture/discussion—4 hours. Prerequisite: Mathematics 210 and 226, Physics 9B. Continuum mechanics of static and dynamic air, water, earth and biological systems using hydraulic, heat and electrical conductivity; diffusivity; dispersion; strain; stress; deformation gradient; velocity gradient; stretch and spin tensors. (Same course as Biological Systems Engineering 205.)—F [F] Fogg

210. Vadose Modeling and Characterization (3)
Lecture—1.5 hours; laboratory—3 hours; discussion—0.5 hours. Prerequisite: Soil Science 107, or consent of instructor. Principles and modeling of water flow and chemical transport in the vadose zone, with specific applications to soils. Topics include hydraulic properties, finite difference application to unsaturated flow parameter optimization, diffusive and convective transport in gaseous and liquid phases. Offered in alternate years. —S [S] Hopmans

243. Water Resource Planning and Management (3)
Lecture—3 hours. Prerequisite: course 141 or Civil and Environmental Engineering 142. Applications of deterministic and stochastic mathematical programming techniques to water resource planning, analysis, design and management. Water allocation, capacity expansion, and reservoir operation. Conjunctive use of surface water and groundwater. Water quality management. Irrigation planning and operation models. (Same course as Biological Systems Engineering 243.)—F [F] Hopmans

245. Climate Change, Water and Society (4)
Lecture—4 hours. Class size limited to 25 students. Integration of climate science and hydrology with policy to understand hydroclimatology and its impact upon natural and human systems. Assignments: readings, take-home examination on climate and hydrologic science, paper that integrates clear concepts into a research prospectus or review article. (Same course as Atmospheric Science 245 and Ecology 245.)—F [F] Fogg, Lubell, Ullrich

252. Hillslope Geomorphology and Sediment Budgets (4)
Lecture—3 hours; fieldwork—3 hours. Prerequisite: course 141 or Geology 35 or Civil and Environmental Engineering 142 or consent of instructor. Exploration of theoretical and empirical foundations of sediment production on hillslopes using computer models and field experiments to promote an understanding of how watersheds evolve naturally and with human impacts. Offered irregularly. —S [S] Pasternack

254Y. Ecohydraulics (3)
Web virtual lecture—1 hour; discussion—1 hour; extensive problem solving. Use of 2D hydraulic modeling to predict water flow, assessment by exploring flow-dependent hydraulic patterns at multiple spatial scales and extrapolating results with empirical and analytical functions to evaluate geomorphic resilience functions. Offered in alternate years. —F [F] Pasternack

256. Geomorphology of Estuaries and Deltas (4)
Lecture—3 hours; fieldwork—3 hours. Prerequisite: course 141 or Geology 35 or Civil and Environmental Engineering 42 or consent of instructor. Survey of the processes and landforms associated with sediment deposition in the coastal zone. Application of geomorphic principles to coastal management issues. Offered irregularly—S [S] Pasternack

264. Modeling of Hydrologic Processes (3)
Lecture—3 hours. Prerequisite: course 141 or the equivalent and Statistics 102 or the equivalent. Techniques used to model the spatio-temporal structure of rainfall and runoff are introduced. Procedures studied include those based on stochastic process techniques, chaos theory, fractal geometry, and fractional noises. Offered in alternate years. —S [S] Fuente

269. Numerical Modeling of Groundwater Systems (3)
Lecture—3 hours. Prerequisite: course 145A or Civil Engineering 144 and course 145B. Mathematics 228. Finite difference and finite element techniques in modeling groundwater flow and transport. Fundamentals of constructing and calibrating models with hands-on applications. Methods and limitations of numerical solution of transport equations. Model interpretation and ethics. Offered in alternate years. —S [S] Fuente

273. Introduction to Geostatistics (3)
Lecture—3 hours. Prerequisite: Statistics 130A and 130B, or the equivalent. Statistical treatment of spatial data with emphasis on hydrologic problems. Topics include theory of random functions, variogram analysis, Kriging, co-Kriging, indicator geostatistics, and stochastic simulation of spatial variability. Demonstration and use of interactive geostatistical software included. Offered in alternate years. —F [F] Fogg

274. Practice of Groundwater Flow and Transport Modeling (3)
Lecture—2 hours; lecture/laboratory—0.5 hours; lecture/discussion—0.5 hours. Prerequisite: course 269, Civil and Environmental Engineering 272B, or Civil and Environmental Engineering 272C. Selecting and building groundwater flow and transport models. Planning, preparation, execution, presentation, and review of modeling projects. Review of methods, assumptions, and limitations of groundwater models; practicing with MODFLOW, MT3D, associated GUI, and with other groundwater modeling software of choice. Offered in alternate years. —F [F] Hopmans

275. Analysis of Spatial Processes (3)
Lecture—3 hours. Prerequisite: Statistics 102 or the equivalent; course 273 or Statistics 273A recommended. Characterization of homogeneous random fields: extremes and spectral parameters; geometry of excursions, local averaging; scale of fluctuation; non-Gaussian and irregular random fields; geostatistical applications.

286. Selected Topics in Environmental Remote Sensing (3)
Discussion—2 hours; lecture—1 hour; project. Prerequisite: consent of instructor; Environmental and Resource Sciences 186 or equivalent required; Environmental and Resource Sciences 186 recommended. In depth investigation of advanced topics in remote sensing applications, measurements, and theory. (Same course as Geography 286) May be repeated for credit. Offered irregularly. —S [S] Soltwisch

290. Seminar in Hydrologic Science (1)
Seminar—1 hour. Prerequisite: graduate standing and background in Hydrologic Science, consent of instructor. Seminars and critical review of problems, issues, and research in hydrologic sciences. Oral presentations of research. Topics will vary. May be repeated for credit. (S/U grading only.)—S [S] Usin

298 Group Study (1-5)
Prerequisite: graduate standing and consent of instructor. (S/U grading only.)—F, W, S, W, S

299. Research (1-12)
Prerequisite: graduate standing and consent of instructor. (S/U grading only.)—F, W, S, W, S
Hydrology

[College of Agricultural and Environmental Sciences] Faculty. See under Department of Land, Air and Water Resources, on page 397. Hydrology Section.

The Program

Hydrology is the study of the occurrence, distribution, circulation, and fate of water and waterborne materials in the environment of Earth. It includes practical measurement and technical analysis of water phenomena underground, on the Earth’s surface, and in the atmosphere. Contemporary hydrologic problems costing society $10-100 billion per year include environmental restoration, sustainability of groundwater and surface water resources, water pollution, and natural disasters such as floods, droughts, landslides, avalanches, and land subsidence. The management of these problems demands hydrologists who are familiar with the comprehensive, interdisciplinary education embodied in this program. Beyond its societal utility, hydrology can be an exciting science for the curious-minded. Hydrologists explore natural phenomena such as climate change, waterfalls, hot springs, coral reefs, biogeochemical cycles, and aquifers.

The Program. A hydrologist needs a strong background across the basic sciences of physics, mathematics, chemistry, and biology. Breadth of understanding comes from exposure to ecology, geology, engineering, policy, and law. Depth of experience is provided by core hydrology courses, internship opportunities, and practical outdoor training. Students should consult with their advisor to match their interests and career goals. Transfer students should have completed as much as possible of the preparatory subject matter listed below.

Internships and Career Alternatives. Job opportunities in hydrology exceed the available supply of trained hydrologists. Students commonly obtain internships and jobs with state and federal agencies, private consulting firms, agricultural interest groups, irrigation districts, and utility companies. Federal agencies hiring hydrologists include the U.S. Geological Survey, U.S. Department of Agriculture (Fish and Wildlife, Agricultural Research, Forest Service, and National Resource Conservation Service), Environmental Protection Agency, and national research laboratories (Lawrence Livermore National Laboratory, Oak Ridge National Laboratory).

State and local agency employers include California’s Departments of Water Resources, Conservation, Fish and Game, and Toxic Substances as well as the Water Resources Control Board and Regional Water Quality Control Boards. To obtain higher levels of responsibility and salary, hydrologists often seek advanced degrees, and the hydrology major is designed to provide students with a highly competitive education to get into graduate school.

B.S. Major Requirements:

Preparatory Subject Matter

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biological Sciences 2A, 2B</td>
<td>10</td>
</tr>
<tr>
<td>Chemistry 2A, 2B, 2C</td>
<td>15</td>
</tr>
<tr>
<td>Physics 9A, 9B, 9C</td>
<td>15</td>
</tr>
<tr>
<td>Mathematics 21A, 21B, 21C, 21D, 22A</td>
<td>22</td>
</tr>
<tr>
<td>Geology 50, 50L</td>
<td>5</td>
</tr>
<tr>
<td>Engineering 6 or the equivalent</td>
<td>4</td>
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</table>

Dependent Subject Matter

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrologic Science 103N or Engineering 103 or equivalent</td>
<td>4</td>
</tr>
<tr>
<td>Civil and Environmental Engineering 144</td>
<td>4</td>
</tr>
<tr>
<td>Statistics 130A and 130B</td>
<td>4</td>
</tr>
<tr>
<td>Hydrologic Science 134, 141, 142, 144, 151</td>
<td>21</td>
</tr>
<tr>
<td>Soil Science 107, 108</td>
<td>5</td>
</tr>
<tr>
<td>Select one of Hydrologic Science 150, Agricultural and Resource Economics 147, Environmental Science and Policy 161, 165N</td>
<td>3-4</td>
</tr>
<tr>
<td>Select three of Hydrologic Science 110, 124, 143, 146, Civil and Environmental Engineering 143, Applied Biological Systems Technology 165</td>
<td>9-13</td>
</tr>
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</table>

Restricted Electives

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>To supplement or expand areas of student interest selected with approval of adviser</td>
<td></td>
</tr>
</tbody>
</table>

Total Units for the Major

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Adviser, Helen Dahlke (Land, Air and Water Resources)</td>
<td></td>
</tr>
<tr>
<td>Advising Center</td>
<td>1150 PES Building Staff Adviser Lacole Brooks <a href="mailto:lbrooks@ucdavis.edu">lbrooks@ucdavis.edu</a></td>
</tr>
</tbody>
</table>

Minor Program Requirements:

Hydrology

The Hydrology Section of the Department of Land, Air and Water Resources offers the minor in Hydrology for environmental and natural science students who have an interest in water in environmental issues. The interested student should have completed preparatory course work in calculus (Mathematics 16B), chemistry (Chemistry 2A, Chemistry 28 recommended), physics (Physics 7A), and biology (Biological Sciences 2A). Course work in the minor provides fundamental skills and knowledge of the hydrologic sciences. The program is sufficiently flexible for students to pursue particular water issues or problems of interest to them.

Watershed Science

The Hydrology Program of the Department of Land, Air and Water Resources offers the minor in Watershed Science. This minor is intended for environmental, natural, or social science students who have an interest in the interfaces between hydrology, ecology, policy, and management. The interested student should have completed preparatory course work in calculus (Mathematics 16B), chemistry (Chemistry 2A, Chemistry 28 recommended), physics (Physics 7A), and biology (Biological Sciences 2A). Course work in the minor provides fundamental skills and knowledge on science and management of watersheds in the context of current water resources and ecological problems.

Minor Program Requirements:

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watershed Science</td>
<td>21-26</td>
</tr>
<tr>
<td>Hydrologic Science 141 or Environmental Science and Management 140</td>
<td>4</td>
</tr>
<tr>
<td>Soil Science 100 or 100X</td>
<td>4</td>
</tr>
<tr>
<td>Hydrologic Science 144 or Soil Science 107</td>
<td>4-5</td>
</tr>
<tr>
<td>Hydrologic Science 124, or Hydrologic Science 121</td>
<td></td>
</tr>
<tr>
<td>Hydrologic Science 143, Environmental Science and Management 144</td>
<td>4</td>
</tr>
<tr>
<td>Environmental Science and Policy 151</td>
<td>3-4</td>
</tr>
<tr>
<td>Hydrologic Science 150, Environmental Science and Management 121, or Environmental Science and Policy 161</td>
<td>3-4</td>
</tr>
</tbody>
</table>

Minor Adviser. Graham Fogg 530-752-6810; gefogg@ucdavis.edu.

Courses in Hydrologic Science (HYD)

Questions pertaining to the following courses should be directed to the instructor or to the Resource Sciences Center in 113 Veihmeyer Hall or in 1150 Plant and Environmental Sciences Building 532-222-1603.

Lower Division

10. Water, Power, Society (3)

Lecture—2 hours; laboratory—1 hour. Water resources issues. How water has been used to gain and wield socio-political power. Water resources development in California as related to current and future sustainability of water resources and quality. Roles of science and policy in solving water problems. (Same course as Science and Society 10.) GE credit. SciEng or SocSci, WR1 | SE, SL. —S. (S.) Fogg.

47. Watershed Processes and Water Quality in the Tahoe Basin (2)

Lecture/laboratory—21 hours; fieldwork—9 hours; discussion—3 hours; term paper. Prerequisite: basic knowledge of environmental, soil, or hydrologic sciences. Processes, runoff, water-quality management, restoration in Lake Tahoe Basin. Soils, precipitation-runoff, revegetation and adaptive management related to erosion control, effective solutions, development of restoration strategies. Students develop field restoration. Course involves 3 days of instruction in Tahoe City. (Same course as Environmental Science and Management 47.) Not open to students who have successfully completed Environmental and Resource Sciences 47. (Formerly Environmental and Resource Sciences 47.) GE credit. SciEng | GL, SE, SL—S. (S.) Fogg.

92. Hydrologic Science Internship (1-12)

Internship—3-36 hours. Prerequisite: lower division student, consent of instructor. Work experience off and on in Hydrologic Science. Internship supervised by a member of the faculty. (P/NP grading only) | F, W, S. (F, W, S.)

98. Directed Group Study (1-5)

Prerequisite: consent of instructor. Offered irregularly. (P/NP grading only.)

Upper Division

103N. Fluid Mechanics Fundamentals (4)

Lecture—4 hours. Prerequisite: Physics 9B. Fluid mechanics axioms, fluid statics, kinematics, velocity fields for one-dimensional incompressible flow and boundary layers, turbulent flow time averaging, potential flow, dimensional analysis, and macroscopic balances to solve a range of practical problems. (Same course as Biological Systems Engineering 103.) Offered irregularly. GE credit. SciEng | GL, SE, VL—F (F).

110. Irrigation Principles and Practices (3)

Lecture—2 hours; laboratory—3 hours. Prerequisite: Physics 7A; Soil Science 100 recommended. General course for agricultural and engineering students.

Fall 2011 and on Revised General Education (GE) Requirements:

ArtHum—Arts and Humanities; SciEng—Science and Engineering; SS—Social Sciences; ACH—American Cultures; DD—Domestic Diversity; OL—Oral Skills; OLQ—Quantitative; SL—Scientific; VL—Visual; WC—World Cultures; WE—Writing Experience